FY 2019 City-to-City Collaboration for Low-Carbon Society

(Project to Create a Low-Carbon Society in Davao City through Support for the Development of a Local Climate Change Action Plan)

Report

February 2020

Institute for Global Environmental Strategies

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Reference 1： Documents for the kick-off meeting
Reference 2： Programme of the stakeholder workshop
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I. Background and Purpose of Project

1. Socio-economic Situation of Davao City

Davao City is a first-class city in the island of Mindanao, Philippines. It is considered as the largest city in the Philippines with a total land area of 2,443.61 km2 (943.48 sq mi). It is the most populous city in Mindanao with a population of 1,632,991 with a growth rate of 2.30%, based on the Philippine Statistics Census in 2015. The city is divided into three congressional districts, which are subdivided into 11 administrative districts with a total of 182 barangays.

Table 1 Profile of Davao City

Total Population (2015)	1,632,991
Land Area (hectare)	244,000
Population Density (per hectare)	7 persons
Population Growth Rate	2.30%
Number of Barangays/Villages	182
Share of Internal Revenue Allotment（IRA）	3,330,085,561
IRA Dependency	53.97%
Total Local Government Unit (LGU) Income	7,307,595,301.66
Average LGU Revenue per capita	4,474.97
Ecosystem Type	Watershed
Economy	First Class

Source: Davao City Socio-economic Indicators

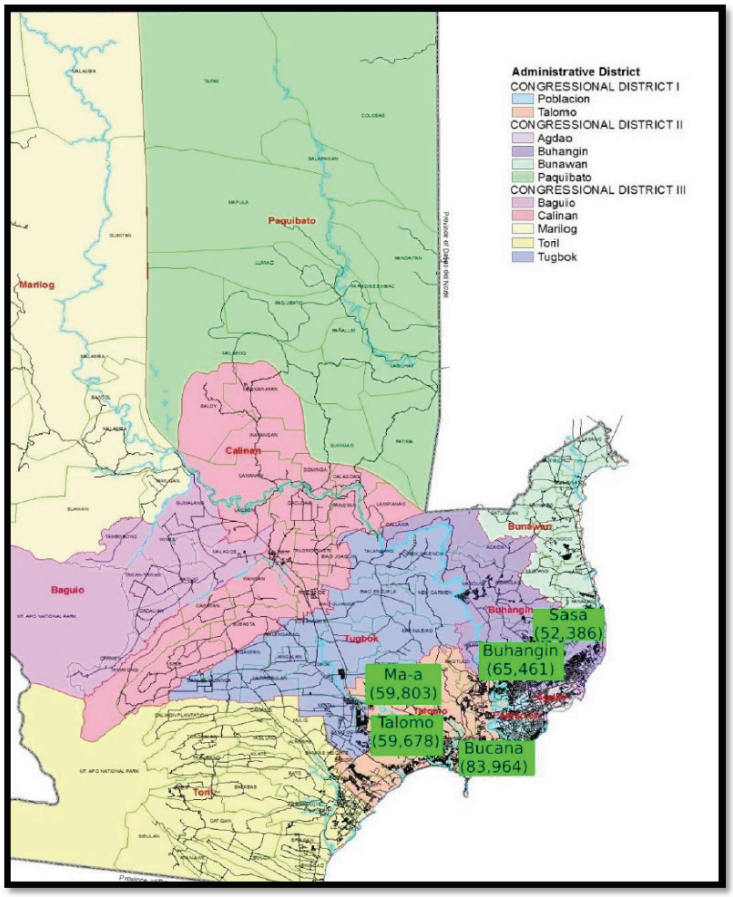
Geography

Davao City is approximately 588 miles (946 km) southeast of Manila over land and 971 kilometers (524 NMI) by sea. The city is located in southeastern Mindanao, on the northwestern shore of Davao Gulf, opposite Samal Island.

Davao City is located in the southeastern part of Mindanao, lying in the grid squares of 6 58′ to 7 34′ N latitude, and 125 14′ to 125 40′ E longitude. It is bounded on the north by Davao Province; on the east partly by Davao Province and Davao Gulf; on the south by

Davao del Sur, and the west by North Catabato.[1]

Davao City is divided into three (3) congressional districts which are further subdivided into 182 barangays. It has 11 administrative districts situated in the three congressional districts (See Map)



Source: Office of the City Planning and Development Coordinator

Figure 1 Map of Davao City

Topography

Davao City's land, totaling about 2,443.61 square kilometers (943.48 sq mi), is hilly in the west (the Marilog district) and slopes down to the southeastern shore. Mount Apo, the highest peak in the Philippines, is located at the city's southwestern tip. The Davao River is the city's primary drainage channel. Draining an area of over 1,700 km2 (660 sq mi), the 160-kilometer (99 mi) river begins in the town of San Fernando, Bukidnon. The mouth of the river is located at Barangay Bucana at Talomo District.

1 Davao City Comprehensive and Land Use Plan (CLUP)

Climate

Davao has a tropical rainforest climate (Köppen climate classification Af), with little seasonal variation in temperature. The areological mechanism of the Intertropical Convergence Zone occurs more often than that of the trade winds and because it experiences rare cyclones the climate is not purely equatorial but subequatorial. Average monthly temperatures are always above 26 °C (78.8 °F), and average monthly rainfall is above 77 millimeters (3.03 in).

Economy

The city serves as the main trade, commerce, and industry hub of Mindanao, and the regional center of Davao Region. The city has a projected average annual growth of 2.53 percent over 15 years. As the largest economy outside Metro Manila, the city also serves as the largest local economy in the southern Philippines.

Commerce, Trade, and Industry[2]

Agriculture remains the largest economic sector comprising banana, pineapple, coffee and coconut plantations in the city. It is the island's leading exporter of fruits such as mangoes, pomelos, bananas, coconut products, pineapples, papayas, mangosteens, and cacao. In 2016, production areas for agricultural and industrial crops, fruits, root crops, and vegetables spanned approximately 74,158 hectares with a total production of 630,000 metric tons.

The volume of livestock production for cattle and carabao were estimated to be at 74,570 heads in 2016. The swine production is in part 53.78% (222,341 heads) of the total livestock production with goats totaling 11.26% (46,553 heads) and poultry at 6, 293,775 heads.

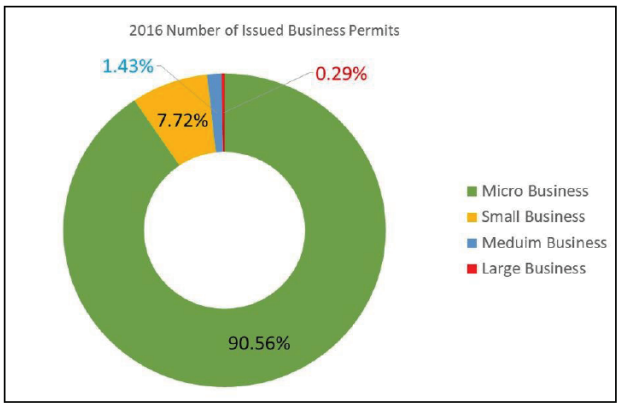
Aquaculture production in Davao City reached 617,020 metric tons in 2016, accounted as: inland fishing at 908.79 metric tons; fishponds at 227,418.92 metric tons; and deep-sea fishing at 388,597.95 metric tons.

The chocolate industry is the newest development in the city. Malagos Chocolate, developed by Malagos Agriventures Corp., is now the country's leading artisan chocolate recognized worldwide. On the other hand, Seed Core Enterprises is the country's biggest exporter of cacao to Barry Callebaut. Local corporations like Lorenzo Group, Anflo Group, AMS Group, Sarangani Agricultural Corp. and Vizcaya Plantations Inc. have operations and headquarters in Davao City. Multinational companies like Dole, Sumifru/Sumitomo, and Del Monte have their regional headquarters in the city

2 Davao City Comprehensive and Land Use Plan (CLUP) 2019

In 2016, the city registered 36,254 establishments with capitalisation of Php 227,395,300,819.52. The majority of the investment (77.83%) are large from large businesses. While micro businesses hired the most number of employees at 122, 389 (64.77%)[3]

A total of 60,759 business lines were registered in 2016. Each business establishment may have more business lines. Retailers account for 42.11% of the business lines, services at 18%, wholesalers/distributors at 9.66%, and food handlers composed of restaurants, cafeterias, and refreshment parlors at 6.5%. Moreover, a particular increase in delivery services has been reported at 5.31%.[4]



Source: Business Bureau

Figure 2 Number of issued business permits

Table 2 Business establishments, capitalization and employment, by type of business, 2015

Type of Business	Issued Permits	Capitalization	No. of Employees
Micro	31,126	14,117,541,772.46	114,196
Small	2,483	16,855,256,666.60	40,488
Medium	482	15,229,207,136.16	18,516
Large	101	167,688,409,516.34	6,703
Davao City	**34,192**	**213,890,415,091.56**	**179,903**

Source: Business Bureau – City Mayor's Office, Davao City

2. Climate change legislation of the Philippine government

All municipalities in the Philippines are required to formulate Local Climate Change Action Plans (LCCAP), in line with the country's Climate Change Act of 2009 (Republic Act No. 9729). The Act calls for the development of plans for adaptation measures, in particular, although Intended Nationally Determined Contributions (INDC) submitted by the

3 Davao City Business Bureau
4 Ibid.

Philippines under the Paris Agreement also emphasise the promotion of mitigation measures, setting out a goal of "undertaking emissions reduction of about 70% by 2030 relative to its BAU scenario of 2000 to 2030".[5]

In addition, the Government of the Philippines released two Voluntary National Reviews (VNR) in 2016 and 2019 as part of its efforts to promote the Sustainable Development Goals (SDGs). The 2019 VNR has set and is promoting the following two climate change measures (Goal 13):

- Target 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Target 13.2 Integrate climate change measures into national policies, strategies and planning

The LCCAP guidelines published by the Philippines Climate Change Commission (CCC) also recommend the inclusion of mitigation measures in such plans. The CCC also provides support in the country for the formulation of LCCAPs that contain mitigation measures, including the publication of a manual on GHG inventories, which are required as basic information for mitigation measures, and the organisation of training workshops for local governments upon request.

3. Cooperative relationship between Davao and Kitakyushu

City-to-city (C2C) cooperation between the cities of Kitakyushu and Davao is promoted under the "Strategic Environmental Partnership Agreement" (concluded on 15 November 2016) and a "Memorandum of Understanding on Green Sister City Cooperation" (concluded on 28 November 2017), exchanged between Mayor Kenji Kitahashi of Kitakyushu City and Mayor Sara Duterte of Davao City. C2C cooperation is being promoted in the waste management sector, in particular, in projects by the Ministry of the Environment of Japan (MOE) and the Japan International Cooperation Agency (JICA).

<u>Examples of support provided to Davao City in the waste management sector from Kitakyushu City and related organisations</u>

- "Preparatory study and examination of feasibility for commercialisation of waste-to-energy projects in Davao City, Philippines" (MOE): Support for reduction of CO_2 emissions overseas through strategic international development of Japanese recycling industries (FY 2017)
- "Project to support the improvement of waste management capacity in Davao City,

5 The Philippine government is currently reviewing its INDC. As of February 2019, it has yet to clarify its Nationally Determined Contributions (NDC).

Republic of the Philippines" (JICA Partnership Program) (FY 2017 to FY 2019)

- "Project to promote the spread of power generation technologies utilising waste in Davao City" (JICA): Project to promote the spread of technology from the private sector for social and economic development in developing countries (FY 2014)

Under the new memorandum of agreement concluded in 2017, the two cities have decided to expand areas of cooperation to create a low-carbon society. Through past projects, a trusting relationship has been developed between Kitakyushu City and the executives of Davao City, in particular, which makes it possible for both cities to work together efficiently with the executives in Davao City acting as contacts.

4. Aims of the city-to-city cooperation project

In light of the climate change policies of the Philippines and the rapidly-growing socio-economic situation in Davao City, it is essential for governments to promote low-carbon development through the formulation of Local Climate Change Action Plans (LCCAP) and the implementation of concrete projects in cooperation with the private sector in order to achieve sustainable growth in the future. Mindful of the fact that the "creation of a low-carbon society" has also been positioned as an area of cooperation in the city-to-city collaborative framework between the cities of Davao and Kitakyushu, the "Kitakyushu Team" (City of Kitakyushu, IGES, private companies) has decided to collaborate and conduct studies to contribute to low-carbon development in Davao with a focus on JCM activities through public-private partnerships as it transfers its know-how on creating low-carbon cities.

II. Objective and Implementation System for Feasibility Studies on the Development of Promising JCM Model Projects

1. Overview of project

This project has been designed to provide support for the formulation of the LCCAP based on a request from Davao City under C2C cooperation between Kitakyushu and Davao. Concrete mitigation measures are positioned in this action plan and the use of the financing programme for JCM model projects is being considered as a resource to implement mitigation measures. Specific areas of support are as follows. Each area will be described in detail below.

1) Support for the formulation of the LCCAP promoted by Davao City
   - Support for the development of a GHG inventory
   - Support for examining mitigation measures
   - Support for considering adaptation measures
2) Potential for the implementation of a low-carbon development projects in Davao City
3) Studies on the possible application of JCM model projects for waste-to-energy projects promoted by Davao City

1) Support for the formulation of the LCCAP promoted by Davao City

Davao City has formulated the LCCAP with a focus on adaptation measures with support from UNHABITAT in 2013. However, mitigation measures and the establishment of a system to develop the LCCAP has not yet begun. For this reason, a decision was reached to provide support through this project for the formulation of the LCCAP, including support for the creation of an implementation system and consideration of the development of a GHG inventory and mitigation measures, in response to a request by Davao City. As part of this support, a decision was reached to use the LCCAP preparation manual published by the Philippine CCC and GHG inventory manual jointly created by CCC and USAID for local governments in the Philippines as reference in order to formulate a LCCAP that is fully rooted on the policies and local conditions of the Philippines. Data started to be collected last fiscal year with reference to a manual for preparing a GHG inventory. A Technical Working Group (TWG) team was formed by a decree from the mayor in December 2018 for the development of the LCCAP. In addition, using opportunities for training in Japan (November 6-8, 2018) and sharing Kitakyushu's knowledge on calculating GHG emissions

within the city area (creation of GHG inventory), formulating and implementing plans for mitigation measures, evaluating GHG reduction effects, and implementing stakeholder and intra-/inter-departmental coordination based on Kitakyushu's experiences in creating the "Kitakyushu City Implementation Plan for Global Warming Countermeasures and Eco-Model City Action Plan: Kitakyushu New Green Frontier Plan" may encourage staff in Davao to improve their capacity to formulate the LCCAP. This support was mainly carried out by IGES and Kitakyushu, as well as in coordination with Ateneo de Davao University. A point to note in promoting this type of support is to provide appropriate information and act as intermediaries between experts, while also encouraging independent action as much as possible to allow Davao to develop a sustainable implementation system themselves for the implementation of promising measures, rather than IGES and Kitakyushu providing data and developing a plan to hand over to Davao.

This fiscal year, activities have been developed in collaboration with the TWG team from the Davao City Planning and Development Office (CPDO) targeting the (1) completion of the GHG Inventory and (2) preparation of a long list of mitigation options as output based on the progress and activity period in the previous fiscal year.

2) Feasibility Study for a low-carbon project on energy sector

3) Studies on the possible application of JCM model projects for waste-to-energy projects promoted by Davao City

The following two projects for possible application as JCM model projects were examined continuing from last year.

- Conversion of street lights to LED lighting
- Waste-to-energy (generators, boilers, transformer facilities, etc.)

2. Implementation system

Under C2C collaboration between the cities of Kitakyushu and Davao, IGES oversaw a joint study with Kitakyushu as the organisation responsible for the conduct of studies. IGES and Ateneo de Davao University collaborated to provide support to Davao City for the formulation of the LCCAP. A study related to the financing programme for JCM model projects was conducted in collaboration with Nippon Steel Engineering Co., Ltd. Dowa Technos Co., Ltd., and Join Planning Corporation.

JCM City-to-city Cooperation Project between City of Kitakyushu and Davao City

Project to realize low carbon society in Davao City
through a support for a development of Local Climate Change Action Plan

Support & study items

1. **Support for the development of Local Climate Change Action Plan (LCCAP) of Davao City**
   - **Establishment of a sustainable implementation system enabling Davao City to formulate and implement the action plan**
   - **Support for the development of GHG inventory, mitigation measures, and others**
   - **Clarification of the positioning and priority of low-carbon project related to infrastructure development in the action plan**
2. **Study on the applicability of JCM model project to the Waste-to-Energy (WtE) project**
   - **NIPPON STEEL ENGINEERING CO., LTD.**
3. **Feasibility study on the LED streetlight conversion project**
   - **DHOWA TECHNOS Co., Ltd., JOIN PLANNING Co., Ltd.**
4. **Feasibility study on the EV bus and renewable energy projects**
   - **SoftEnergy Controls Inc., KYOWA ENGINEERING CONSULTANTS Co., Ltd.**

Figure 3 Implementation system

III. Result of Feasibility Studies

1. Activity 1: Support for the formulation of the LCCAP promoted by Davao City

①Meeting of Working Group members (November 21, 2019, Davao City Hall)

Starting with the kick-off meeting on May 15, 2018, support has been provided for the formulation of a GHG Inventory (GHGI) and studies on mitigation options as part of assistance in developing the LCCAP. In December 2018, the mayor ordered the establishment of the LCCAP Technical Working Group (TWG). The final meeting of the city-to-city cooperation project in February 2019, which brought together officials from Davao City and members of the Philippines Climate Change Committee, which is in charge of providing support to local governments in formulating the LCCAP, found that even during the period when there were no city-to-city cooperation activities being implemented (March to September 2019), Davao City took the initiative to invite the members of the Climate Change to Davao and held workshops to press forward with preparations for the development of the GHGI.

During a visit to Davao City in late November after the start of this fiscal year's city-to-city cooperation project, updated provisional figures for the city's GHGI, expected mitigation options, vulnerability assessments and expected adaptation measures were shared (See Reference 1). At that time, data collected as basic information for the 2017 GHGI had already been reflected in calculation sheets and was close to completion. IGES proposed that calculation sheets be checked as part of quality control (QC), leaning in the direction of checks to be completed in the Philippines based on the reasoning that, should this work be requested, it would be preferable for it to be undertaken by the Climate Change Commission as the competent ministry and workshop leader.

However, since the list of mitigation options was not limited to climate change mitigation options, but instead also included disaster mitigation options that were similar to adaptation measures, all stakeholders felt the need to confirm terms defining mitigation options. This was widely publicized at the stakeholder meeting held at the beginning of the year.

Figure 4　TWG members

FIgure5　Meeting of staff involved in the formulation of the LCCAP

During this meeting, attendees also shared information on the city-to-city cooperation seminar slated to be held in Tokyo in January at the beginning of the year and confirmed that a progress report would be presented on the LCCAP at that time. The seminar was expected to include the participation of high-level attendees, such as Vice Mayor Sebastian Zimmerman Duterte and City Councilor J. Melchor JR. Bumpus Quitain.

②Stakeholder workshop (January 30-31, 2020, Malayan Colleges Mindanao (MCM))

A two-day stakeholder workshop was jointly organised by the Davao City Planning and Development Office (CPOD), IGES, and MCM in January 2020. In Davao, it is customary to hold stakeholder workshops as the first step in formulating administrative plans. This workshop, which brought together relevant municipality departments, NGOs, and companies that are expected to collaborate with one another in the formulation and implementation of the LCCAP, presented an opportunity to explain about the current status of progress and gather ideas and opinions from a broad sector on the activities that should be done.

At the start of the meeting, the Executive Vice President and Chief Operating Officer, Engr. Dodjie Maestrecampo of MCM, the host of the workshop, welcomed all participants. Next, Atty. Rachel Herrera, Commissioner of the Philippines Climate Change Commission, presented a report on the state of climate change in the country. Reports were also presented by members of the team from Kitakyushu, which is providing support in the city-to-city cooperation framework, including introductions by Research Manager Akagi on climate change measures in Japan and Kitakyushu City and Programme Director Hayashi on studies related to the conversion of street lights to LED lighting which is being implemented in Davao City at present. Discussions have been held with TWG members to

date, but this meeting offered an excellent opportunity to provide information on the activities of Kitakyushu City to a wide range of stakeholders. IDIS (Interface Development Interventions Inc.), an environmental NGO involved in the implementation of local environmental administration, proposed what could be done within the context of the LCCAP and shared information that included perspectives on the legal basis for the development of the LCCAP, as well as promotion of the Sustainable Development Goals (SDGs). In addition, Associate Professor Dr. Gernelyn T. Logrosa from MCM shared information on vulnerability assessments and adaptation measures, followed by Professor Dr. Doris Montecastro from Ateneo de Davao University who provided information on the state of GHG emissions in Davao City.（Reference 2-4）.

Figure 6 Workshop speakers

Figure 7 Workshop

Based on this information, stakeholders were divided into seven teams (see below), in which each group exchanged ideas on potential climate change actions. The seven teams were based on the sectors presented in the LGU Guidebook for the Formulation of the LCCAP in the Philippines. Each group included about eight to ten participants.

<7 group work teams>

1) Food security
2) Water sufficiency
3) Ecological and environmental stability
4) Human security
5) Climate-smart industries and services
6) Sustainable energy
7) Knowledge and capacity development

At the start, the following guiding questions were presented to encourage the exchange of ideas.

<Guiding Questions>

1. What initiatives/plan/policies do we have or are doing now that address climate change (adaptation and mitigation) & DRRM? Who is in-charge of those?
2. Based on what we learned from the input today, what must be done now to address climate change?
3. Complete the initial plan by:

a) Inputting names or offices/departments who can lead action

b) Listing what we or our offices can do to commit to achieving or taking necessary action

After about three hours of group work, representatives from each group presented the results of their discussions. They explained about the importance of promoting each action from the perspective of promoting the LCCAP, with a basic focus on activities that are already being carried out by each department and NGOs.

At this point, after a wide range of ideas had been compiled, Davao City indicated that the CPDO would take the initiative to consult with experts and narrow down the areas that would be positioned in the LCCAP.

Lastly, the CPDO presented letters of appreciation to the speakers and certificates of completion to all participants. The workshop ended with the shared belief that the LCCAP would be completed by June.

Figure 8 Group work

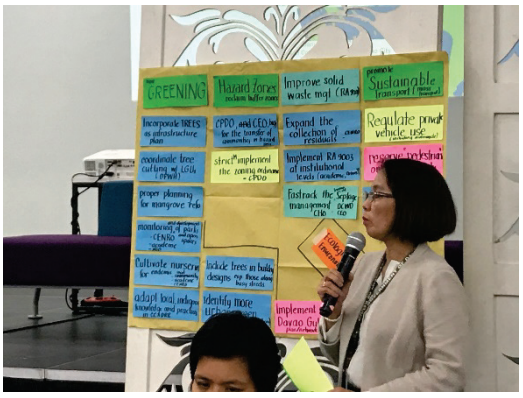


Figure 9 Final report from group work

③Deliverables to support the formulation of the LCCAP

This fiscal year includes two deliverables to support the formulation of the LCCAP: a report on the GHGI that stakeholders have been working on since last fiscal year and a list of mitigation options compiled at the stakeholder meeting.

Overview of GHGI

According to estimates by Davao City, GHG emissions in 2017 amounted to approximately 4.7 million tonnes. Most emissions were generated from industrial processes, which accounted for 60% of total emissions. Next, emissions from the transport sector accounted for 30%, with 10% resulting from fuel combustion in the household sector. Data on industrial processes was sourced from cement companies, but the integrity of the data, including in other fields, is questionable. Data from 2017 has not necessarily been used, and data from other cities has been substituted out of necessity, indicating a need to improve the integrity of data as a point of improvement in the future. The following points have also been cited as issues that need to be addressed in formulating the GHGI in Davao City. Support is expected to be required in the future in terms of coaching for calculation work.

<Issues in Davao City's GHGI>

As Davao City accounts for its GHG emissions for the first time there were a few challenges encountered. Articulating these impediments will contribute to the improvement of the GHGI inventory in the next reporting period.

1. Filtering of data. Some figures such as the specific business line of establishments were not disaggregated according to the required values of the GHG inventory. The TWE team had to use their best judgment and use published reference baselines to extract the data accordingly. There is a need to work with the City Business Bureau to collect a more accurate classification of data that would be useful for the GHGI process and reporting for the succeeding period.
2. Difficulties in securing the total production values of commercial and industrial processes as most businesses would prefer not to divulge such information easily. In the case of electricity consumption, there is a need to work with the Department of

Energy to get more meaningful data and disaggregated information.

3. More capacity building for the GHGI team in learning the tools especially in the quantification process and identification of uncertainties per parameter and categories. As part of the learning curve, there were a few difficulties in interpreting information that is not covered in the GHGI User's Manual, the team needs further coaching and mentoring to be able to be more effective in their roles.
4. Partnership and linking with other Government Agencies. In the next reporting period, the quantification of GHG emissions in solid waste and wastewater treatment/discharge needs more preparation on the part of the Davao City TWG Team. A more comprehensive baselining and data collection is needed to be able to secure the required information for GHG emission accounting.

In all areas of concern, it is strategic fro the team to work, get support, mentoring and collaboration with the Environmental Management Bureau, Barangay Local Government Units and all other national government agencies. A lot of information has been gathered in these institutions and agencies and it would be a matter of synchronising data collection in the succeeding period to be able to do a more comprehensive GHG Inventory.

Descriptions of the methodology, data and data sources used in Davao City's 2017 GHGI have been included for the preparation of this GHGI report. The GHGI will be improved with continuous updates, and in this case, it is important to archive information about how previous databases were developed. This is expected to be helpful in improving the GHGI of Davao City in the future.

Overview of mitigation options

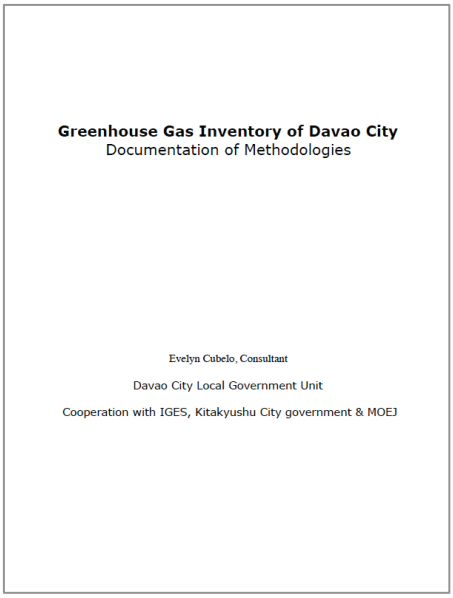
Mitigation options in Davao City are divided into groups and encompass a wide range of activities. In particular, the number of items in the "water sufficiency" group has increased, although this can be attributed to the strong presence of IDIS in participating NGOs. The following table includes those mitigation policies that were seen as potential projects for the JCM in the future.

Table 3 Mitigation policies as potential projects for the JCM

FOOD SECURITY		
Go for renewal energy sources	Explore windmill, solar powered pump and irrigation system	SDGs：13, 7, 11
Bio energy	Process livestock/poultry waste into organic fertiliser; Biogas technology	SDGs：2, 7, 11, 15
CLIMATE-SMART INDUSTRIES AND SERVICES		
Amend Green Building Code	Build Green Houses	SDGs：2, 11, 13
Mandatory Materials Recycling Facility for all Barangay Local Government Units	Commercial establishments, institutions/schools, subdivisions	SDGs：11
SUSTAINABLE ENERGY		
Mini Hydropower supply for off-grid and forested areas	Conduct studies in collaboration with agencies	SDGs：13, 11, 7
Vehicle conversion: use of alternative fuels	Conduct studies with government agencies	SDGs：13
Upgrade to biodiesel fuels	Conduct Feasibility Studies	SDGs：11, 13, 7
Promote Euro IV Fuels	Information Education Communication Campaigns on Liquid fuels conservation	SDGs：13

It is not clear whether the mitigation options listed here, including those above, will actually be positioned in the LCCAP. As well, since they do not fall outside of the range of the initial ideas, the Kitakyushu team will once again check to see if there is any support they can provide for mitigation options that have been positioned in the LCCAP once it has been completed.

To create a list of mitigation options, the information collected at the stakeholders workshop was listed up and then tied to specific SDG goals. This will help promote the SDGs in Davao City.



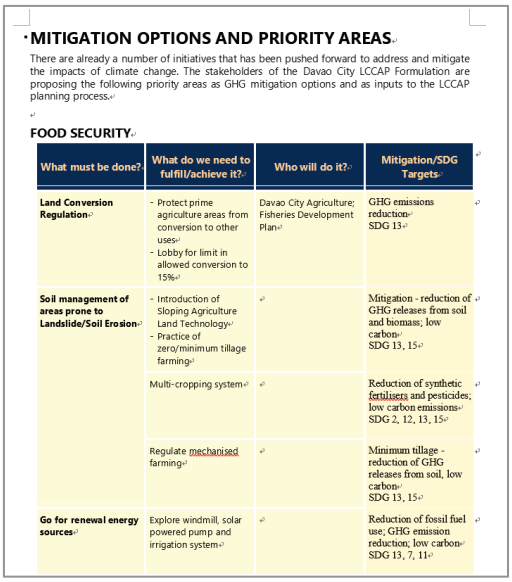
Greenhouse Gas Inventory of Davao City
Documentation of Methodologies

Evelyn Cubelo, Consultant

Davao City Local Government Unit

Cooperation with IGES, Kitakyushu City government & MOEJ

Figure 10 GHGI Report



MITIGATION OPTIONS AND PRIORITY AREAS

There are already a number of initiatives that has been pushed forward to address and mitigate the impacts of climate change. The stakeholders of the Davao City LCCAP Formulation are proposing the following priority areas as GHG mitigation options and as inputs to the LCCAP planning process.

FOOD SECURITY

What must be done?	What do we need to fulfill/achieve it?	Who will do it?	Mitigation/SDG Targets
Land Conversion Regulation	- Protect prime agriculture areas from conversion to other uses - Lobby for limit in allowed conversion to 15%	Davao City Agriculture; Fisheries Development Plan	GHG emissions reduction SDG 13
Soil management of areas prone to Landslide/Soil Erosion	- Introduction of Sloping Agriculture Land Technology - Practice of zero/minimum tillage farming		Mitigation - reduction of GHG releases from soil and biomass; low carbon SDG 13, 15
	Multi-cropping system		Reduction of synthetic fertilisers and pesticides; low carbon emissions SDG 2, 12, 13, 15
	Regulate mechanised farming		Minimum tillage - reduction of GHG releases from soil, low carbon SDG 13, 15
Go for renewal energy sources	Explore windmill, solar powered pump and irrigation system		Reduction of fossil fuel use; GHG emission reduction; low carbon SDG 13, 7, 11

Figure 11 List of mitigation policies

④Summary of tasks to support the formulation of the LCCAP

The first LCCAP in Davao City is expected to be completed around June 2020. The basis for planning and implementation has been drawn together under the framework of city-to-city cooperation, which has been able to contribute to the development of components for the LCCAP. Unfortunately, tasks to position proposed projects in the LCCAP to be studied under the city-to-city cooperation programme (waste-to-energy and LED street lighting) have not materialized as initially expected in terms of political decisions and private sector initiatives. However, ideas will continue to be exchanged with Davao City on other mitigation options that may be of interest to the city and about their potential to become JCM projects in the future.

2. Activity 2: Feasibility study on a low-carbon project in energy sector

A Davao City ordinance that requires the Davao Light and Power Company (hereinafter referred to as "DLPC") to comply with the city's street lighting efficiency programme to install light-emitting diodes (LED) for street lighting in areas under the jurisdiction of Davao City (Ordinance No. 0409-18/2018) (hereinafter referred to as the "LED ordinance") specifies that all street lights in the city's jurisdiction will be converted from high-pressure sodium (HPS) lights to light-emitting diode (LED) lights.

Plans are in place to update all of the approximately 40,000 street lights in the city with LED lights over a five-year period, and the change from HPS to LED has already started in the Central Business District (CBD). Over the next three years, 22,788 street lights will be converted to LED lights, and a study was conducted on this initiative as a potential JCM model project. The breakdown of these 22,788 street lights is shown in the figure below (60W (10,008 lights), 80W (3,348 lights), 110W (7,632 lights), 212W (1,800)).

Table 4 Breakdown of LED street lights to be installed in Davao City

Wattage	Yearly Qty	Total for Remaining 3 years
60W	3,336	10,008
80W	1,116	3,348
110W	2,544	7,632
210W	600	1,800
	Total units	22788

Requirements for LED street lights to be installed to replace existing street lights (minimum specifications, excerpt from LED ordinance).

a. Lighting fixtures may be specially designed for the use of a light source based on semiconductor technology (LED). Products designed for other types of light sources or those adapted or modified for LED light sources are not acceptable.
b. Sealants for lights and control equipment compartments should be a minimum of IP66.
c. The minimum level of shock resistance against disruption shall be IK08 (based on a 10-grade evaluation).
d. The lifetime of lighting performance should satisfy L80B10 at a minimum with a burn time of 100,000 hours (90% of lamps maintain 80% of lumens at 100,000 hours). This will prevent a rapid decay of light output by lighting fixtures.
e. Electrical safety classification: Class 1, installation of double insulation wires
f. Power factor: >90 at 100% load
g. Ambient temperature during use (Ta): 45℃ or higher
h. Main voltage tolerance: 120V to 227V
i. Correlated Colour Temperature (CCT): 3000k
j. Colour Rendering Index (CRI): >70

k. Lumens per watt: Minimum value of 85
l. Casings should be made from a die-cast aluminium alloy with transparent and flat-tempered glass (polycarbonate or similar materials are not acceptable).
m. Surge protection device: 10kV
n. Light-fixture angle system: Minimum of +5 to -10 degrees
o. Manufacturer's warranty: 6 or more years
p. IEC complaint authentication must be provided for the following: IP, IK, fragmentation, EMC, LM80 tests
q. All measurement work should be carried out using equipment with ISO17025 certification.
r. The outward appearance of objects captured by CCTV securing monitoring equipment shall not be disturbed or damaged by the use of these lights.

Under this ordinance, the DLPC will cover all costs related to the installation of LED lighting, while Davao City will recover costs by adding installation costs to electricity bills paid to DLPC in the future (see figure below). In addition, the Energy Regulatory Commission (ERC) of the Philippines has approved a budget (ERC Case No. 2018-123RC) for the LED street lighting project being implemented by DLPC, which has also secured its own budget to implement the project.

This project will have a broad beneficial impact on the residents of Davao (see figure below) as the JCM model project will reduce the initial investment associated with the conversion to LED lights paid for by DLPC, which will also reduce electricity bills paid to DLPC by Davao City in the future.(See the figure below）

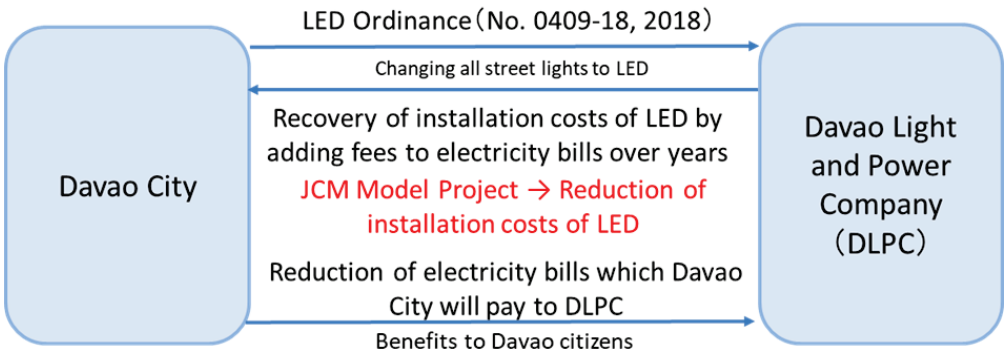


Figure 12 Project scheme of LED street light project

Discussions have been carried out with the top management of DLPC and engineering departments since the last fiscal year in connection with the LED street lighting project, in which information was received on the results of technical assessments on products proposed by Japan last fiscal year, as well as technical specifications ordered by DLPC (see Reference 7). Based on these technical specifications, the proposing companies (Dhowa Technos Co., Ltd., JOIN Planning Co., Ltd.) redesigned the product from scratch to create the following product samples, which were submitted to DLPC.

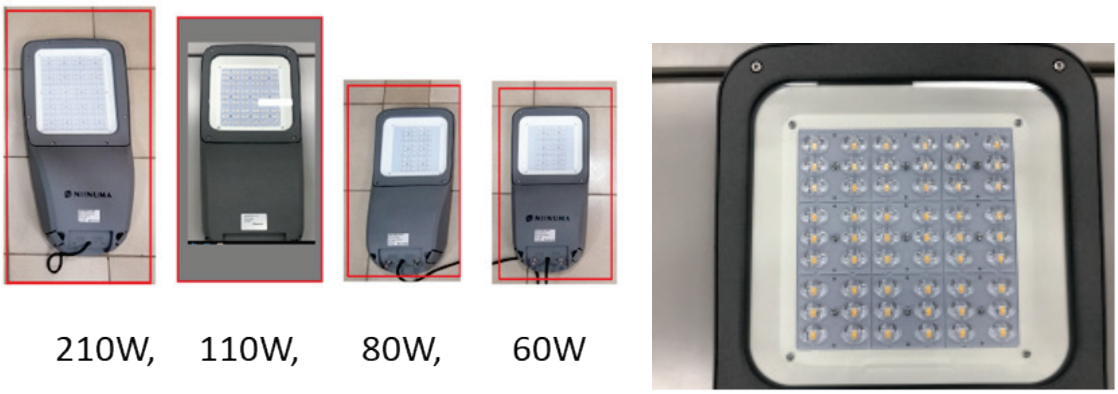


Figure 13 LED Samples made by the proposing companies

In this fiscal year, discussions took place with DLPC on technical and financial assessments of these new sample products, as well as on the JCM model project scheme.

At the first field survey (December 10, 2019), DLPC submitted a technical assessment report on the proposed product (see Reference 8). In the sample products provided to DLPC, all parts related to product performance satisfied criteria and were well received, with the exception of the lack of a surge protector on the 110W sample product (attributed to human error as it had been overlooked), and differences in the joint part connecting the pole and LED device (use of the existing pole changed the diameter of the joint connected to the LED to 42mm). By the next field visit, the technical assessment had been provisionally completed once the joint parts were rebuilt. In addition, during the next visit, an agreement had been reached after members confirmed the quoted amount of money reflected in the JCM model project subsidy, schedule, application documents and conditions for applying for a subsidy in the next fiscal year and discussions were held on DLPC's bidding schedule.

The second on-site discussions with DLPC were held on January 31, 2020. At the start of discussions, the Japanese members presented a device with the modified joint part as had

been indicated in the previous technical assessment report. Next, the members explained the overview, application conditions, schedule and other issues related to the JCM model project, and discussions on financial aspects were held with the Global Environment Center (GEC) based on the contents of earlier meetings. The main points related to the content of these discussions can be found below (See Reference 9).

- Estimated reduction in CO_2 emissions for 22,788 LED lights is 21,932.6 t-CO_2 (statutory useful life: 10 years)

(Methodology: Calculated based on JCM_ID_AM018_ver01.0)

- If the project's cost effectiveness is set at JPY 4,000/t-CO_2, a subsidy of about JPY 90 million (subsidy rate: about 20%) can be expected.
- When applying for a JCM model project, DLPC would be required to submit a specified private tender to a representative Japanese company (Dhowa Technos Co., Ltd.), instead of a general bid for the LED project.
- Offer by Japan to provide additional discounts for a 3-year blanket order
- In addition, the members agreed that when applying for the JCM model project subsidy, DLPC would set a flexible ordering period, and provide documents when submitting the application (explanatory materials on the calculation process and basis of the payout period and internal rate of return (two types, both with and without assistance), and a description of the financial status of the joint venture).

Based on the results of the above discussions, it was decided that DLPC would consult with the Japanese side to determine if the figures and conditions presented by them were feasible (3-year blanket orders through specified private tender).

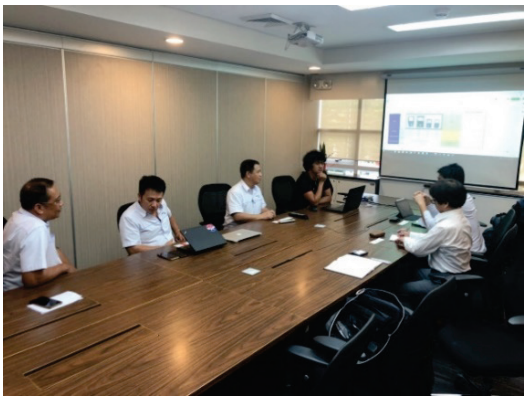


Figure 14 First field survey

Figure 15 Second field survey

Before the second field survey, preliminary discussions were held with the Global Environment Center (GEC) on the application for a JCM model project (February 22, 2020). These discussions were based on an interview sheet (see Reference 10), confirming the following points, in particular.

- Statutory useful life of LED lighting
  → Expected statutory useful life of 10 years
  (Supporting materials: Structures, metal structures, suspension bridges, chimneys, incinerators, driven wells, fences, street lights and guardrails in the "Appended table of the durable life of tangible depreciable assets other than machinery and equipment" in the "Ministerial Ordinance Concerning the Durable Life, etc. of Depreciable Assets")
- Documents to be submitted by the joint venture
  → Explanatory materials on the calculation process and basis for investment payout period and internal rate of return (two types, with and without subsidy) indicating the difficulty of implementing the project without a subsidy. Materials disclosed to shareholders, such as a statement on the financial status of the joint venture, can also be used if the joint venture is a listed company.
- Contents of MRV monitoring
  → Can refer to project on introducing LED lighting for street lights in Indonesia (methodology: ID_AM018_ver01.0). The representative company submits a report after filling in the monitoring sheet, with verification provided by a third party. Then, the representative company submits an application for issuing credits (allocation of credits to be determined in advance, but the Japanese government has conditions set to 50% or more). The project should be implemented one year after it has been adopted. After this, the application can be made for multiple years.
- Concepts of excluding profits and subsidy rates, as well as the flow of subsidies in a diagram of an implementation system for an international consortium
  → Concept of providing subsidies for purchasing costs. This does not, however, involve the asking price of Japanese representative companies in the international consortium to the joint venture. For this reason, there is no need to disclose information to the joint venture on subsidy rates or purchase costs, if not necessary (although a statement of delivery from the joint venture is required). The representative company must submit an estimate, purchase order, contract, proof of

purchase, etc. from the manufacturer.

- Schedule for public offering for the JCM model project for the next fiscal year

  → At this time, the schedule for the next fiscal year is assumed to be the same as this year.

The following figure illustrates the proposed implementation scheme for the JCM model project with Dhowa Technos Co., Ltd. selected as the representative company and Join Planning Co., Ltd. (positioned outside the consortium) as the equipment manufacturer. Davao Light and Power Company (DLPC) is selected as the co-applicant.

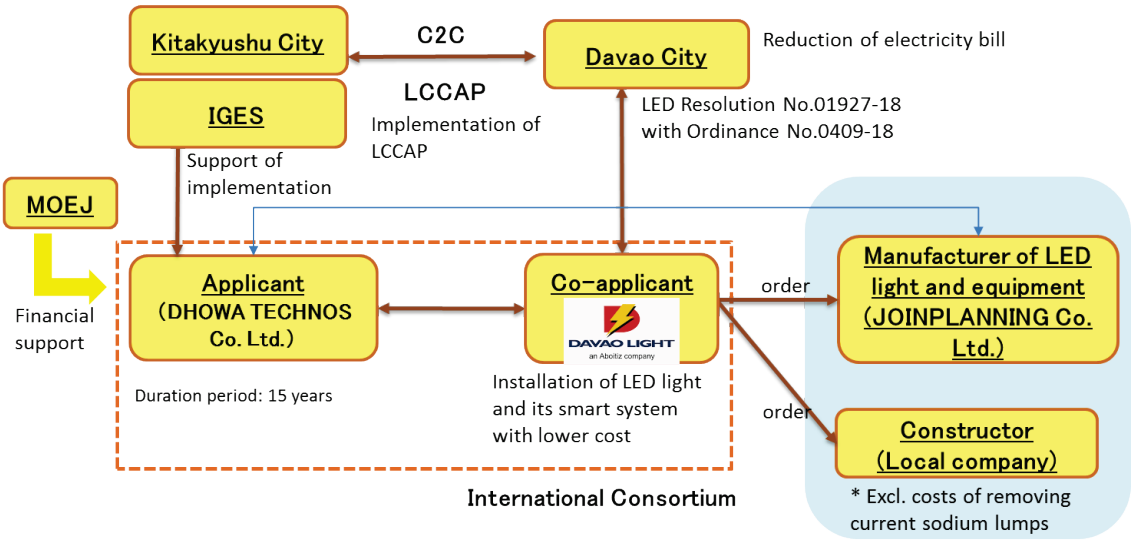


Figure 16 Proposed implementation system for the LED project for street lights in Davao City

A project converting sodium lamps to LED lighting in Cambodia (Methodology No. KH_AM001) and a project introducing LED lighting to street lights in Indonesia (Methodology NO. ID_AM018_ver01.0) were used as reference for the GHG reduction effects associated with the use of LED street lights.

$$ER_p = RE_p - PE_p$$

Criterion 1	The project installs LED street lighting system utilizing wireless network control, which is connected to an electricity grid system.
Criterion 2	All lighting equipment in one lighting system has the same specifications.
Criterion 3	Wireless network technology enables controlling of the volume of lighting.

$$RE_p = \sum_i P_i \times \left(\boldsymbol{\eta}_{PJ,i} \div \boldsymbol{\eta}_{RE}\right) \times PO_{i,p} \times EF_{grid} \times 10^{-6}$$

PE_p	Project emissions during the period p (tCO_2/p)
$PEC_{i,p}$	Total amount of electricity consumed in the project lighting system i during the period p (Wh/p)
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)
i	Identification number of the lighting system

$$PE_p = \sum_i PEC_{i,p} \times EF_{grid} \times 10^{-6}$$

RE_p	Reference emissions during the period p (tCO_2/p)
P_i	Rated power consumption of a lighting equipment used in the project lighting system i (W)
$\eta^{PJ,i}$	Luminaire efficiency of a lighting equipment used in the project lighting system i (lm/W)
η^{RE}	Luminaire efficiency of the reference lighting system (lm/W)
$PO_{i,p}$	Total operating hours of project lighting system i during the period p (hrs/p)
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)
i	Identification number of the lighting system

Source: https://www.jcm.go.jp/kh-jp/methodologies/34

Besides, the following conditions are set for a calculation of GHG reduction:

- Over the next three years, 22,788 street lights will be converted to LED lights, and a study will be conducted on this initiative as a potential JCM model project.
- Use of emission factor of 0.286 tCO_2/MWh from Mindanao, Philippines
  (Source: http://gec.jp/jcm/jp/kobo/h30/mp/jcmsbsd30_emission_factor0723.pdf)
- Expected statutory useful life of 10 years
  (Supporting materials: Structures, metal structures, suspension bridges, chimneys, incinerators, driven wells, fences, street lights and guardrails in the "Appended table of the durable life of tangible depreciable assets other than machinery and equipment" in the "Ministerial Ordinance Concerning the Durable Life, etc. of Depreciable Assets")

Table 5 Calculation methodology for GHG reduction for the LED project

						DHOWA TECHNOS				
DLPC						JOINT PLANNING				
HPS (W)	actula power consumption incl. ballest		LED (W)	Number of units to be replaced		luminance	Number of lights	W/pcs	actual power consumption (W)	Luminaire efficiency (lm/W)
70	85	→	60	10,008		6165	1	45	41.5	137
150	171	→	80	3,348		8220	1	60	57.8	137
250	300	→	110	7,632		10960	1	80	83	137
		→	210	1,800		21920	1	160	157.9	137
				22,788						

Wh	Wh/day	Wh/year	Total power consumption (Wh/year)	Project Emission (tCO2/year)	Reference Emission (tCO2/year)	GHG emission reduction (tCO2/year)
41.5	498	181,770	1,819,154,160	520.28	1174.8	
57.8	693.6	253,164	847,593,072	242.41	547.4	
83	996	363,540	2,774,537,280	793.52	1791.8	
157.9	1894.8	691,602	654,372,000	187.15	422.6	
		1,490,076		1,743.36	3,937	**2,193.26**

Calculations based on the above figures found that a GHG reduction effect of 21,932.6 t-CO_2e/year can be expected.

3. Activity 3: Studies on the possible application of JCM model projects for waste-to-energy projects promoted by Davao City

The Waste-to-Energy (hereinafter WtE) Project in Davao City is expected to be a first WtE project in the Philippines and a model project possibly replicating other cities of the Philippines. The WtE project in Davao City is awarded and funded by the official development assistance (ODA) by Japan government, and the project is implemented with a support of a procurement agency appointed by the governments. This means that it is necessary to examine the potential for collaboration with the above-mentioned, grant-in-aid projects that offers business rights, rather than an independent study on financing projects as JCM model projects. Since the procurement process was behind the original schedule, the detail design and budget estimation for the equipments possibly targeting JCM model projects (e.g. boilers, legal durable years is 15 years) cannot be conducted. Instead, the study this year focuses on investigation of the preparation status of the WtE project in Davao City as well as implementation support for the project.

Trend in Davao City

Davao City nominated the private-owned land (9ha) in Barangay Biao Escuela as a potential site for the WtE project and proceeded an approval process of the city council, and completed the land acquisition in October 2019 (see the below figure).

Davao City needs to acquire an Environmental Compliance Certificate (ECC) from Department of Environment and Natural Resources (DENR) when the city will implement the WtE project. In the acquiring process, it is one of the conditions needed to meet that Davao City's 10 years Solid Management Plan which mentions the implementation of WtE project is approved by DENR. The 10 years solid waste management plan was endorsed by DENR in November 2019.

Figure 17 Proposed site for the WtE plant in Davao City

Trend at national-level

The project tem visited Usec. Antiporda of DENR on August 2nd, 2019 together with Davao City officials and explained DENR and other agencies the project overviews and discussed on the Department Administrative Order for a WtE project which DENR was preparing, especially for the concerns on the possible dioxin emissions from a WtE facility. The project team explained about the emission standard of dioxins from a WtE plant and how the emission standard was set in Japan and provided the information on a dioxin emission inventory in Japan (See Reference 11). The followings are the participants of the discussion sessions from the Philippine-side:

- DENR: Mr. Antiporda (Undersecretary for Solid Waste Management and Local Government Units Concerns), Eng. Nolan Francisco (OIC-Chief, Solid Waste Management Division (SWMD)), Delia Valdez (Senior environmental management specialist of the Solid Waste Management Division of the Environmental Management Bureau (EMB)), Head of regional offices of DENR, Eng. Esguerra (Chief Science Research Specialist, Environment and Biotechnology Division, Industrial Technology Development Institute (ITDI), and other.
- Davao City：Atty. Domingo (Assistant City Administrator / Project Manager of), Eng. Madrazo (Assistant Project Manager for WtE Project Management Team), Atty. Gallo

(Member of legal and financial unit of WtE Project Management Team), and other.

DENR issued DENR Administrative Order (No. 2019-21) named "the Guidelines Governing Waste-to-Energy (WtE) Facilities for the Integrated Management of Municipal Solid Wastes" on November 26th, 2019 (See Reference 12). In the administrative order, the standard of dioxin emission is set at 0.1 ng-TEQ/NCM.

Also, the project team had a meeting with DERN together with JICA Technical Assistant team as well as the procurement agency team on a treatment standard of as generated from a WtE facilities. As a result of the meeting, it is revealed that elution standard at a landfill site is set by the regulations while the emission standards at a WtE facility is not set by the current regulations in the Philippines unlike Japan.

Besides, the hearing sessions on a WtE bill were held on January 28th and February 11th, 2020 by a call of Senator Win Gatchalian. Davao City, the related national agencies, private companies and NGOs are called, and the concerns and issues to implement a WtE project in the Philippines are discussed.

Feasibility Study of the ODA project

The appointed procurement agency conducted the detail feasibility study for the proposed WtE project in Davao City. The tentative result was shared with Davao City and Department of Finance of the Philippines and agreed that Davao City, which is an implementation authority of the WtE project, will try to fill the viability gap by applying a subsidy to DENR.

The project structure of the WtE project is shown as below. The applicant of a JCM model project is Nippon Steel Engineering Co., Ltd.

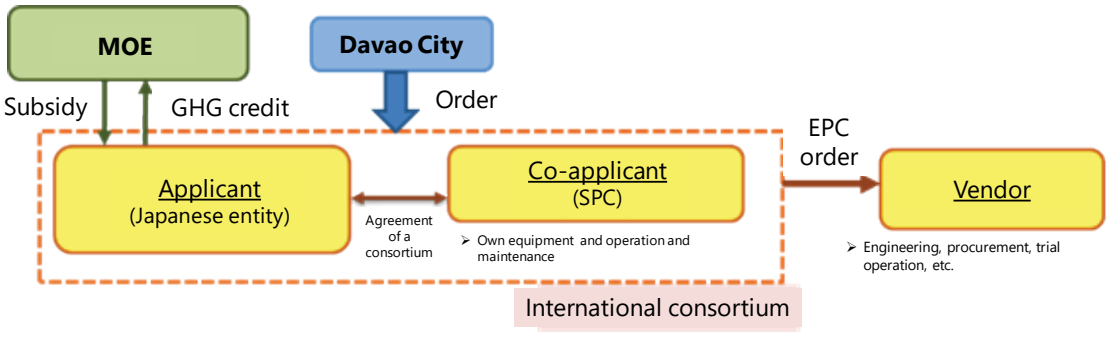


Figure 18 Structure of implementation system for waste-to-energy (WtE) projects

The following items have been identified as tasks for the development of a WtE project as a JCM model project.

- Timing of order for WtE project by Davao City as well as for establishing SPC
  The timing of the order for the WtE project by Davao City must correspond with the schedule for public tender and decision on adopted JCM model projects. However, this concern is solved by introducing the full year open call for JCM model project this year. The contractor for the WtE project (company that will form the SPC, mentioned later) must be decided by Davao City and target equipment ordered from the relevant SPC within the three-month period following the internal announcement of adopted JCM model projects and upon receipt of the decision for delivery of the subsidy for the model project. When bidding for the WtE project by Davao City, an application will be submitted for the JCM model project before bidding by Davao City for the WtE project starts, but it should be clarified that the order has been placed before the provisional adoption of the project.
- Engineering work related to target facilities/equipment
  Subsidies are not available for costs related to engineering work for target facilities/equipment prior to the decision on grants. Delaying engineering work until the decision on the grant is made will slow down the process and certain costs will be excluded from the subsidized project, which means that it will be necessary to coordinate with the timing of orders for the WtE project.

MRV methodology for the proposed WtE project is developed by referring to the methodology used for the WtE project in Yangon City of Myanmar.

The reference emission is calculated based on the amount and composition of waste incinerated and the amount of electricity supplying to the grid. The amount of GHG emissions from landfill sites is calculated by using First Order Decay (FOD) formula. The amount of emission from the grid is calculated by multiplying the amount of electricity supplying to the grid and the emission factor.

The project emission is calculated based on the emissions generated from burning fossil fuels at the point of starting operation of the WtE facility as well as burning waste which is derived from fossil fuels such as plastics. Besides, N2O and CH4 are calculated as a project emission which are consist with the exhaust gas.

The followings are parameters for monitoring:

- Waste composition and amount providing to the WtE facility
- Amount of fossil-fuel consumption
- Electricity supply to the grid

The following conditions are set in order to calculate the possible reduction of CO2 emissions.

Table 6 Conditions set to calculate a possible CO2 reduction

Component	
Treatment capacity of a WtE facility	600t/day
Annual operation hours	7,440 hours（310 days）
Annual energy generation	87,048MWh
Annual sales of electricity	74,688MWh
Grid emission factor (Average value in Mindanao Island)	0.163 t-CO2/MWh

（1）**Reference emission**（reference emission [tCO2/p] during the period p）

$RE_p = RE_{CH4, SWDS, p} + RE_{elec, p}$

$RE_{CH4, SWDS, p}$	Reference emission from decomposition of SDWS during p	(tCO2/p)
$RE_{elec, p}$	Reference emission from grid power during p	(tCO_2/p)

（2）**Project emission**（project emission [tCO2/p] during the period p）

$PE_p = PE_{FC, p} + PE_{COM\_CO2, p} + PE_{COM\_CH4N2O, p}$

$PE_{FC, p}$	CO2 emission from fossil-fuel consumption during p	(tCO2/p)
$PE_{COM\_CO2, p}$	CO2 emission from incinerating waste derived from fossil fuel during p	(tCO_2/p)
$PE_{COM\_CH4N2O, p}$	GHG emission which is included in exhaust gas from an incineration facility during p	(tCO2/p)

（3）**Amount of GHG reduction**

$ER_p = RE_p - PE_p$

IV. Participation in Seminar

1. Seminar on City-to-City Collaboration for Creating Low-carbon Society and invitation to Kitakyushu City

Kitakyushu extended an invitation to Vice Mayor Sebastian Zimmerman Duterte and City Councilor Atty. J. Melchor B. Quitain from Davao City to visit the city timed with their plans to participate in the Seminar on City-to-City Collaboration for Creating Low-carbon Society held in Tokyo on January 16-17, 2020.

Vice Mayor Duterte was first elected to his position in Davao City during elections held in May 2019 and is regarded as a promising candidate as the next mayor of Davao. He is serving as the acting mayor while Mayor Sara Duterte is away from the city on business. Atty. Quitain is also the chair of Davao City Council's Parliamentary Steering and Legislative Committees and a leading member of the Davao City Council. Atty. Quitain has long been interested in collaborative projects with Kitakyushu and was invited to the city because he expressed a wish to visit waste-to-power and energy-saving facilities in Kitakyushu.

A group from Davao City, which included these two high-level members, planned to visit Kitakyushu from January 13-15 to learn about policies and measures in partner cities and engage in discussions with stakeholders, with a plan to strengthen city-to-city partnerships. In particular, they planned to enhance their understanding of the current status of the city-to-city cooperation and waste-to-energy projects (see the figure below for an itinerary and list of invited participants).

Unfortunately, the eruption of the Taal Volcano on Luzon island on January 12 shut down Ninoy Aquino International Airport in Manila that evening, and as a result, all flights between Davao and Manila, as well as Manila to Fukuoka were cancelled on the following day. Due to the uncertainty surrounding the operation of subsequent flights, the safety of the group could not be secured and all of the group's plans to visit Japan were subsequently cancelled (See Reference 12).

The representatives from City of Kitakyushu introduced the collaboration projects between Davao City and Kitakyushu City at the seminar (See Reference 13).

Table 7　Planned Schedule for Japan Visit in January 2020

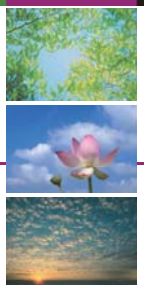
Date & Time	Itinerary
13 Jan.	
06:15-08:10	Davao→Manila (PR1810)
09:45-14:15	Manila→Fukuoka (PR426)
15:30	Move to Kitakyushu by charter bus
17:00	Hotel Check-in
	Orientation
14 Jan.	
09:00-10:00	Lecture & Discussion on City-to-City Collaboration Project between Davao and Kitakyushu
10:30-11:00	Site Visit 1: Garbage Collection Site (Momozono Area, Yahata-West, Kitakyushu City)
11:30-12:45	Lunch
13:00-13:40	Site Visit 2: Cans & Bins Recycling Centre in Junnoharu
14:00-15:00	Site Visit 3: WtE Plant in Jinnoharu
15:30-16:30	Site Visit 4: Final Landfill Site in Hibikinada
18：30-20：30	Welcome Dinner with other delegates from asian cities
15 Jan.	
09:30-10:30	Site Visit 5: Kitakyushu Environmental Museum
11:00-11:30	Site Visit 6: Kitakyushu Technology Center, Nippon Steel Engineering
12:30-13:30	Lunch with Hon. Mayor of Kitakyushu City
13:45-14:15	Courtesy Visit to Kitakyushu City Council
	Move to Kitakyushu Airport by charter bus
16:20-17:50	Kitakyushu→Tokyo Haneda（SFJ86）
	Hotel Check-in
16 Jan.	
9:00-12:00	Closed seminar on City-to-City Collaboration Program I
12:00-14:00	Lunch
14:00-17:00	Site Visit in Tokyo (Tokyo Gas Science Museum)
17 Jan.	
9:00-12:00	Closed seminar on City-to-City Collaboration Program II
12:00-14:00	Lunch
14:00-17:00	Open seminar on City-to-City Collaboration Program
18 Jan.	Hotel Check-out
	Move to Tokyo Haneda Airport
15:20-19:30	Tokyo Haneda→Manila（PR421）
22:15-00:05^{+1}	Manila→Davao（PR2825）

Table 8 List of Invitees from Davao City

	Name	Organization	Position	Remarks
1	Mr. Sebastian Zimmerman Duterte	Davao City Government	Vice Mayor	
2	Mr. J. Melchor JR. Bumpus Quitain	City Councilor of Davao	City councilor	
3	Ms. Diana Ann Welborn Quitain	Office of Atty. Quitain, City Councilor of Davao	Chief of Staff	Self-sponsored
4	Mr. Vince Jul O. Malicay	Office of Vice Mayor of Davao	Executive Assistant of Vice Mayor Duterte	Self-sponsored

Attachment

Reference 1： Documents for the kick-off meeting
Reference 2： Programme of the stakeholder workshop
Reference 3： Participants list of the stakeholder workshop
Reference 4： Presentation materials for the stakeholder workshop
Reference 5： Green House Gus Inventory (GHGI) Report for Davao City
Reference 6： List of mitigation policies summarised at the stakeholder workshop
Reference 7： LEC technical specifications
Reference 8： Evaluation Matrix of LED street lights (proposed by the Japanese companies) by Davao Light
Reference 9： Presentation material of the JCM model project (project of LED street lights) in Davao City
Reference 10： Interview sheet regarding application for JCM projects and promotion of collaboration
Reference 11： Documents for the collaboration scheme between the Philippines and Japan on the waste management (August 2, 2019)
Reference 12： Department of Environment and Natural Resources (DENR) Administrative Order No. 2019-21
Reference 13： Official Letter issued by the Davao City Government concerning cancellation of Japan Visit of Vice Mayor
Reference 14: Presentation material of the city-to-city collaboration between Davao City and Kitakyushu City for Seminar on the City-to-City Collaboration (January 16-17, 2020)



City-to-City Collaboration Project between Davao and Kitakyushu

LCCAP development in FY2019 including GHG inventory & mitigation options

Junko Akagi
Research Manager
Kitakyushu Urban Centre

21 Nov. 2019

IGES Institute for Global Environmental Strategies

Outline of city-to-city collaboration program

-Basic concept is transferring the knowledge and experience of Japanese cities for creating low carbon society to foreign cities which have the mutual relationship.
-Private companies formulate the consortiums with Japanese cities and support foreign cities to create low carbon cities.

Ex) Support to design city masterplan and install low carbon technology etc.

Company
・Surveying local needs and information
・Identifying suitable technology

Japanese city ⇔ **Foreign city** : **Collaboration**

・Transferring the knowledge of designing the local systems
・Providing lecture for city management

・communication and negotiation with stakeholders in own country
・supporting low-carbon society creation

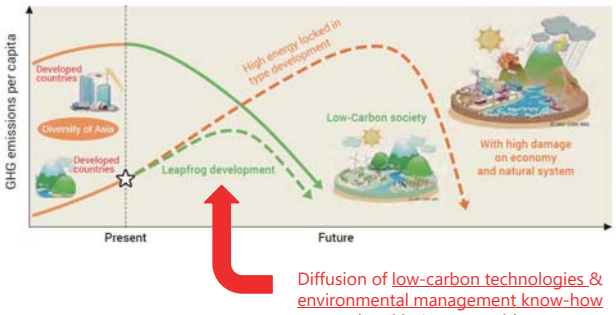
- Creating low carbon project efficiently and effectively
- Designing the local systems to promote low carbon society
  Ex) low carbon action plan and technology evaluation criteria etc.
- Capacity building for local staffs

Promotion of private investment → **Self-sustained development of foreign city** → **Transferring low-carbon technology to other fields**

Source: MOEJ

Creating a low-carbon and sustainable society

Conceptual diagram of leapfrog development



Diffusion of low-carbon technologies & environmental management know-how accumulated in Japanese cities

Source: National Institute for Environmental Studies

FY2019 Cities joining the city-to-city collaboration program by MOEJ

1. **Ho Chi Minh City (Vietnam) – Osaka City**
   City-to-City Collaboration Project between Ho Chi Minh City and Osaka City
2. **Bali City (Indonesia) – Toyama City**
   Support on Tourism Future City of Bali Province through City-to-City Collaboration
3. **Hlegu township,Yangon (Myanmar) – Kitakyushu City**
   Low carbonization in smart city development project in Yangon Region
4. **Iskandar Development Area(Malaysia) – Kitakyushu City**
   Promotion of Low Carbon Society in Iskandar Regional Area
5. **Bangkok and Laem Chabang (Thailand) – Yokohama City**
   ports in Thailand to reduce GHG emission by advancing modal shift and enhancing terminal efficiency
6. **Yangon city (Myanmar) – Kawasaki City**
   Support on Low Carbon Mega Food Park through City-to-City Collaboration
7. **Can Tho city (Vietnam) – Hiroshima pref. government**
   Biomass power generation project using milled rice husks for compressed solid fuel
8. **Sagaing Region (Myanmar) – Fukushima City**
   Promotion project of low-carbon regional development in Sagaing Region
9. **Rokan Hulu Regency (Indonesia) – Kawasaki City**
   Project to Promote Circular Economy for Palm Industry in Riau Province Region
10. **Kuala Lumpur City (Malaysia) – Tokyo Metropolitan Government**
    Project developing a policy framework for building energy efficiency through city to city collaboration between Kuala Lumpur Government and Tokyo Metropolitan Government

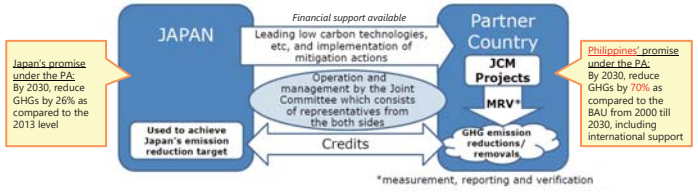
11. **Davao City (Philippines) - Kitakyushu City**
12. **Quezon City (Philippines) – Osaka City**
13. **Hai Phong (Vietnam) – Kitakyushu City**
14. **EEC and Bangkok (Thailand) – Osaka City**
15. **Jakarta (Indonesia) – Kawasaki City**
16. **Ayeyarwady (Myanmar) – Fukushima City**
17. **Semarang (Indonesia) – Toyama City**

Source: MOEJ

Mechanism for facilitating the diffusion

Joint Crediting Mechanisms (JCM)

Bilateral agreement
Jan. 12, 2017
(Manila)



Japan's promise under the PA:
By 2030, reduce GHGs by 26% as compared to the 2013 level

Philippines' promise under the PA:
By 2030, reduce GHGs by 70% as compared to the BAU from 2000 till 2030, including international support

Source: METI

JCM City-to-city Cooperation Project between City of Kitakyushu and Davao City

Project to realize low carbon society in Davao City
through a support for a development of Local Climate Change Action Plan

City of Kitakyushu ⇔ Green Sister City Agreement (November, 28th, 2017) Expanding the cooperation area to a development of low carbon society ⇔ Davao City
C/P
- Assistant City Administrator
- City Environment and Natural Resources Office (CENRO)

Focal point

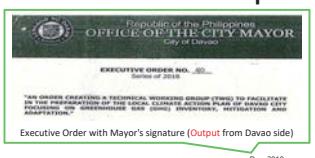
Institute for Global Environmental Strategies (IGES) ⇔ Agreement on cooperation ⇔ Ateneo De Davao University

Local consultant
Agreement on cooperation

Support & study items

1. **Support for the development of Local Climate Change Action Plan (LCCAP) of Davao City**
2. **Study on the applicability of JCM model project to the Waste-to-Energy (WtE) project**
   - **NIPPON STEEL ENGINEERING CO., LTD.**
3. **Feasibility study on the LED streetlight conversion project**
   - **DHOWA TECHNOS Co., Ltd., JOIN PLANNING Co., Ltd.**
4. **Feasibility study on the EV bus and renewable energy projects**
   - **SoftEnergy Controls Inc., KYOWA ENGINEERING CONSULTANTS Co., Ltd.**

LCCAP development support in Davao City


Republic of the Philippines
OFFICE OF THE CITY MAYOR
City of Davao

EXECUTIVE ORDER NO. 40
Series of 2018

"AN ORDER CREATING A TECHNICAL WORKING GROUP (TWG) TO FACILITATE IN THE PREPARATION OF THE LOCAL CLIMATE ACTION PLAN OF DAVAO CITY FOCUSING ON GREENHOUSE GAS (GHG) INVENTORY, MITIGATION AND ADAPTATION."

Executive Order with Mayor's signature (Output from Davao side)

Vulnerability assessment & Adaptation option longlist
LCCAP draft

May 2018
C2C collaboration started

Input from IGES & City of Kitakyushu:
- Basic information on GHGI & LCCAP
- Sharing of a list of data to be collected
- Hands-on training in Japan
- Liaison with Climate Change Commission

Dec. 2018
TWG establishment
EO No. 40
December 28, 2018

April 2019
GHGI development
CCC's Technical WS
April 30-May 2, 2019

Input from IGES & City of Kitakyushu:
How do we work together with the Davao City government?
- Mainstreaming low-carbon city concept by aligning other administrative plans;
- Establishing institutional arrangement for implementation;
- Placing concrete low-carbon (JCM) projects as mitigation measures.

X 2019
Mitigation option longlist & Mainstreaming
Potential low-carbon projects (e.g., LED, WtE) to be included in the LCCAP

X 2020-
Launch, implement & monitor LCCAP
LCCAP

Davao City — Actor

UNHABITAT (2013) — IGES & City of Kitakyushu (2018-) — Supporters

Green Sister City Agreement (December 28, 2017)

Activities under the FY2019 C2C project

1. Completion of Davao City's GHG inventory & documentation
2. Creating a longlist of mitigation options based on:
   - municipal administration goals (CDP, CLUP)
   - GHG inventory
   - F/S under the C2C Project (e.g., WtE, LED)
   - SDGs
3. Update adaptation plan, as necessary

Develop draft components of the LCCAP

Schedule for the FY2019 C2C project

	FY2018	FY2019 Nov	Dec	Jan	Feb	FY2020
LCCAP TWG established	■					
CCC's GHGI workshop	■					
Preliminary GHGI results	■					
Completion of GHGI		■	■			
Documentation of GHGI (local con.)			■	■		
C2C seminar in Tokyo (Vice Mayor)				■		
Mitigation options consideration		■	■	■		
Documentation of mitigation options (local con.)					■	
Update of adaptation options						■
Documentation as LCCAP						■
LCCAP finalization						■

Expected output for FY2019: (1) GHGI report, (2) Longlist of mitigation options

C2C Seminar in Tokyo (16-17 Jan 2020, Tokyo)

Organizer: Ministry of the Environment of Japan & IGES

Participants: Participants of the FY2019 C2C Projects
- About 80 people for the closed seminar
- About 150 people for the open seminar (17th PM)

Purpose: To share and disseminate the progress made by each project

From Davao City, Vice Mayor and his chief staff will attend the seminar.
(They will visit Kitakyushu prior to the seminar.)

They are requested to make a 5 min. presentation on our project:
- ✓ Overview of the C2C project and expected outcome;
- ✓ Progress made for the development of LCCAP and low-carbon projects;
- ✓ Roles played by the Davao City government in the C2C project;
- ✓ Challenges faced by the Davao City government for creating low-carbon and sustainable society.

Discussion point for today

- Stocktaking
- Do you agree with the suggested actions for FY2019?
  - ✓ How can we document the GHG inventory results?
  - ✓ How can we create a longlist of mitigation options?
- How can we support you to develop the LCCAP?
  Do you have any requests to the "Team Kitakyushu"?
  - ✓ Local consultant will be hired based on the request FY2018.

2020.01.29 version

PROGRAMME

Formulation of Local Climate Change Actions for Davao City
January 30-31, 2020
Venue: Malayan Colleges Mindanao, Davao City Campus

Day 1 Sessions - January 30, 2020

AGENDA		
9:00 - 9:30	Preliminaries: Prayer and Philippine National Anthem; Davao Hymn	
	Inspirational Message	Davao City Local Chief Executive
	Welcome Address	Engr. Dodjie Maestrecampo EVP and COO Malayan Colleges Mindanao, A Mapúa School
	Rationale and Objectives of Davao City LCCAP Workshop	
9:30 - 10:00	Participants Introduction	Group Exercise - Mood setting
10:00 - 10:30	INPUT 1: Overview of the current Local Climate and Disaster Risk Situation *Understanding Climate Change (CC)*	Keynote: Atty. Rachel Ann Herrera, Climate Change Commissioner
10:30 - 11:00	INPUT 2: Sharing of Experience on Climate Change Mitigation Strategies: The Case of Kitakyushu City, Japan	Institute for Global Environmental Strategies (IGES): Mr. Shiko Hayashi, Director and Ms. Junko Akagi, Research Program Manager
11:00 - 11:30	INPUT 3: Interfacing Development Interventions for Sustainability's Experience in addressing climate change impacts and its causes in Davao City	Interfacing Development Interventions for Sustainability, Mr. Lemuel Ibanez - Manalo, Environmental Planner
	OPEN FORUM	
13:15 - 13:30	INPUT 4. Legal Bases of CCA/ DRR Initiatives: Why do LGUs need to formulate a Local Climate Change Action Plan?	Atty. Mark Penalver, IDIS Coordinator
13:30 - 14:30	WORKSHOP A.2 - Next Steps	Workshop

2020.01.29 version

14:30 - 15:30	INPUT 5: A review and analysis of Davao City's situation and assessment: 4.1 Climate Change Vulnerability and Risk Assessment	Dr. Gernelyn T. Logrosa, Malayan Colleges Mindanao
	4.2 GHG Inventory results and Review of Current Mitigation Actions	Dr. Doris Montecastro, Ateneo de Davao University
	OPEN FORUM	
16:00-16:30	Synthesis - key actions - Commitments	

Day 2 - January 31, 2020

Mapping of Strategic Options and Priorities

AGENDA

9:00 - 9:30	Recap	
9:30 -10:30	Step 1: Review of Development Goals; Setting Objectives and Strategies for Climate Change Actions	Workshop and Plenary
10:30 - 12:00	Step 2: Options Identification	Workshop and Plenary
13:00 -14:00	Step 3: Options Assessment	
	Coffee Break	
14:30 - 16:00	Implementation: Putting it together and Presentation per sector	Plenary
16:00 - 16:30	OPEN FORUM	
16:30 - 16:45	Synthesis: Key Actions and Commitment	
	Closing	

Republic of the Philippines
City of Davao
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR

Davao City Local Climate Change Action Plan Workshop
Malayan Colleges Mindanao, A Mapua School
Mac Arthur Highway, Davao City
January 30, 2020, 8:00 a.m. – 5:00 p.m.

ATTENDANCE SHEET

No	Name	Offices/Agency	E-mail address	AM Signature	PM Signature
1	RACHEL C. VILLA MMCM	MCM			
2	MERIAM P. LEOPOLDO	MCM			
3	Nipa, Irenco Jr	city Disaster			
4	Lakandiwa Orcullo	CBNRO			
5	GONZALES, LENDEL M	CDRRMO			
6	FELINEE CABRERA	CENRO			
7	JASON HENDERLN	DENR-EMB RXI			
8	JALMAN P. SARIP	SANGGUNIAN PANLUNGSOD			
9	Liza Mae C. Villors	DENR-EMB RXI			
10	Marigold P. Arancta	DOE-Mindanao			
11	Gonzales, Eday Mcu	CDO			
12	Rex Anthony Dejas	San Lorenzo Foundation (Salorsed Fi)			
13	ROY JOSE PASCUA	DEPT. OF AGRI			
14	Eduardo B. Perez III	CTTMO			
15	Anthony Ray Cada	City Agr			
16	EDITO S MANDI	CDRRMO			
17	ROMEO LINTAPAO	CPDO			
18	KARINA CAÑETO	CPDO			
19	KHIMBERLY ALBANO	CPDO			
20	GAMATOT, MACK ARTHUR C.	DepEd-Davao			
21	MISA, MARIA LOURDES P.	CPDO			
22	LORA, RUBY ROSE L.	CPDO			
23	Casan, Jamalia A.	AdDU			
24	REBUTA, MICHAEL	CEO			
25	LEMUEL MAMAC	IDLS			
26	JOSIE E MAMAC	DCWD			
27	GOPOY, CRISIL E.	CENRO			
28	PASOD, VIRGINIA A.	CENRO			
29	Rodrigo C. Bustil	CDRRMO			
30	Mary Ann V. Fuentes				

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No	Name	Offices/Agency	E-mail address	AM Signature	PM Signature
31	DIOSDADO GONZALES	DLPC	[redacted]		
32	DANTE BORINAGA	DLPC	[redacted]		
33	Jennifer P. Manial	NCIP- RXI	[redacted]		
34	SALVG, LEE JESSICA	DPWH XI	[redacted]		
35	VILLUCINO, KELVIN N.	DPWH XI	[redacted]		
36	ACORES Co. AMORES	CVO	[redacted]		
37	[illegible] P. [illegible] (double)	GANGEUNIAN [illegible]	[redacted]		
38	Bae Kasunaya Gahon Atega	World Peace Committee	[redacted]		
39	Marycon Delos Reyes	MCM	[redacted]		
40	Mio Nogawa	APLA	[redacted]		
41	CHINKIE GOLVE	IDIS	[redacted]		
42	Lalaine Joan Alfeche	mcm	[redacted]		
43	Maria Fibi T. [illegible]	DA XI	[redacted]		
44	JOHN BAYNOSA	DCWD	[redacted]		
45	KERYL JOYCE PAHAYAC	MCM- CCO	[redacted]		
46	KATEL ERYCA NADONG	MCM - CCO VOLS	[redacted]		
47	ABDULJALIL ABDULBASIT	MCM-CCO-VOLS	[redacted]		
48	GERTIE QUIJADA	CCO-MCM	[redacted]		
49	BEA ABIGAIL LEONCITO	CCO-MCM-VOLS	[redacted]		
50	BAARDE, LARISSA MARIE M	CCO-MCM	[redacted]		
51	CUEZON, Astrid A.	CCO MCM	[redacted]		
52	Dosalla, Don M.	CCO-MCM-VOLS	[redacted]		
53	CELELYN B PINILI	City Agt.	[redacted]		
54	Loraida P. Fabro	CPDO	[redacted]		
55	Ian Gorcianes	SALIGAN	[redacted]		
56	Bong Villardo	USeP- SOL	[redacted]		
57	Renoy, Dave John B.	MCM	[redacted]		
58	RUTH G. JABINES	DCWD	[redacted]		
59	ANJI LAURA GRECIA-LORONA	DCWD	[redacted]		
60	ELVEN S. APOK	DCWD	[redacted]		

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No	Name	Offices/Agency	E-mail address	AM Signature	PM Signature
61	Dam Vertido	Mindanao La			
62	Carmela "myLai" Santos	Ecotenco - Ateneo d Davao Un			
63	[illegible]	bhgcawlo.bogs@yah			
64	THOMAS [illegible]				
65	Judy Ann E. Ugarpa	IDIS			
66	Thelma S. UBOD	BANTAY Bukid			
67	Frederick E. Pater	Bantay pukid			
68	John B. Balapan	Bantay Bukid			
69	MAJE EGENIO	PHIL. EAGLE F			
70	ATTY JIM PALMA	SEA-ADDU			
71	VICTORIA I HORFILLA	GUIDE INC			
72	NORITA VANELLANA	TAMBAYAN			
73	ARNOLD VANDENBUSCHE	IDIS			
74	LEANDRO S. ESCALANTA	DASIPAG			
75	MICHAEL G. CALUMBA	MCM			
76	John Jomar S. Enig	SK staff			
77	PIERRE JOHN B. YUMAGUE	CPDO - PPD			
78	ALDETH E. MANULAT	CPDO - PPD			
79	Gina R. Santos	CPDO			
80	Engr John S. Demorin	CPDO			
81	Jo Ann L. Esguerra	PMED			
82	EDWIN G. BACALSO JR.	PMED			
83	MARWIC O. GUBALANE	PMED			
84	MARY JOY D. TURREMOCHA	CPDO			
85	Ariel C. Lirio	CPDO			
86	Alcaraz, Lorella	CPDO			
87	JASON CHIN CHONG	CPDO			
88	ERIC PAYE	CPDO			
89	Aquilan, Rona Marie	CPDO			
90	IVAN C. CORTEZ	CPDO			

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No	Name	Offices/Agency	E-mail address	AM Signature	PM Signature
91	Felices, Ruel Kenneth A.	IDLS			
92	Estela D. Malate	CPDO			
93	Mary Lizbeth Singco	CPDO			
94	Felix T. Adormes	IDIS			
95	ASTRIO CUEZON	MCM			
96	AUGUSTO CAMPOS III	SP			
97	DORIS B. MONTECASTRO	ADDU			
98	ROMEL MENDOZA RUIZ	DCWD			
99	MINERVA R. GUEVARA	CPDO			
100	Jane Manton	CPDO			
101	April D. Loquias	PED			
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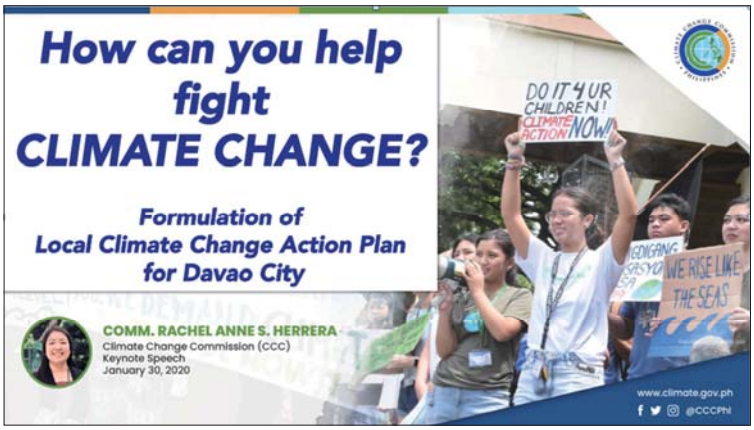
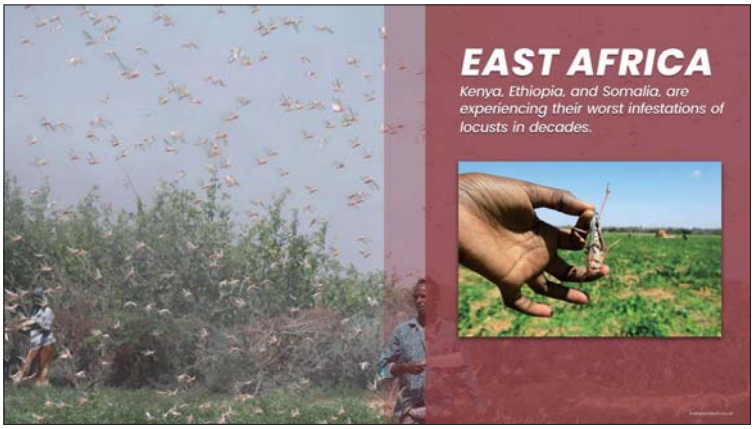

How can you help fight CLIMATE CHANGE?
Formulation of Local Climate Change Action Plan for Davao City
COMM. RACHEL ANNE S. HERRERA
Climate Change Commission (CCC)
Keynote Speech
January 30, 2020
DO IT 4 UR CHILDREN! CLIMATE ACTION NOW!
WE RISE LIKE THE SEAS
www.climate.gov.ph
@CCCPhl

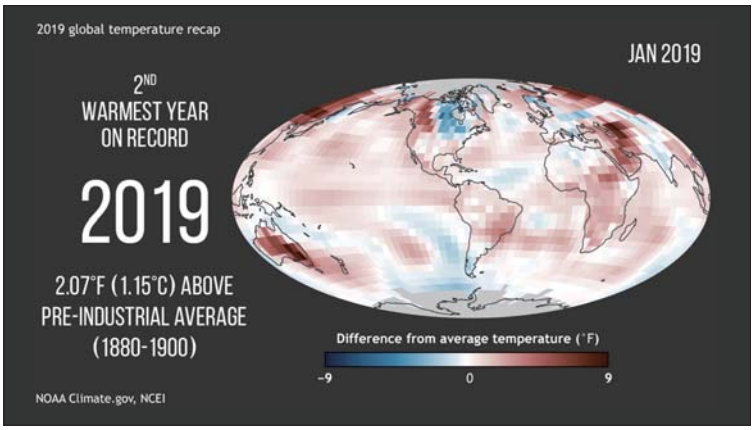

INDONESIA
Heavy rainfall caused flashfloods and landslides forcing hundreds of thousands to evacuate


CLIMATE CHANGE
is the greatest threat faced by this generation


AUSTRALIA
Severe drought ignited bushfires across the country
More than
6.3 Million
hectares of bush and forests burned
Estimated
1 Billion
animals have died

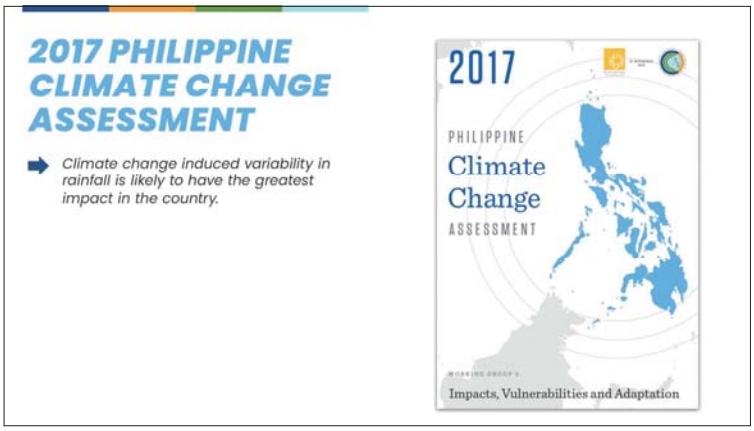

TYPHOON URSULA DAMAGES
783,000
people affected
P4.38 Billion
estimated cost of damage to infrastructure & agriculture
57
people dead

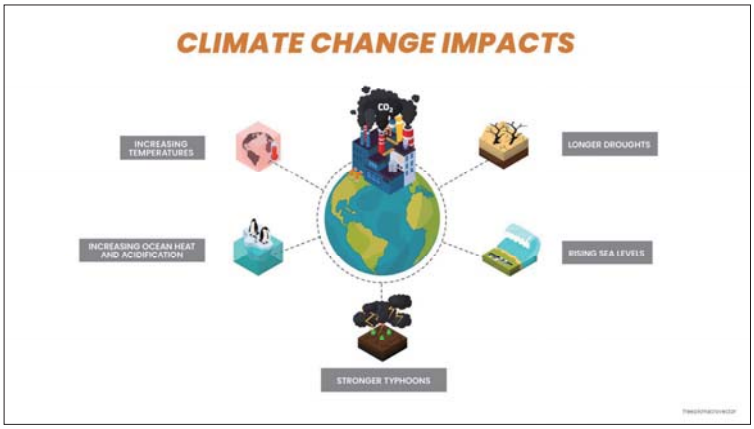

EAST AFRICA
Kenya, Ethiopia, and Somalia, are experiencing their worst infestations of locusts in decades.

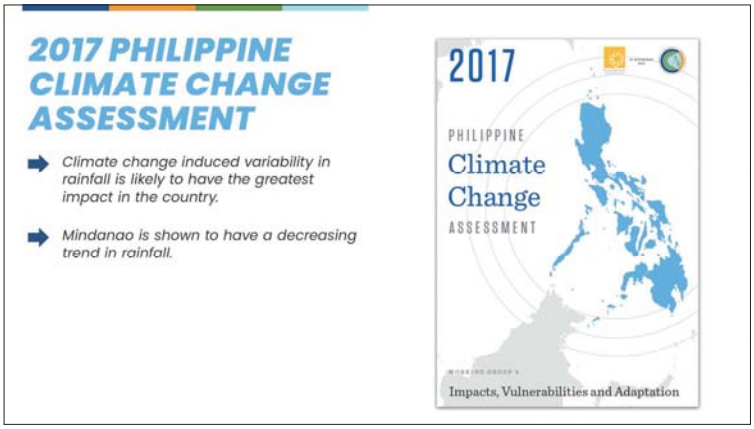

2019 global temperature recap
JAN 2019
2ND
WARMEST YEAR
ON RECORD
2019
2.07°F (1.15°C) ABOVE
PRE-INDUSTRIAL AVERAGE
(1880-1900)
Difference from average temperature (°F)
-9
0
9
NOAA Climate.gov, NCEI


THE PHILIPPINES
Experiencing a continuous decline in biodiversity due to unsustainable land conversion, deforestation, and pollution.


CLIMATE CRISIS

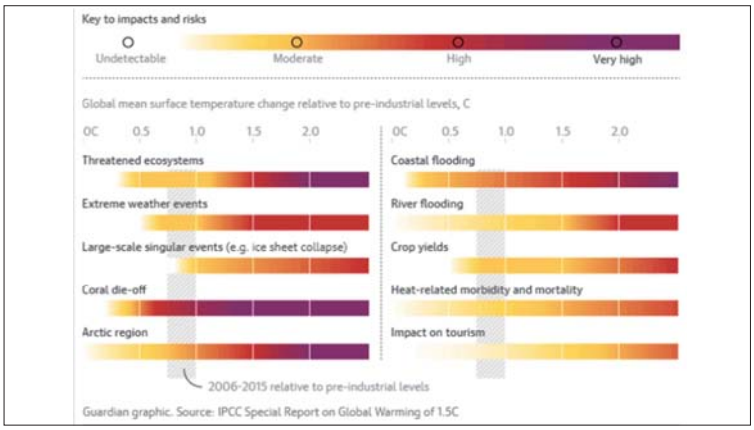

2017 PHILIPPINE CLIMATE CHANGE ASSESSMENT
Climate change induced variability in rainfall is likely to have the greatest impact in the country.
2017
PHILIPPINE
Climate
Change
ASSESSMENT
Impacts, Vulnerabilities and Adaptation


CLIMATE CHANGE IMPACTS
INCREASING TEMPERATURES
LONGER DROUGHTS
INCREASING OCEAN HEAT AND ACIDIFICATION
RISING SEA LEVELS
STRONGER TYPHOONS


2017 PHILIPPINE CLIMATE CHANGE ASSESSMENT
Climate change induced variability in rainfall is likely to have the greatest impact in the country.
Mindanao is shown to have a decreasing trend in rainfall.
2017
PHILIPPINE
Climate
Change
ASSESSMENT
Impacts, Vulnerabilities and Adaptation

2017 PHILIPPINE CLIMATE CHANGE ASSESSMENT

- *Climate change induced variability in rainfall is likely to have the greatest impact in the country.*
- *Mindanao is shown to have a decreasing trend in rainfall.*
- *Davao del Sur has been identified as one of the most vulnerable to drought and tropical cyclones.*



2017 PHILIPPINE CLIMATE CHANGE ASSESSMENT

- *Climate change induced variability in rainfall is likely to have the greatest impact in the country.*
- *Mindanao is shown to have a decreasing trend in rainfall.*
- *Davao del Sur has been identified as one of the most vulnerable to drought and tropical cyclones.*
- *Davao is listed as one of the top 25 cities with the largest population exposure to storm surges caused by strong winds from typhoons.*

If we go business-as-usual, ***global temperatures are on track to increase by at least 3°C*** *towards the end of the century.*

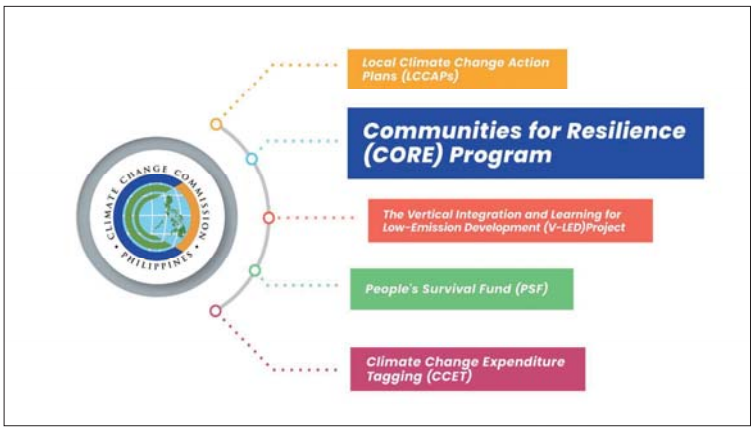
We only have until 2050 to ensure that the consequences of climate change will not be irreversible.

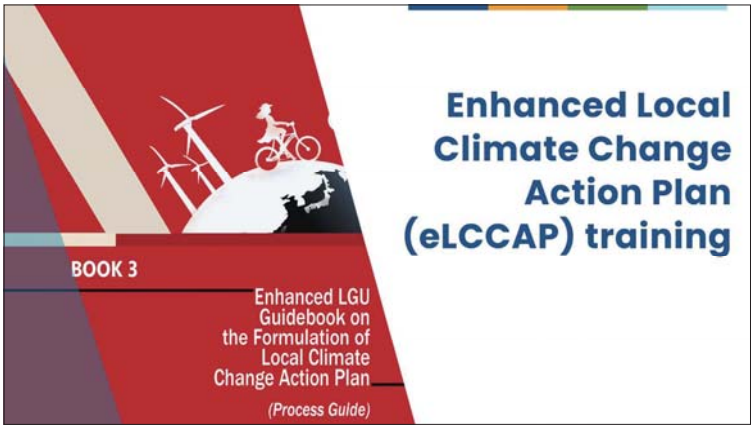
LOCAL GOVERNMENT UNITS (LGUs)

Our country's first responders and first lines of defense against climate change.

TRANSFORMATIVE ACTION
is the key to effective climate change adaptation.

Our choice is clear: Delay and pay, or plan and prosper?



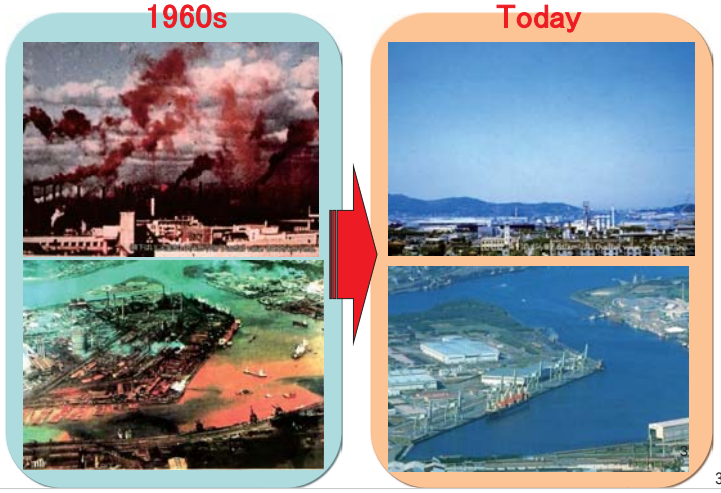


Future City Kitakyushu

Sharing experience:
The case of Kitakyushu City in Japan

January 30th 2020
IGES & City of Kitakyushu

Overcoming Severe Pollution: Kitakyushu's Experience



3

City located near to other Asian nations, rich in nature, and developed as a manufacturing area

Population: 957,000 (2016)
Area: 491.95 Km²
GDP: 3,366 billion yen (2013)

Rich nature and branded food materials

Major companies in Kitakyushu area

Nippon Steel Corporation · Yasukawa Electric Corporation · TOTO Ltd. · Mitsubishi Chemical Corporation · Toyota Motor Corporation · Nissan Motor Co., Ltd. · Mitsubishi Materials Corporation

1

Experience in Overcoming Pollution Problems

Kitakyushu City With Long History

2

Kitakyushu Asian Center for Low Carbon Society

Center established as engine for green growth activities

Concept ： Developing interactions that place value on the relationship between cities and that will help Japan gain respect from international society in order to contribute to the creation of green cities in Asia

Compile the experiences and know-how of the city from the process of overcoming pollution and becoming an environmental city in order to Create the "Kitakyushu Model"

192 projects in cooperation with 106 Japanese companies and universities in 80 Asian cities

5

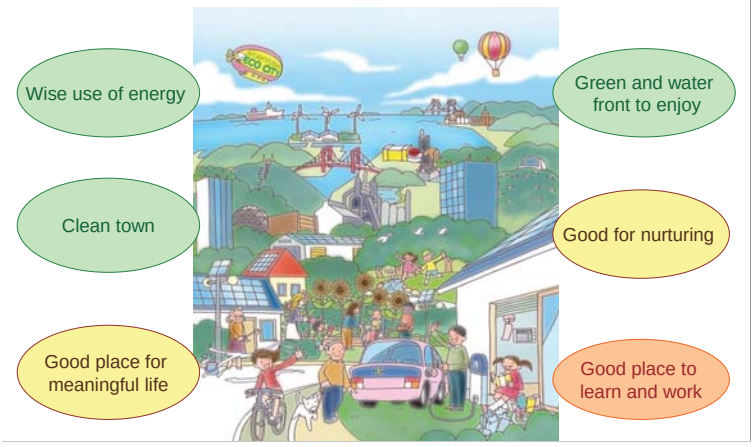
Signing of a Memorandum of Understanding for a Green Sister City Relationship with Davao, The Republic of the Philippines

On November 28th, 2017, the City of Kitakyushu and the City of Davao, in the Republic of the Philippines, signed a Memorandum of Understanding creating a Green Sister City relationship between the cities that aims to create cooperative partnerships in the environmental field for the purpose of expanding mutual benefits and positively driving development through low-carbon societal initiatives, resource circulation projects, and development of local human resources.
The City of Davao is the City of Kitakyushu's second Green Sister City, and its first since Surabaya in the Republic of Indonesia, in November of 2012. Through the signing of a Memorandum of Understanding, cooperation between the public and private sectors can strongly support the export of city infrastructure systems, create a path for regional revitalization, and drive national growth strategies.

Signing of the Memorandum of Understanding:
Mayors Sara Duterte of Davao and Kenji Kitahashi of Kitakyushu

Kitakyushu's Proposal of Env' Future City

City where everyone wants to live, where every one is energetic



JCM City-to-city Cooperation Project between City of Kitakyushu and Davao City

Project to realize low carbon society in Davao City through a support for a development of Local Climate Action Plan **(MoEJ : FY 2018)**

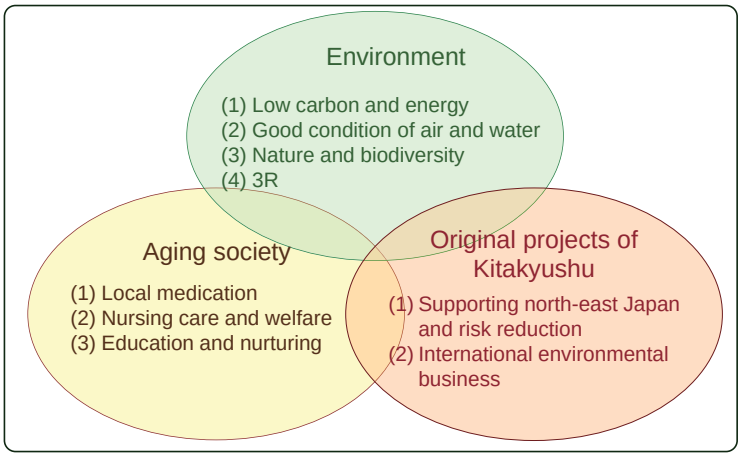
Support for a development of Local Climate Change Action Plan of Davao City
- A development of GHG inventory (supported by IGES)
- A development of mitigation measures (supported by Kitakyushu City and IGES)
- A development of adaptation measures (supported by Ateneo De Davao Uni.)

An implementation of concrete mitigation measures

Study on a feasibility of renewable energy project (for JCM model project)
- Waste-to-Energy (WtE) project (Nippon Steel & Sumikin Engineering Co., Ltd.)
- Feasibility study on other low-carbon projects (renewable energy and energy saving projects)
- Coordination with related-stakeholders for an implementation, technical study, evaluation of the amount of CO2 reduction, etc.
- Supporting for a preparation of applying JCM model project

Programs of Environmental Future City in Kitakyushu

Promoting programs especially for better environment and aging society



Kitakyushu
Environmental Future City

Five Policies to Achieve Targets

CO_2 Reduction Target

Action Plan “New Green Frontier Plan” (2016)

Medium-term target　　Up to 2030

Target of greenhouse gas reduction:
30%, 4.7 million ton (city area)
[Compared to the data of FY2005]

Long-term target　　Up to 2050

Target of greenhouse gas reduction:
50%, 8 million ton (city area)
150%, 23.4 million ton (Asia area)
[Compared to the data of FY2005]

Overview of the Kitakyushu Regional Energy Base Promotion Project

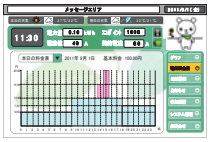
Potentials of the city

●Potentials as locations for renewable energy or high-efficient thermal power generation

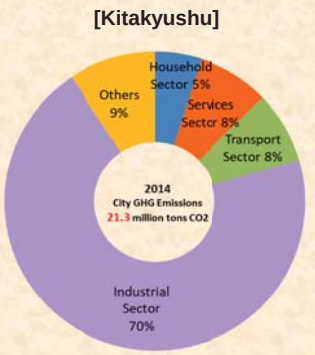
- Good wind conditions
- Presence of large-scale coal and LNG import bases
- Vast land

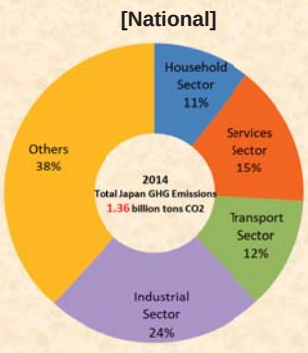
●Energy management know-how earned through the Smart Community demonstration





State of Greenhouse Gas Emissions



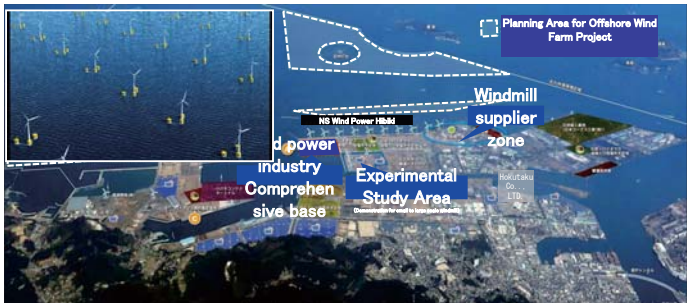


※Others: Waste, Industrial Processes, Energy Conversion, Other Gases(Methane etc.)

- Higher than national average per capita → **22** t / person (National average: 11t)
- Lowest amongst major cities in the household sector → **2.5** t / household (National average: 3.3 t / household) (1st nationwide)

10

Integration of the Wind Power Generation Industry



Offshore Wind Power Firm (Under planning)
Operator: Hibiki Wind Energy Co., Ltd.
No. of windmills: 44 (maximum)
Total investment: 175 billion yen
Project Schedule: 2017～ Environmental assessment
2022～ Start of construction

Program for Promoting the Establishment of a Regional Energy Base

Integration of the Wind Power Industry and Human Resource Development

● Accumulation of the maintenance and parts industry

Related industries: windmill parts, construction work, O&M, and commodity distribution

Number of parts: 20,000

Need for the Development of Human Resources in the Wind Power Industry

Development of human resources in the wind power industry through partnership with local universities

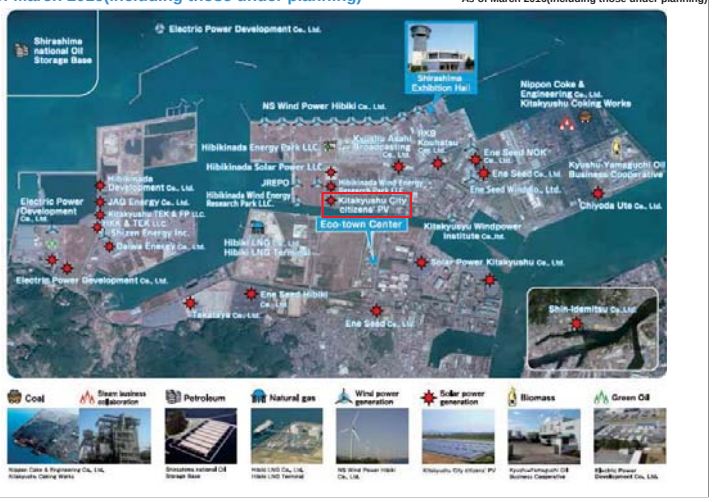
* This fiscal year, the following will be carried out in cooperation with The University of Kitakyushu.
(1) Conducting lectures on wind power
(2) Conducting courses on wind power research

Ref: “A Guide to an Offshore Wind Farm”, The Crown Estate

Kitakyushu Next-generation Energy Park

As of March 2016(including those under planning)

As of March 2016(including those under planning)



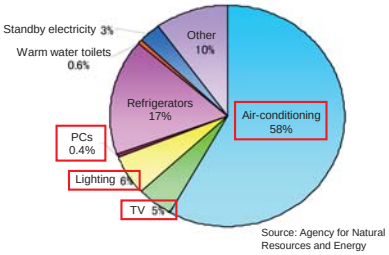
Kitakyushu City Energy Saving/Electricity Conservation Measures

Implementation of Heat Avoidance Areas in the City

Teitan Card

Show the card

Gifts



Source: Agency for Natural Resources and Energy

Electrical power consumed at home (at about 2 pm in summer)

Enlightening Activities

Kitakyushu City Energy Saving/Electricity Conservation Measures

Turning off of unnecessary lights by weeding out lighting and using power-off cords

Power-off cords

"Thank you for turning off." activity

Installed at 4,000 points of 8 institutions such as the main city hall and ward offices

Replacement with LED: 3,500 pieces at 126 institutions
Straight tube type: More than 240 pieces at 8 institutions

Kitakyushu City Energy Saving/Electricity Conservation Measures

[For citizens]

- Citywide posting of energy saving/electricity conservation posters
- Implementation of the Summer Energy Saving King contest
- Implementation of Heat Avoidance Areas in the City

[For companies]

- Implementation of energy saving/electricity conservation seminars
- Distribution of “Requests for energy saving/electricity conservation,” a special edition of the Kaeru Press

The Hibikinada Area of Wakamatsu-ku, a General Center for Environmental Learning where the Environment and Industry are Fused

The three elements required for the creation of a sustainable society (low carbon, recycling and co-existence with nature) are arranged in a unified manner as a general center for environmental learning in the Hibikinada Area of Wakamatsu, where all three elements are present.

- Kitakyushu Eco-Town (formation of a recycling-based society, promotion of environmental industry)
- Next-Generation Energy Park (comprehensive development and exhibition of next generation energy to prevent global warming)
- The Hibikinada Birdsong Green Corridor, Japan’s biggest biotope (co-existence of city and nature, creation of a pleasant relaxing space for people and animals)

Introduction of fuel-cell vehicles

The City of Kitakyushu introduced fuel-cell vehicles (FCV) as the official vehicles and promotes them by having exhibitions and test-driving at various events.

Selected as SDGs Model City by OECD

April 2018:
First city in Asia to be selected as SDGs Model City by OECD

* Other selected cities (as of April 2018)
Bonn (Germany), Tuscany (Italy), Friuli-Venezia Giulia (Italy), southern Denmark, Córdoba Province (Argentina)

June 2018:
Selected as SDGs Future City by Japanese government (Cabinet Office)

Carry out efforts for improving air quality as part of SDGs measures as well

Cooperation of city residents
Implementation of measures in other cities

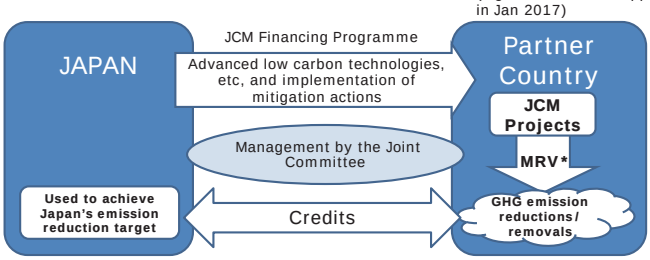
Thank you very much!!

ご清聴ありがとうございました!!

Basic Concept of Joint Crediting Mechanism (JCM)

- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions of partner countries.
- Evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner by MRV.
- Contributing to achieve Japan's emission reduction target of the UNFCCC by facilitating global actions for GHG emission reductions.

17 Countries (signed with the Philippines in Jan 2017)

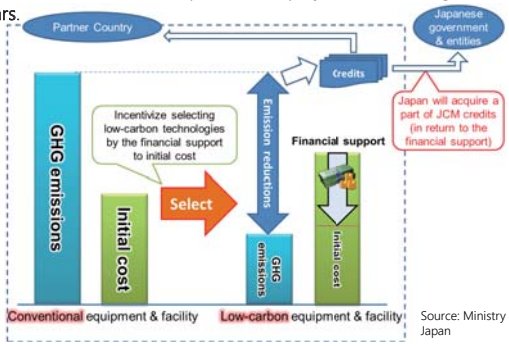


*measurement, reporting and verification

Source: Ministry of the Environment, Japan

Financing Programme for JCM Model Project

- Scope of the financing:
  Facilities, equipment, vehicles, etc. which **reduce CO_2 from fossil fuel combustion** as well as construction cost for installing those facilities, etc.
- Eligible projects:
  Starting installation after the adoption of the project and finishing installation **within three years.**



Source: Ministry of the Environment, Japan

Possible ideas of low-carbon projects in Davao City

Possible **public** projects:

- Solar panel on a roof of a public market located in Toril, Davao City
  - ✓ need to consult with MOEJ if it is regarded as a leading low-carbon technologies
  - ✓ The rate of a subsidy on an installation costs provided from MOEJ would be less than 50% (30 projects approved (2 in the Philippines) among 106)
- **Exchange of street lights to LED lights**
  - ✓ need to further consult with Davao City and Davao Lights
  - ✓ If it is a public project, need a open tender (matters of schedule & selection)
- Introduction of a few electronic buses for the High Priority Bus System
  - ✓ There is a case introduced an electronic bus and electronic charging station under a C2C Collaboration Programme under Kitakyushu and Hai Phong, VN.

Possible **private** projects:

- Waste heat recovery-system to a cement facility
- High-efficiency chiller for air-conditioning to hotel or shopping mall, etc.
- High-efficiency boiler system to factories, etc.

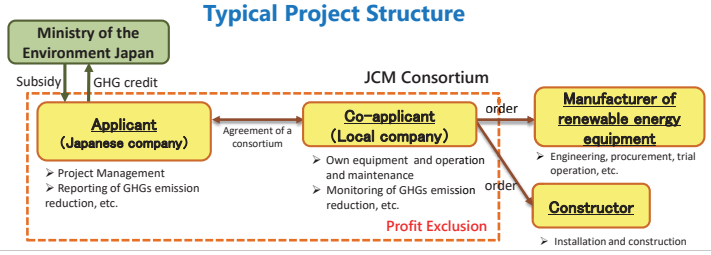
Note: You can check the past approved JCM Model Projects at http://gec.jp/jcm/projects/

Study on possible application of JCM Model Project

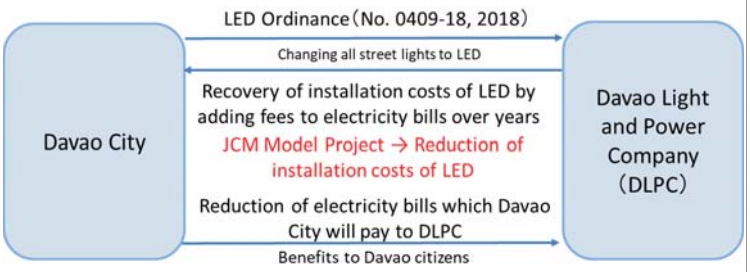
Components will be checked for a feasibility study on low-carbon projects:

- Forming an **international consortium** including both a owner and user of the equipment, etc.
- Coordination on a **timing and condition** of a procurement of a low-carbon project in Davao City with related organizations, etc.
- Coordination with **manufacturers** of renewable energy equipment as well as **constructors**
- **Selection of equipment**, calculate the amount CO2 reduction, support for a preparation to apply for JCM Model Project

Typical Project Structure

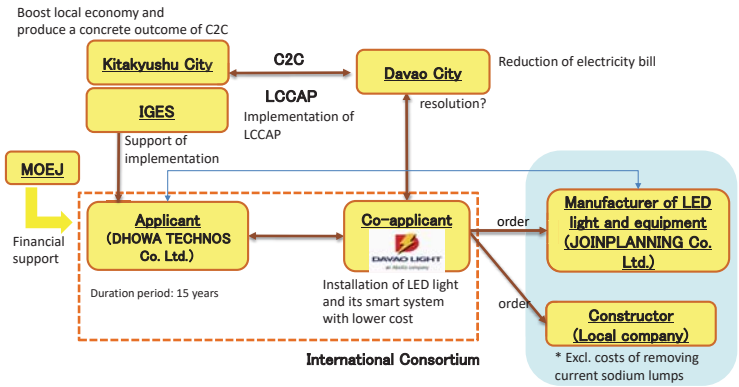


Feasibility Study of LED Project



Picture: LED lighting for street lights (JOIN PLANNING Co., Ltd.)

Possible Project Structure



Calculation of GHG emission reduction

$$ER_p = RE_p - PE_p$$

ER_p	Emissions reduction during the period p (tCO_2/p)	
RE_p	Reference emissions during the period p (tCO_2/p)	
PE_p	Project emissions during the period p (tCO_2/p)	

Criterion 1	The project installs LED street lighting system utilizing wireless network control, which is connected to an electricity grid system.
Criterion 2	All lighting equipment in one lighting system has the same specifications.
Criterion 3	Wireless network technology enables controlling of the volume of lighting.

$$RE_p = \sum_i P_i \times \left(\eta_{PJ,i} \div \eta_{RE}\right) \times PO_{i,p} \times EF_{grid} \times 10^{-6}$$

RE_p	Reference emissions during the period p (tCO_2/p)	
P_i	Rated power consumption of a lighting equipment used in the project lighting system i (W)	
$\eta_{PJ,i}$	Luminaire efficiency of a lighting equipment used in the project lighting system i (lm/W)	140
η_{RE}	Luminaire efficiency of the reference lighting system (lm/W)	62 (default)
$PO_{i,p}$	Total operating hours of project lighting system i during the period p (hrs/p)	4380 hrs/year
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)	0.286
i	Identification number of the lighting system	

$$PE_p = \sum_i PEC_{i,p} \times EF_{grid} \times 10^{-6}$$

GHG emission reduction : **2,193.26 t-CO2/year**
Total GHG emission reduction (10 years): **21,932.6 t-CO2**

PE_p	Project emissions during the period p (tCO_2/p)	
$PEC_{i,p}$	Total amount of electricity consumed in the project lighting system i during the period p (Wh/p)	
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)	0.286
i	Identification number of the lighting system	

Source: https://www.jcm.go.jp/kh-jp/methodologies/34

IDIS Proposed Climate Mitigation & Adaptation Measures for Davao City LCCAP

EnP. Lemuel Lloyd I. Manalo
Environmental Research Specialist, IDIS

Sustainable Development Goals

- Climate Action which aims to **"Take urgent action to combat climate change and its impacts."** Human Settlements need to strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries and more importantly to integrate climate change measures into national policies, strategies and planning.

IDIS | WHO WE ARE

IDIS is an environmental non-government organization registered with the Securities and Exchanges Commission (SEC) since 1999

- Policy Advocacy and Lobby
- Networking & Coalition Building
- Education & Information
- Media Advocacy & Public Awareness
- Research & Publication

Climate Change

"Refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere in addition to natural climate variability observed over **comparable time periods**"

United Nations Framework Convention on Climate Change (UNFCCC)

- **Climate Change** - the average weather conditions over a long period of time (typically 30 years, not limited to temperature rise)
- **Weather** - A specific meteorological event or condition that happens over a period of hours or days
- **Global Warming** – Recent and ongoing rise of earth's surface temperature caused by greenhouse gases in the atmosphere

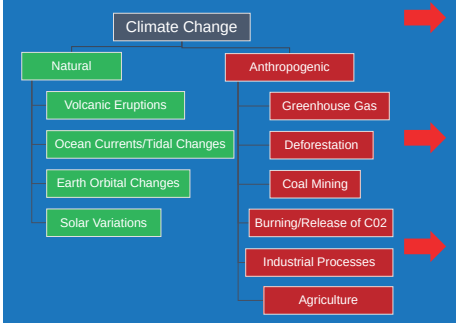
Introduction

Davao City is one of the fastest growing cities in terms of population and economic hub for trade and industry. However, these leads to increased the amount of greenhouse gases, particularly carbon dioxide and increased atmospheric heat.

Climate Change is inevitable and have already caused a great impact to cities and human settlements, it will continue and will have an effect to both present and future generations. As such, there is a need to adapt and mitigate climate change the best stakeholders possibly can.

Proposed Matina Linear Park, McArthur Highway, Davao City

Climate Change Causes & Effects



1. Rise of Sea Level
2. Heavy Rainfall and Wind
3. Extreme Drought
4. Decline in Crop Productivity
5. Changing Ecosystems & Species Depletion
6. Strong Hurricanes and Typhoons
7. Rise of Surface Temperature
8. Rise of Acidity in Freshwater & Seawater

NATURAL DISASTERS

Redefining Climate Mitigation & Adaptation

Sustainability

Mitigation

- ▶ actions that are taken to **reduce and curb greenhouse gas emissions**
- ▶ attends to the causes of climate change
- ▶ strategies to avoid the increase of pollutant emissions

Adaptation

- ▶ reducing vulnerability to the effects of climate change
- ▶ addresses the impacts brought about by Climate Change

Review on GHG & Global Warming

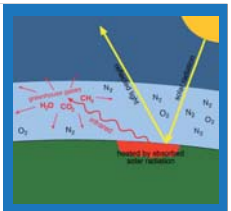
Water Vapor (H_2O)
invisible state of water within the hydrosphere

Carbon Dioxide (CO_2)
chemical compound emitted when an organic material is burnt, occurs naturally in atmosphere as a trace gas

Methane (CH_4)
hydrocarbons that are the most potent of the greenhouse gases

Nitrous Oxide (N_2O)
colorless non-flammable gas, with a slight metallic scent and taste, often used in sedation process

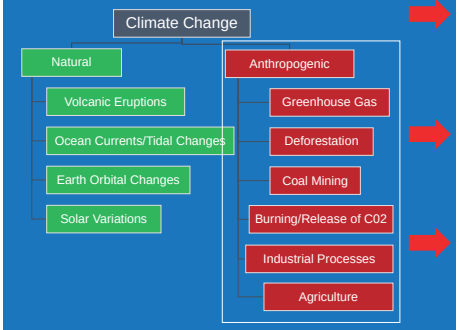
Ozone (O_3)
a trioxygen, an inorganic molecule that occurs both in the earth's upper atmosphere and at ground level



Greenhouse gases act like a blanket, absorbing IR radiation and preventing it from escaping into outer space.

The net effect is the gradual heating of Earth's atmosphere and surface, a process known as **global warming**.

Climate Change Causes & Effects



1. Rise of Sea Level
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ADDRESSED THROUGH ADAPTIVE INTERVENTIONS

Climate-Mitigation Measures

- **Green Growth –** Substantial reforestation & greening efforts both urban and rural areas, carbon sinks, declaration of local protected areas and sanctuaries
- **Infrastructure –** Promotion of Green & Energy-Efficient Designs, Green Buildings
- **Transportation -** Mass Transit and Carpooling System, Provision of infrastructure support for sustainable and non-motorized Transportation (EUVs, E-Bicycles, Cycling, Walking), Anti-Smoke Belching enforcement
- **Energy -** Provision of renewable energy and energy conservation initiatives
- **Waste –** Prohibition of open burning, incineration, closure of dumpsites, Full implementation of proper solid waste law and zero waste programs
- **Administrative-** Carbon Taxation and Off-setting, Polluter's Pay principle, Green procurement

Mitigation Measures

Adaptation Measures

Climate Hazards in Davao City

1. Storms and Floods
2. Erosion and Landslide Susceptibility
3. Liquefaction Susceptibility and Earthquakes
4. Tsunami, Stormsurge and Sea Level Rise
5. Increasing Heat Temperature, Drought and Decline in Crop Productivity
6. Air Pollution, Smog and Haze


GEM Village, Maa, Davao City (2013)

1. Storms & Floods

Climate-Adaptive Interventions

- Preservation of Wetlands & Floodplains
- Riverbank stabilization through Bioengineering & Riparian Forestry
- Rainwater Harvesting
- Permeable Pavement System
- Drainage Systems Clearing
- Sustainable Urban Drainage System (SUDs)
- Stormwater/Flood Park Designs and Esplanades along Floodway Mitigation Zones

Hazard Risk Mitigation & Prevention

- Regulation on desilting and quarrying damage on riverbanks and increased risk of make-shift settlements

Matina Pangi Flooding Incident (June 2011)

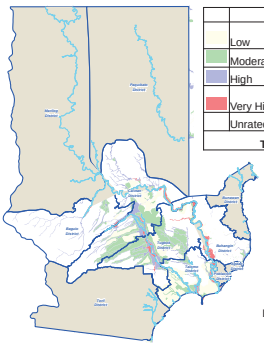
- 10,000 homeless, 33 dead
- “The flooding problem is the most serious problem that must be addressed in an urgent manner.” (page 334 of CDP).
- The biggest flood prone area is along the Talomo River covering Matina Pangi, Matina Aplaya, Langub, Magtuod, Ma-a and Talomo proper (almost 13,000 hectares).”
- Declared as the Most serious problem (page 381) that hinder the development of Davao City.

Buhangin District, Davao City

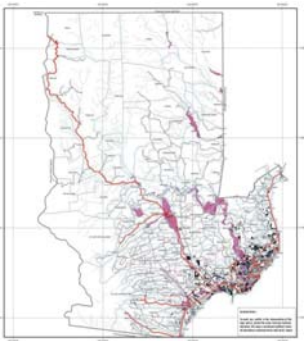
Decreasing Blue Spaces Wetlands in urban areas

Through Bing Satellite survey, researchers also found (2) large wetlands in major urban districts in Davao City which now have been developed for commercial-residential purposes by comparing 2015 and 2018 using historical satellite imagery.

Davao City Flood Susceptibility & Flood Mitigation Zone Maps

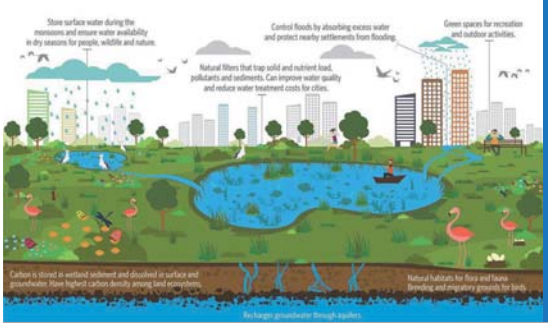


	Area (Has)	%
Low	9,929.82	4.07
Moderate	11,722.81	4.80
High	11,084.32	4.54
Very High	3,775.15	1.55
Unrated	207,487.91	85.04
Total	**244,000.00**	**100.00**



Davao City CLUP & Zoning Ordinance (2011-2022)

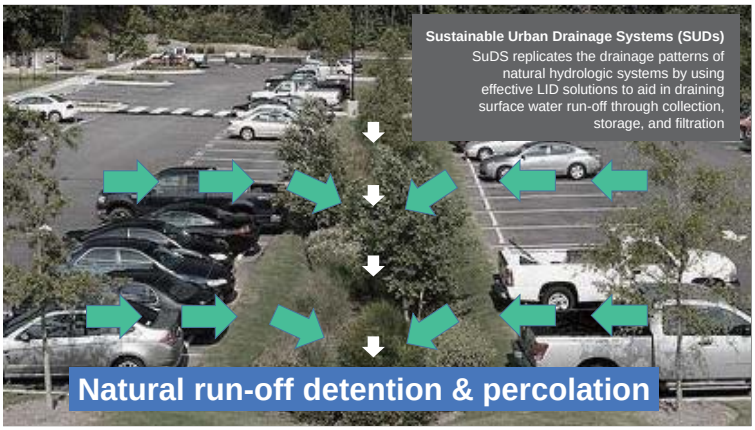
PRESESERVING “BLUE SPACES” OR WETLANDS



A 500-sqm wetland with depth of 1 meter can hold up to **11,180 cu.m** of run-off water

Wetlands is a distinct ecosystem that is flooded by water, either permanently or seasonally, distinguished with characteristics vegetation of aquatic plants adapted to unique hydric soil.

They serve essential functions including water purification, carbon sequestration, riparian stability, habitat and most especially flood mitigation.



3. Earthquakes & Liquefaction

Floodwaters lubricate fault planes, erosion of landslides caused by the torrential rains acts to reduce the weight on any fault below, allowing it to move more easily. Rainfall also influences the pattern of earthquake when prodigious quantities of rain soak into the lowlands. This annual rainwater loading and unloading of the crust is mirrored by the level of earthquake activity. - Wdowinski, 2015

Climate-Adaptive Interventions

- Establishment of Open Spaces as evacuation areas
- Infrastructure and Building Standards Upgrade; use of disaster-resilient designs and materials

Hazard Mitigation & Prevention

- Considering of high liquefaction areas and fault lines as basis for planning and building standards
- Pre-requirement of evacuation plans and access

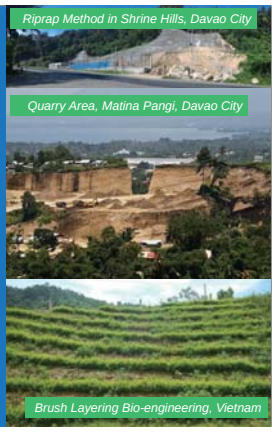
2. Erosion & Landslides

Climate-Adaptive Interventions

- Massive Reforestation and Greening Sloping Terrains
- Establishment of Buffer Zone Greenbelts
- Bioengineering Methods for Slope and Cliff Erosion Control

Hazard Risk Mitigation & Prevention

- Total prohibition of earth-fill and limestone quarrying at identified High Susceptibility areas
- Declaration of more Urban Ecological Enhancement Sub-Zones due to high susceptibilities on erosion and landslide



4. Tsunamis, Stormsurges & Sea Level-Rise

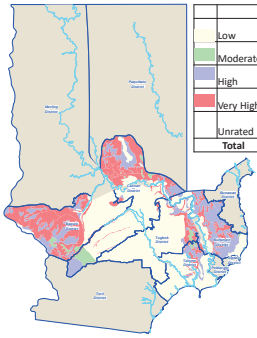
Climate-Adaptive Interventions

- Delineation and declaration of more Marine Protected Areas (MPAs)
- Mass Mangrove Reforestation and Coastal Rehabilitation
- Protection of Coastal Wetlands
- Establishment of New Mangrove Rehabilitation Sites

Hazard Mitigation & Prevention

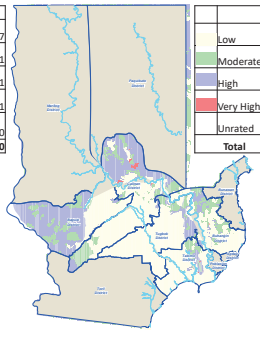
- Decline Large Reclamation Projects for new settlement
- Relocation of settlements at vulnerable areas

Davao City Erosion & Landslide Susceptibility Maps



	Area (Has)	%
Low	63,614.76	26.07
Moderate	17,104.78	7.01
High	51,009.28	20.91
Very High	103,245.35	42.31
Unrated	9,025.84	3.70
Total	**244,000.00**	**100.00**

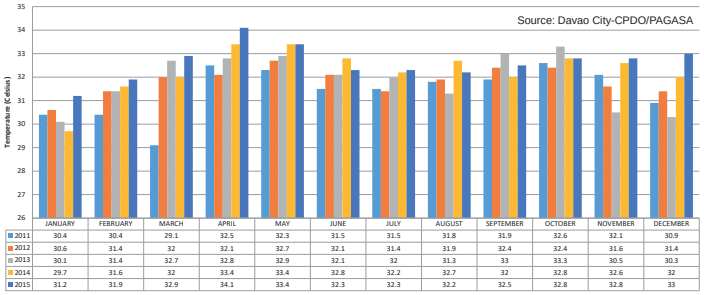
Erosion



	Area (Has)	%
Low	62,186.50	25.49
Moderate	57,999.42	23.77
High	117,789.07	48.27
Very High	675.27	0.28
Unrated	5,349.73	2.19
Total	**244,000.00**	**100.00**

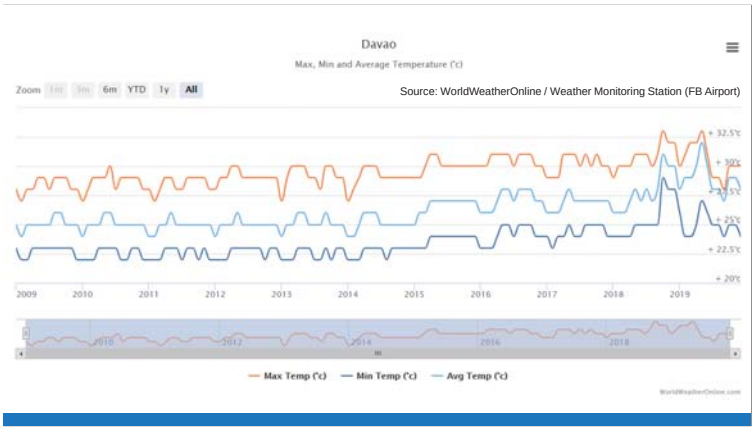
Landslide

Davao City Atmospheric Temperature 2011-2015 (˚C)



	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
2011	30.4	30.4	29.1	32.5	32.3	31.5	31.5	31.8	31.9	32.6	32.1	30.9
2012	30.6	31.4	32	32.1	32.7	32.1	31.4	31.9	32.4	32.4	31.6	31.4
2013	30.1	31.4	32.7	32.8	32.9	32.1	32	31.3	33	33.3	30.5	30.3
2014	29.7	31.6	32	33.4	33.4	32.8	32.2	32.7	32	32.8	32.6	32
2015	31.2	31.9	32.9	34.1	33.4	32.3	32.3	32.2	32.5	32.8	32.8	33

▶ 4th City with Highest Heat Index in PH (March 19, 2019)



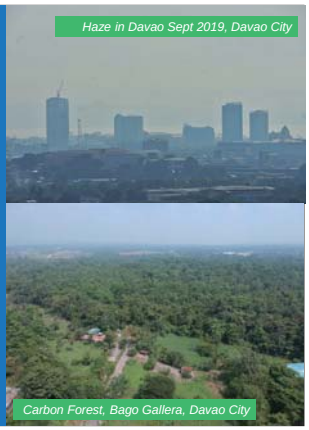
6. Air Pollution, Smog & Haze

Climate-Adaptive Interventions

- Establishment of vegetative buffer zones and greenbelts in conflicting zones
- Requiring of carbon & pollution sinks for industrial plants and areas
- Permeable pavements and surfaces

Hazard Risk Mitigation & Prevention

- Revival and installation of more Air-Quality Monitoring boards


Haze in Davao Sept 2019, Davao City

Carbon Forest, Bago Gallera, Davao City

5. Temperature Increase & Droughts

Climate-Adaptive Interventions

- Enhancement of urban greenery, parks and vegetated streetscapes and park connectors
- Requirement of green building designs; prioritizing ventilation and cooling
- Building Height Limitations for Urban Ventilation
- Urban Roof Gardening, Community Garden, Container Gardening
- Use of permeable pavements and surfaces
- Changing to heat tolerant tree or crop varieties
- Brightening of public roads and alleys through LED-Lights

Hazard Risk Mitigation & Prevention

- Securing efficient forestlands and agricultural areas from numerous appeals for land reclassification


San Francisco High School, Quezon City


CAO Rooftop, Davao City


Greenbelt in Adelaide, SC, Australia

Park Connector in Sapporo, Hokkaido, Japan

Green Streetscapes to Combat Urban Island Heat Effect (UHI)

▶ UHI affect settlements by increasing air conditioning costs, air pollution and greenhouse gas emissions.

Developing a Sustainable & Disaster-Resilient City

Mitigation - Adaptation

- Carbon Taxation and Off-setting System
- Massive Greening & Reforestation Programs
- Promotion of Green & Energy-Efficient Designs
- Mass Transit & Sustainable Transportation
- Renewable Energy
- Implementation of Zero Waste
- Green Procurement & Lifestyle

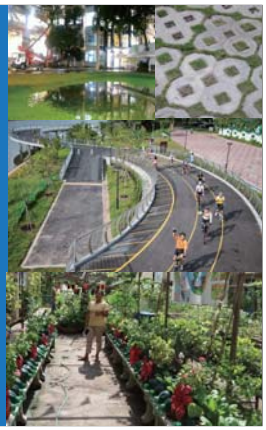
Carbon Emissions & GHG

- Wetlands & Floodplains Preserved
- Resilient and Disaster-Proof Infrastructure Designs
- Bioengineering & Biophillic Designs
- Sustainable Urban Drainage Systems
- Rainwater Harvesting & Permeable Surfaces
- Land-Use Planning
- Maintenance & Sustainability
- Mangrove Reforestation and Coastal Wetlands
- Buffer Zone Green Belts
- Urban Greenery & Heat Tolerance
- Low-Impact Developments (LID)

Geo-Hazards & Disasters

SUSTAINABLE CITIES & MUNICIPALITIES CHECKLIST

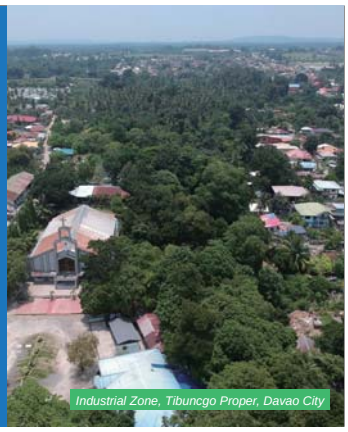
- ☑ Sufficient Urban Greenery Parks and Open Spaces
- ☑ Climate-Adaptive and Resilient Building Designs
- ☑ Rainwater Harvest and Use
- ☑ Adequate Permeable Surfaces and Effective Drainages
- ☑ Protection of Urban Wetlands and Ecological Areas
- ☑ Citizens Farm through Urban Gardening
- ☑ Zero Waste & Plastic-Free Oriented Communities
- ☑ Switching to Sustainable Transportation Alternatives
- ☑ Safe Access for Citizens with Special Needs
- ☑ High Citizen Participation in City Planning



People should be the center of all mitigation and adaptation measures, aiming for high-quality living, adequate resources, safe and resilient human settlements in Davao City

Overall Recommendations

- Research and data availability as part of the outputs and targets in the action plan; (e.g resource threshold basis of desilting projects and commercial quarrying, atmospheric heat index and mapping, river braiding, GHG emissions mapping & inventory).
- Collaborating with Local Resource Institutions (LRIs), academe and other partners in the Civil Society Organizations in the city.
- Intensification, implementation and allocation of funds for Community Based Monitoring (CBMS) must be included in the target actions.
- Transparency and High-Participatory Planning and Governance



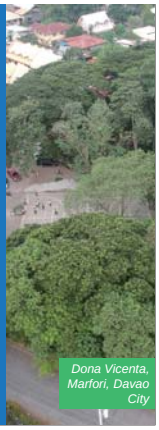
Industrial Zone, Tibuncgo Proper, Davao City

IDIS Proposed Climate Mitigation & Adaptation Measures for Davao City LCCAP

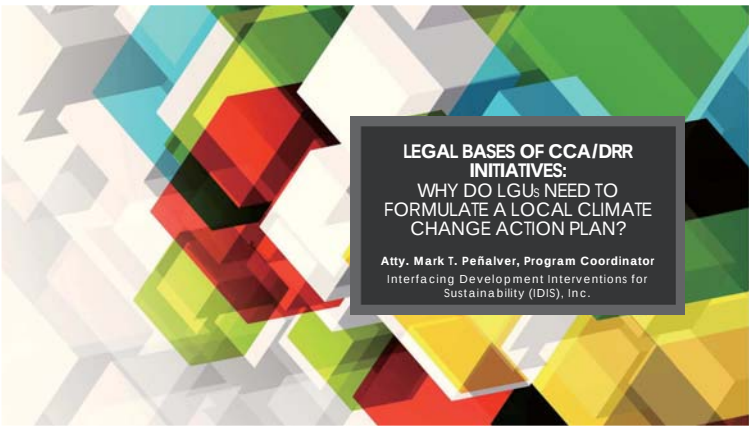
EnP. Lemuel Lloyd I. Manalo
Environmental Research Specialist, IDIS

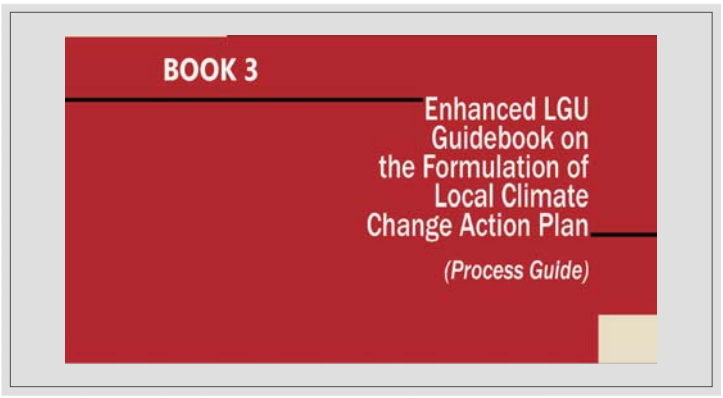
Recommendations for Policy (New Green Ordinances)

1. Land-usage limitations for Wetlands and Floodplains preservation
2. Requirement of Green Roof, Balcony and Community Gardening systems for High-rise Buildings, Commercial-Office Buildings and etc.
3. Requirement of sustainable urban drainage systems for large establishments
4. Protection of urban street islands, plant-strips and vegetation enhancement
5. Green procurement and purchasing ordinance for Local Government Unit
6. Organic Agriculture Network Zones
7. Urban Tree Preservation, Mainstreaming Earth Balling and Replacing Techniques
8. Strengthening of Community-Based Monitoring and Enforcement (Park Watchers, Bantay Suba, Bantay Bukid and Bantay Dagat)



Dona Vicenta, Marfori, Davao City





Climate Change Act

AO 171	EO 774	RA 9729	RA 10174
Created the Presidential Task Force on Climate Change (PTFCC)	Reorganization of PTFCC designating the President as Chairperson	Climate Change Act of 2009	Establishes the People's Survival Fund

Mandate under the Climate Change Act

SEC . 14. Local Climate Change Action Plan. –

- The LGUs shall be the frontline agencies in the formulation, planning and implementation of climate change action plans
- Barangays shall be directly involved with municipal and city governments in prioritizing climate change issues and in identifying and implementing best practices and other solutions.
- Municipal and city governments shall consider climate change adaptation, as one of their regular functions.
- LGUs shall regularly update their respective action plans to reflect changing social, economic, and environmental conditions and emerging issues.
- It shall be the responsibility of the national government to extend technical and financial assistance to LGUs for the accomplishment of their Local Climate Change Action Plans.
- The LGU is hereby expressly authorized to appropriate and use the amount from its Internal Revenue Allotment necessary to implement said local plan effectively, any provision in the Local Government Code to the contrary notwithstanding.

WHAT IS LOCAL CLIMATE CHANGE PLAN?

- LCCAP is the action plan formulated by the LGUs to address climate change concerns.
- The LCCAP focus on both climate adaptation and mitigation and describes how LGUs plan to respond to climate change and mainstream such into local development plans.

PEOPLE'S SURVIVAL FUND

SEC. 18. *Creation of the People's Survival Fund.* – A People's Survival Fund (PSF) is hereby established as a special fund in the National Treasury for the **financing of adaptation programs and projects** based on the National Strategic Framework.

PEOPLE'S SURVIVAL FUND

- annual fund intended for **local government units and accredited local/community organizations** to implement **climate change adaptation projects** that will better equip vulnerable communities to deal with the impacts of climate change.
- Local government units with **high poverty incidence, are exposed to climate risks, and has a key biodiversity area** will be prioritized.
- intended for **adaptation activities** that include water resources management, land management, agriculture and fisheries, health, among others, and serve as guarantee for risk insurance needs for farmers, agricultural workers and other stakeholders.

CRITERIA FOR LGUs SEEKING TO ACCESS THE FUND

- **POVERTY INCIDENCE (40%) –** This criterion identifies the proportion of families (or population) with per capita income less than the per capita poverty threshold to the total number of families (population.
- **EXPOSURE TO CLIMATE RISK (30%) –** This criterion pertains to the potential climate change risks of the province in relation to projected mean temperature rainfall change, and extreme weather events.
- **PRESENCE OF IDENTIFIED AND DELINEATED KEY BIODIVERSITY AREAS (30%) –** Biodiversity areas are sites that are critical for the conservation of globally important biodiversity, identified through the criteria which are:
  - **Globally threatened species;**
  - **Restricted-range species; and**
  - **Congregatory species.**

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interfacedvo@gmail.com

"A Review and Analysis on Davao City's Climate Change Vulnerability and Risk Assessment"

Dr. Gernelyn T. Logrosa
Malayan Colleges Mindanao

Davao City in context

Davao City is located in the southeastern part of Mindanao. A substantial part of Davao City is mountainous, characterized by extensive mountain ranges with uneven distribution of plateaus and lowlands

The Davao River, with its numerous tributaries, is the main drainage system of the City.

Why we need to know Davao City's Climate Change Vulnerability and Risk?

Although Climate Change has a global focus, there is no *one-size-fits-all* approach to this problem. Every country has different economic development needs and capacities. Every city has a unique set of resources that reflect its own socio-economic conditions.

Therefore, vulnerability and risk relating to Climate Change should be understood from a local context. From this contextualized understanding, then we can produce tailored fit mitigative and adaptive strategies.

United Nations, 2012

Why we need to know Davao City's Climate Change Vulnerability and Risk?

Davao is rapidly developing.


BusinessMirror
Is Davao growing faster than the city can handle?

PHILIPPINE NEWS AGENCY
Davao Region 2nd fastest growing economy in 2018


'Build, Build, Build' program to turn Davao City into manufacturing, agro-industry hub

Risk of Climate Change in Davao City

Davao City falls under the Type IV climate of the Coronas Climate Classification System of the Philippine Atmospheric, Geophysical and Astronomical Sciences Administration (PAGASA). This means rainfall is almost evenly distributed during the whole year.

Table 1: Seasonal Temperature Change in 2020 and 2050 under A1B Medium-Range Emission Scenario for Davao City

SEASON	OBSERVED (°C)	PROJECTED CHANGE (°C)		PROJECTED MEAN TEMPERATURE (°C)	
	(1971-2000)	(2006-2035)	(2036-2065)	(2006-2035)	(2036-2065)
Dec-Jan-Feb (DJF)	26.9	0.9	1.9	27.8	28.8
Mar-Apr-May (MAM)	27.8	1.1	2.2	28.9	30.0
Jun-Jul-Aug (JJA)	26.9	1.1	2.3	28.0	29.2
Sep-Oct-Nov (SON)	27.1	1.0	2.0	28.1	29.1

Figure 1: Annual Average Temperature of Davao City, 1914-2100

Data Source: PAGASA, Region XI

Risk of Climate Change in Davao City

UN International Strategy for Disaster Reduction (ISDR) Policy Issues and Guidelines, water-related disasters account for 90% of all natural disasters, and their frequency and intensity generally rise. In Davao City, the average monthly rainfall increased by 10mm from 140mm in 1990 to 150mm as recorded in 2010.

Table 2: Seasonal Rainfall Change in 2020 and 2050 under Medium-Range Emission Scenario for Davao City

SEASON	OBSERVED (mm)	PROJECTED CHANGE (%)		PROJECTED RAINFALL AMOUNT(mm)	
	(1971-2000)	(2006-2035)	(2036-2065)	(2006-2035)	(2036-2065)
Dec-Jan-Feb (DJF)	288.1	18.1	15.2	340.25	331.9
Mar-Apr-May (MAM)	347.1	-9.8	-12	313.08	305.4
Jun-Jul-Aug (JJA)	494.1	-7.8	-12.6	455.56	431.8
Sep-Oct-Nov (SON)	442.3	-2.4	-4.5	431.68	422.4

Data Source: PAGASA, Region XI; Photo from Edge Davao

Five (5) Main Natural Hazards in Davao City

Flood

Landslide

Storm Surge

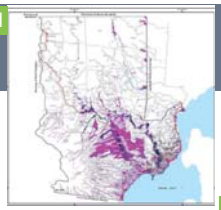
Liquefaction

Active Fault Line

Data Source: OCPDC; Photo from Edge Davao; Newsline

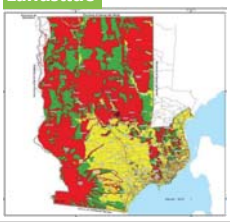
Five (5) Main Natural Hazards in Davao City: Susceptibility Maps

Flood



Data Source: OCPDC

Landslide



Storm Surge

Liquefaction

Vulnerability and Risk Assessment

Data Source: OCPDC

Five (5) Main Natural Hazards in Davao City: Population Vulnerability Index

Flood

Data Source: OCPDC

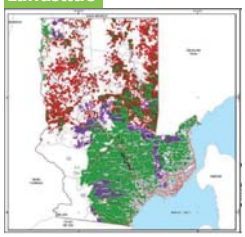
Landslide

Storm Surge

Liquefaction

Main Natural Hazards in Davao City: Natural Resource Based Production Areas

Landslide



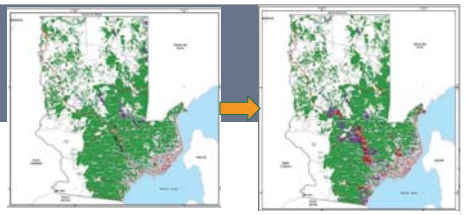
Flood

Storm Surge

Data Source: OCPDC

Natural Resource Based Production Areas: Vulnerability to Risk

Flood



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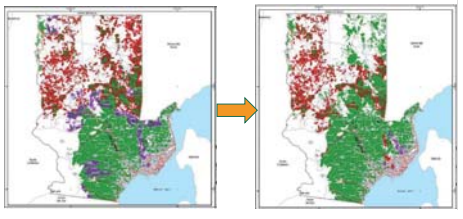
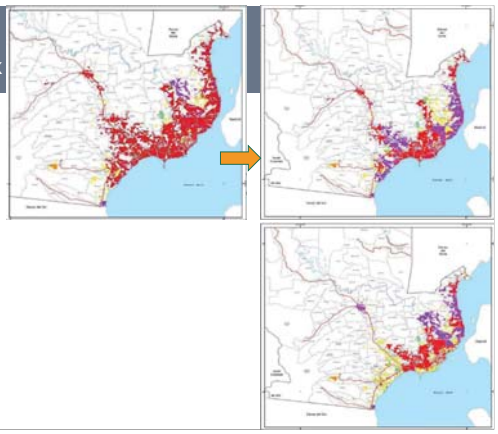


Data Source: OCPDC

Urban Use Vulnerability to Risk

Flood

Landslide



Data Source: OCPDC

RISK-BASED APPROACH TO CLIMATE CHANGE ADAPTATION

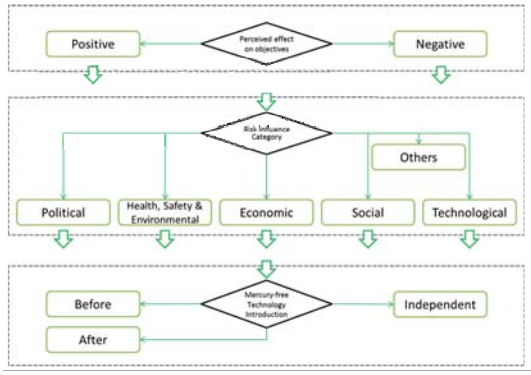


Figure 3: Integrated risk perceptions assessment model for technology adoption in small-scale mining communities (Logrosa, 2018)

- Integrated analysis
- Involves multi-stakeholder;
- Both perceived and actual risks and barriers

- Stimulate technological advances, reduce costs, and enable progress toward stabilization

CLIMATE CHANGE AND SUSTAINABILITY DEVELOPMENT

The most promising policy approaches, therefore, seem to be those that capitalize on natural synergies between climate protection and development priorities to advance both simultaneously (IPCC, 2007).

Emerging research has identified methodological approaches to identify, characterize and analyze the interactions between sustainable development and climate change responses. Several authors have suggested that sustainable development can be addressed as a framework for jointly assessing social, human, environmental and economic dimensions (IPCC, 2007).

RECOMMENDATIONS

Best Practices
Source: metrocouncil.org

3 I's

1. Integrated risk model
2. Iterative management to inform decision-making
3. Inclusive multi-stakeholder approach

RISK-BASED APPROACH TO CLIMATE CHANGE ADAPTATION

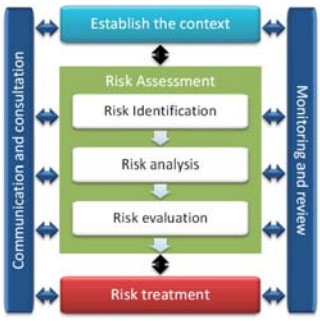
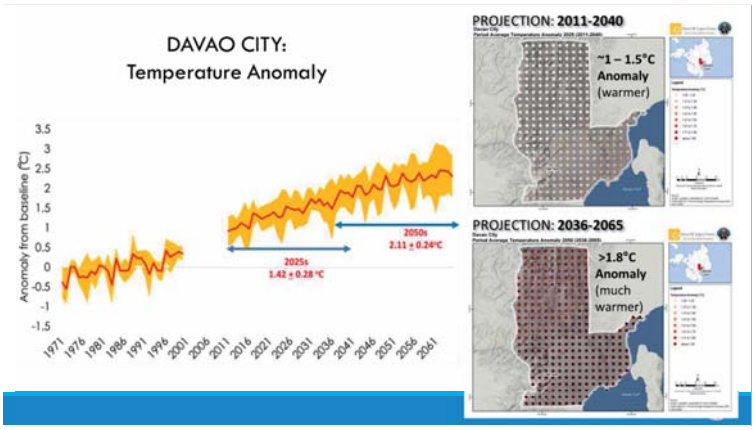


Figure 2: The risk management process (AS/NZS ISO 31000:2009)

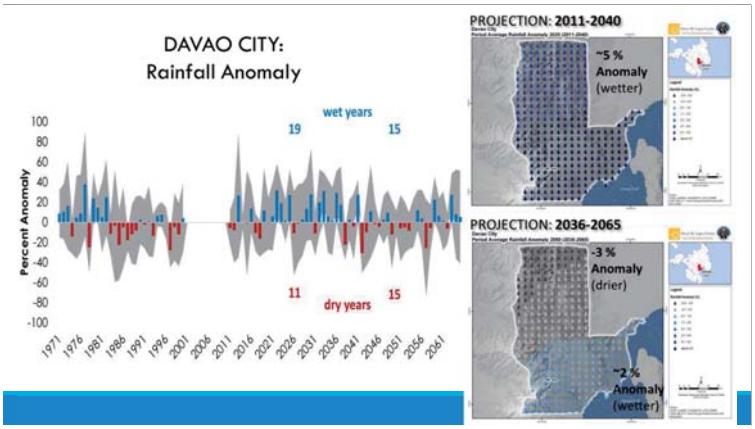
- uses empirical evidence to develop a holistic framework that informs decision makers of the risks to be managed
- over time involves an iterative process that includes mitigation and adaptation

Emerging research has identified methodological approaches to identify, characterize and analyze the interactions between sustainable development and climate change responses. Several authors have suggested that sustainable development can be addressed as a framework for jointly assessing social, human, environmental and economic dimensions (IPCC, 2007).



Climate Change Projections in Mindanao

MANILA OBSERVATORY W/ OSCAR M. LOPEZ (OML) FOUNDATION (DAVAO), CHRISTIAN AID (ZAMBOANGA), AND USAID PROJECTS (CDO)

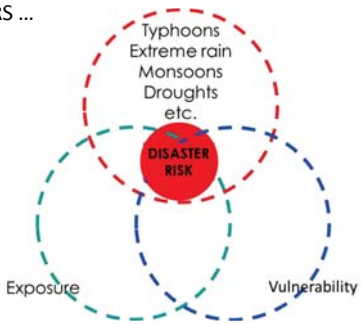


CITY	YEAR	TEMP. (°C)	PRECIP. (%)
Davao City	2025	1.4	~3%
	2050	2.1	+5% to -3%
Davao Oriental	2025	1.3	~1 to 7%
	2050	1.9	+1% to -1.8%
CDO	2025	0.9	1% to 4%
	2050	1.5	-2% to -5%
Zamboanga City	2025	1.4	+0.2% to -0.6%
	2050	2.2	-0.2% to -0.6%

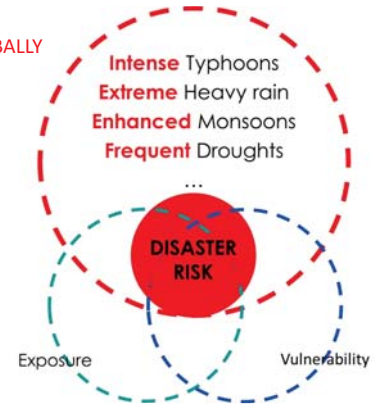
2025: wetter
2050: drier
drier

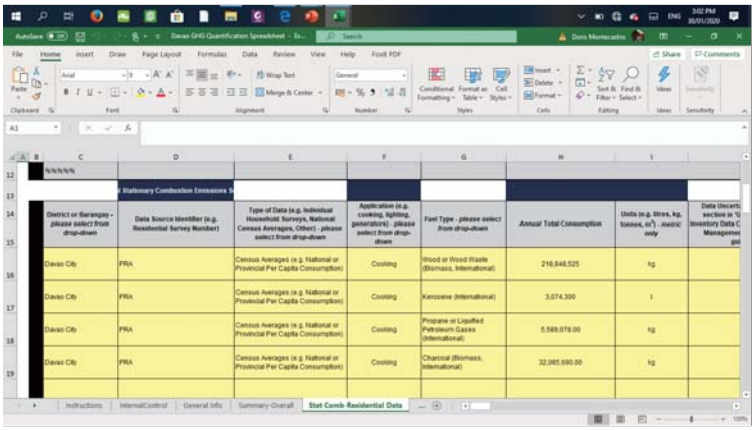
Summary

AT RISK TO DISASTERS …



IN A GLOBALLY WARMER WORLD





LOCAL CLIMATE CHANGE ACTION PLAN (LCCAP)

- R.A. 9729, SEC. 14 - "The LGUs shall be the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas..."

Adaptation

"..adjustments in natural or human systems to a new or changing environment."

Mitigation

"..policy or action, measures or strategies to reduce or avoid GHG emissions or to increase GHG absorption."

Reference: DILG. (2014). LGU Guidebook on the Formulation of Local Climate Change Action Plan (LCCAP) Book 2

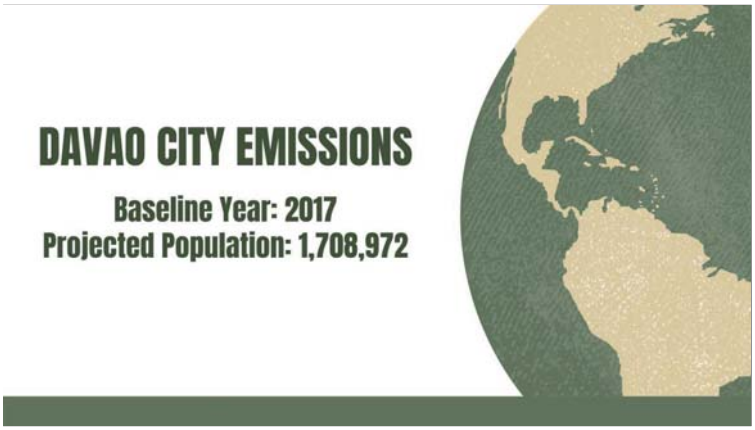
EMISSION SOURCES

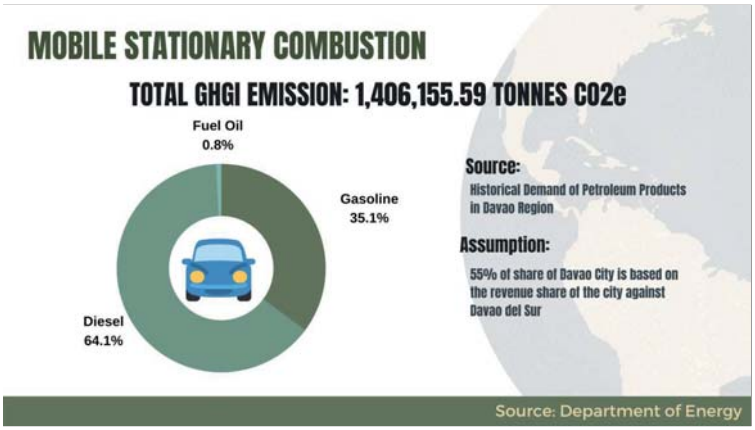
Area Sources	Industrial Sources	Mobile Sources
Commercial Cooking	coal	Jeepney
Generator Sets	bunker	Motorcycle
Landfill	Low Sulphur fuel oil	Tricycle
Residential Cooking	wood	Taxi
Residential Lighting	power plant	Utility Vehicles (UV)
Agricultural Lands	cement	Sports Utility Vehicles (SUV)
		Car
		Light Duty Vehicles (LDV)
		Truck
		Trailer

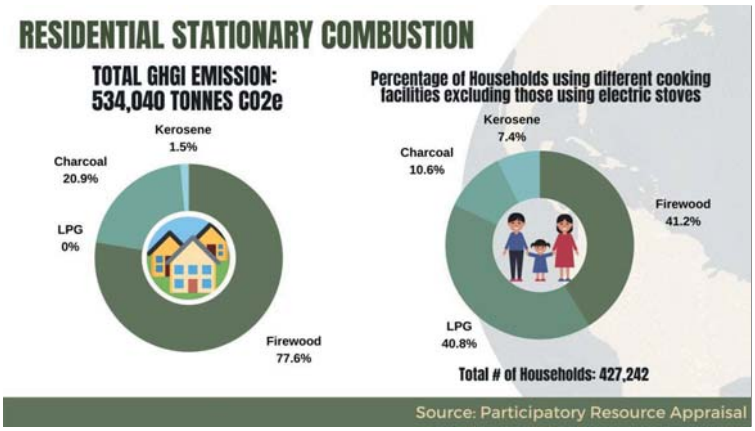
GHG Inventory

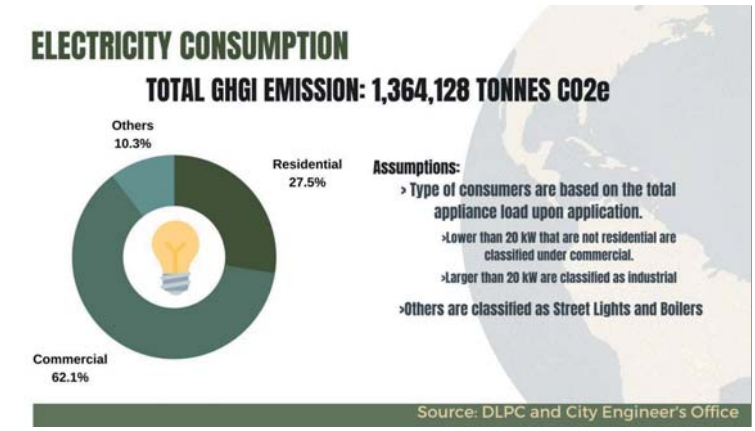
- Estimates of all emissions and removals of greenhouse gases (GHG) from given sources or sinks from a defined region in a specific period of time (IPCC, 2015).
- Help identify the major source of air pollution so that mitigation measures can be made

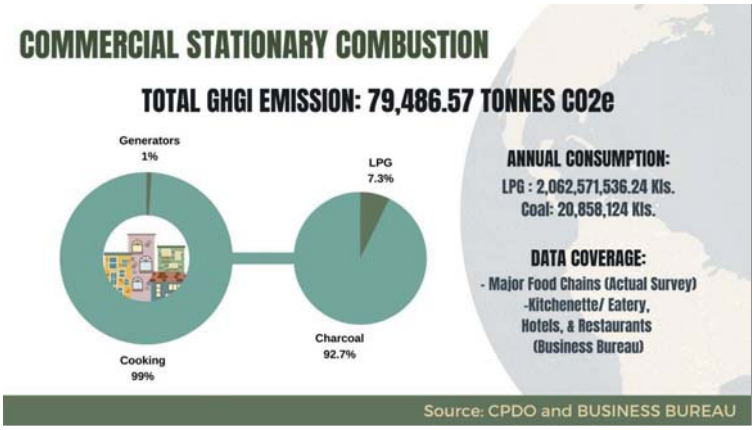
Reference: US EPA. (2016). Climate and Energy Resources for State, Local and Tribal Governments

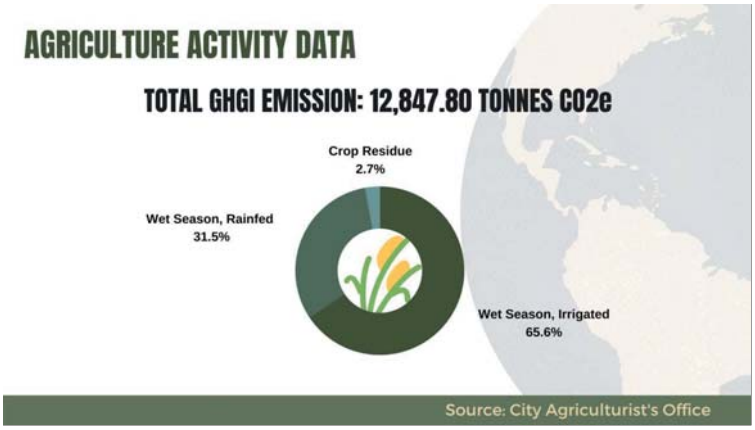

DAVAO CITY EMISSIONS
Baseline Year: 2017
Projected Population: 1,708,972


MOBILE STATIONARY COMBUSTION
TOTAL GHGI EMISSION: 1,406,155.59 TONNES CO2e
Fuel Oil 0.8%
Gasoline 35.1%
Diesel 64.1%
Source:
Historical Demand of Petroleum Products in Davao Region
Assumption:
55% of share of Davao City is based on the revenue share of the city against Davao del Sur
Source: Department of Energy


RESIDENTIAL STATIONARY COMBUSTION
TOTAL GHGI EMISSION: 534,040 TONNES CO2e
Kerosene 1.5%
Charcoal 20.9%
LPG 0%
Firewood 77.6%
Percentage of Households using different cooking facilities excluding those using electric stoves
Kerosene 7.4%
Charcoal 10.6%
Firewood 41.2%
LPG 40.8%
Total # of Households: 427,242
Source: Participatory Resource Appraisal

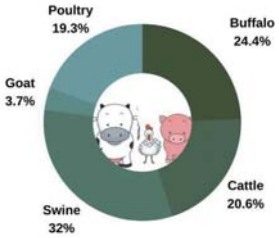

ELECTRICITY CONSUMPTION
TOTAL GHGI EMISSION: 1,364,128 TONNES CO2e
Others 10.3%
Residential 27.5%
Commercial 62.1%
Assumptions:
› Type of consumers are based on the total appliance load upon application.
›Lower than 20 kW that are not residential are classified under commercial.
›Larger than 20 kW are classified as industrial
›Others are classified as Street Lights and Boilers
Source: DLPC and City Engineer's Office


COMMERCIAL STATIONARY COMBUSTION
TOTAL GHGI EMISSION: 79,486.57 TONNES CO2e
Generators 1%
LPG 7.3%
Cooking 99%
Charcoal 92.7%
ANNUAL CONSUMPTION:
LPG : 2,062,571,536.24 Kls.
Coal: 20,858,124 Kls.
DATA COVERAGE:
- Major Food Chains (Actual Survey)
-Kitchenette/ Eatery, Hotels, & Restaurants (Business Bureau)
Source: CPDO and BUSINESS BUREAU


AGRICULTURE ACTIVITY DATA
TOTAL GHGI EMISSION: 12,847.80 TONNES CO2e
Crop Residue 2.7%
Wet Season, Rainfed 31.5%
Wet Season, Irrigated 65.6%
Source: City Agriculturist's Office

AGRICULTURE ACTIVITY DATA (LIVESTOCK)

TOTAL GHGI EMISSION: 305,171.49 TONNES CO2e



TOTAL HEADCOUNT:
Buffalo- 38,642
Cattle- 36,318
Swine- 229,854
Goat- 46,867
Poultry- 6,905,140

Source: City Veterinarian's Office

INDUSTRIAL PROCESS

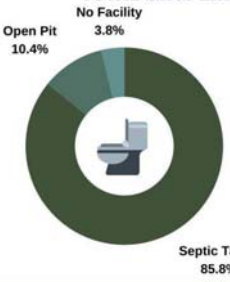
TOTAL GHGI EMISSION: 2,860,448 TONNES CO2e

Total Annual Production:
1,430,224 Tons

Source: HOLCIM Philippines

WASTEWATER TREATMENT AND DISCHARGE

TOTAL GHGI EMISSION: 186,067.53 TONNES CO2e



Limitation:
› Data used only covers the residential wastewater

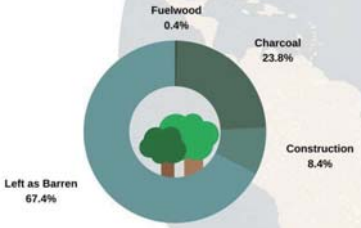
Source: City Healthy Office

FORESTRY AND LAND USE

TOTAL GHGI EMISSION: 175,203.45 TONNES CO2e

99% of the emission are from the changes in the use of the forestlands for agriculture. The remaining **1%** are from wood and wood products harvesting.

Wood and Wood Products Harvesting



Source: CPDO FLUP

SOLID WASTE DISPOSAL

TOTAL GHGI EMISSION: 25.2 TONNES CO2e

Total Solid Waste Collected:
Collection Area: 306,910.8 Tons
Non-Collection Area: 51,792.1 Tons
*Based on CENRO Waste Analysis Characterization Study

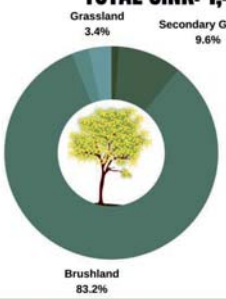
Source: City Environment and Natural Resources Office

6,491,909 Tonnes CO2e
Total Emissions

TOP 5 SOURCES OF EMISSIONS

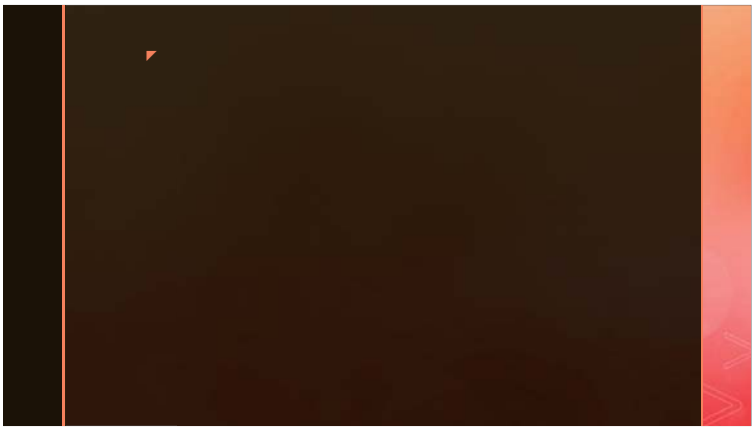
GHG REMOVAL FROM SINK

TOTAL SINK: 1,485,732.76 TONNES CO2e



Protection Forest- 4,920 Ha.
Secondary Forest- 16,651 Ha.
Brushland- 79,188 Ha.
Tree Plantation- 3,225 Ha.
Grassland- 15,636 Ha.

Source: CPDO FLUP



DAVAO CITY TOTAL EMISSIONS

5,456,176 Tonnes CO2e

SUMMARY OF ACTIVITY DATA (2016)

Area Sources	Value	Unit
From Landfill, Commercial & Residential Cooking	214,056	metric tons/year
Generator Sets (diesel)	17,724,574	liters/year
Agricultural Lands (CLUP)	91,082	hectares
Forest Cover (CLUP)	134,380	hectares

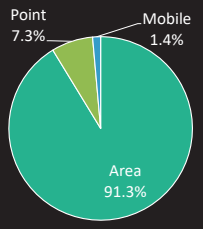
Industrial Sources	Value	Unit
Coal & Wood	1,117,011	metric tons/year
LSFO & Bunker	17,247,459	liters/year

Mobile Sources	Value	Unit
Vehicle Kilometers Travelled (VKT)	2,859,368,067	kilometers
Total Idling Time	57,762,702	hours

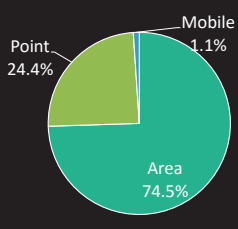
IMPLICATIONS

- Mitigation measures need to address sources
- Updating of GHG Inventory?
- Short-lived Climate Pollutants (SLCPs) – O3, PM, CFCs, HFCs
- SDGs (Sustainable Development Goals)

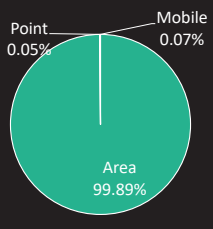
GHG Emissions



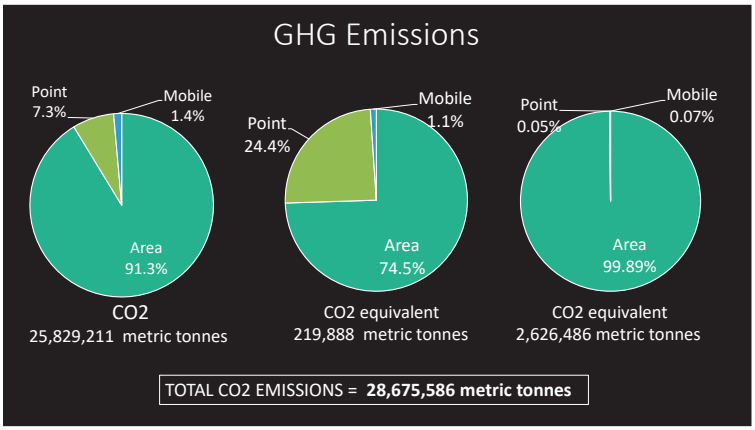
CO2
25,829,211 metric tonnes



N2O
709 metric tonnes



CH4
125,071 metric tonnes



SUMMARY OF ACTIVITY DATA (2017, CPDO)

Area Sources	Value	Unit
From Landfill, Commercial & Residential Cooking	214,056	metric tons/year
Generator Sets	293,518	liters/year
Agricultural Lands	91,082	hectares
Forest Cover	116,620	hectares

Point Sources	Value	Unit
Coal & Wood	1,117,011	metric tons/year
LSFO & Bunker	17,247,459	liters/year

Mobile Sources	Value	Unit
Vehicle Kilometers Travelled (VKT)	2,859,368,067	kilometers
Total Idling Time	57,762,702	hours

Greenhouse Gas Inventory of Davao City

Documentation of Methodologies

Evelyn Cubelo, Consultant

Davao City Local Government Unit
Cooperation with IGES, Kitakyushu City government &
Ministry of the Environment, Japan

Contents

I. Executive Summary

This report documents Davao City's greenhouse gas (GHG) inventory, a detailed accounting of GHG releases based on 2017 baseline data.

Davao City is a first-class city in the island of Mindanao, Philippines. It is considered as the largest city in the Philippines with a total land area of 2,443.61 km^2 (943.48 sq mi). It is the most populous city in Mindanao with a population of 1,632,991 with a growth rate of 2.30%, based on the Philippine Statistics Census in 2015. The city is divided into three congressional districts, which are subdivided into 11 administrative districts with a total of 182 barangays.

The city has a projected average annual growth of 2.53 percent over 15 years. As the largest economy outside Metro Manila, the city also serves as the largest local economy in the southern Philippines. Agriculture remains the largest economic sector.

However, climate change impacts undermine the the sustainability and economic development of Davao City at present and in the longer term period. "Climate change is one of the biggest challenges of our time, especially for developing nations with limited capacity to address its multiple implications on a country's economic development.The Philippines is among the ten most vulnerable countries to the impacts of climate change, according to the United Nations Office for Disaster Risk Reduction (UNISDR). Located in one of the world's most typhoon-prone areas, the Philippines is visited by 20 typhoons annually and Filipinos have developed a familiarity to weathering heavy rains and floods during the rainy season."[1]

The Philippines signed the Paris Agreement in 2017 which aims to "holding the increase of global temperature to "well below 2 degrees C above pre-industrial levels... and to pursue efforts to limit the temperature increase to 1.5 degrees C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change." This warming limit is key to prevent the irreversible damages caused by climate change. Philippines also submitted its Intended Nationally Determined Contributions (INDCs) outlining its target to cut emissions by 70 percent by 2030. The INDCs, now called Nationally Determined Contributions (NDCs) spells out the country's strategy for adaptation and mitigation by pursuing low-carbon development and cutting emissions in energy, transport, forestry, agriculture, industry and waste sectors. The Philippine Climate Change Commission (CCC) highlights the important role of the local government units, as partners in achieving the country's goal to cut carbon emissions through a transparent GHG inventory and reporting mechanism.

Climate Change Act of 2012 (RA 10174) mandates the Philippine Government to address climate change in the context of sustainable development. A guideline for the formulation of the Local Climate Change Action Plan supports Local Government Units in identifying mitigation options to help reduce carbon footprints and contribute to efforts in addressing climate change.

In 2018, Davao City affirmed its commitment to GHG policy by creating a Technical Working Group

1 https://climate.gov.ph/files/GHG-Manual-for-Business-2017.pdf

under the Executive Order No. 40 to facilitate in the preparation of the Local Climate Change Action Plan and GHG Inventory Report. It also forged a memorandum of agreement with the City of Kitakyushu, Japan for mutually beneficial cooperation for the development of two cities such as low carbon society and others.

The Climate Change Commission developed a manual on GHG Inventory to guide LGUs in accounting for their community-level GHG inventories. Although, the rules governing the conduct of GHG Inventories are voluntary and dependent on the choices made by the LGUs but are anchored in internationally recognized standards and protocols on community-level GHG accounting. The main reference document for the conduct of this type of inventory is the IPCC Guidelines for National GHG Inventories.

The GHG Inventory in Davao City covered scope 1 for most sources and scope 2 for purchased electricity. These are stationary combustion from commercial and residential buildings; mobile combustion; purchased electricity (i.e. commercial buildings, residential buildings, others I.e. streetlights); solid waste in landfills; wastewater treatment and discharge; agriculture (crops and livestock); forestry and land-use changes; and industrial processes and products use for selected industries.

A summary of Greenhouse Gas Emissions for Davao City based on 2017 accounting reported a total of GHG emissions output of 4,708,349 tonnes CO_2e for all sectors covered. Emissions from community mobile combustion (29.85%) and industrial processes and product use (60.75%) are the highest contributor to GHG emissions.

The total net GHG emissions accounted for about 31.56% tonnes of CO_2e released and removed from sink or sequestered by the remaining primary and secondary growth forestlands and brushlands in the city.

As Davao City accounts for its GHG emissions for the first time there were a few challenges encountered. Articulating these impediments will contribute to the improvement of the GHGI inventory in the next reporting period.

1. Filtering of data. Some figures such as the specific business line of establishments were not disaggregated according to the required values of the GHG inventory.
2. Difficulties in securing the total production values of commercial and industrial processes as most businesses would prefer not to divulge such information easily.
3. More capacity building for the GHGI team in learning the tools especially in the quantification process and identification of uncertainties per parameter and categories.
4. Partnership and linking with other Government Agencies. In the next reporting period, the quantification of GHG emissions in solid waste and wastewater treatment/discharge needs more preparation on the part of the Davao City TWG Team.

In all areas of concern, it is strategic for the team to collaborate, share information and learn from other agencies such as the Environmental Management Bureau, Barangay Local Government Units and all other national government agencies.

Table 1: Summary of Total Greenhouse Gas Emissions in Davao City in 2017, per sector

Emission Source	GHG Emissions (tonnes CO_2e)	The proportion of Total Emissions
Scope 1 Emissions (Net of Forestry and Land Use)		
GHG Emissions from Community-Level Residential Stationary Fuel Use	534040.77	11.34%
GHG Emissions from Community-Level Commercial Stationary Fuel Use	79486.57	1.69%
GHG Emissions from Community Mobile Combustion	1405481.84	29.85%
GHG Emissions from Solid Waste Disposal - IPCC FOD Method*	0.00	0.00%
GHG Emissions from Other Solid Waste Treatment (ICLEI)*	18285.15	0.39%
GHG Emissions from Solid Waste Open Burning (ICLEI)*	49.24	0.00%
GHG Emissions from Wastewater Treatment and Discharge	186067.53	3.95%
GHG Emissions from Community-Level Agriculture (Crops)	12847.80	0.27%
GHG Emissions from Community-Level Agriculture (Livestock)	305171.49	6.48%
GHG Emissions from Solid Waste Disposal - Inside LGU Geopolitical Boundaries (ICLEI)	0.00	0.00%
GHG Emissions from Wastewater Treatment and Discharge (Other Sources)	0.00	0.00%
GHG Emissions from Industrial Processes and Product Use	2860448.00	60.75%
Scope 1 Emissions/Removal (Forestry and Land Use)		
GHG Emissions from Forestry and Land Use	175203.45	3.72%
GHG Removal from Sink	-1485732.76	-31.56%
Total Scope 1 Emissions	**4,091,349**	**86.88%**
Scope 2 Emissions		
GHG Emissions from Purchased Electricity at Community-Level Residential Sites	150257.18	3.19%
GHG Emissions from Purchased Electricity at Community-Level Commercial Sites	338965.79	7.20%
GHG Emissions from Purchased Electricity at Community-Level for All Other Sources	127776.50	2.71%
Total Scope 2 Emissions	**616,999**	**13.10%**
Scope 3 Emissions		
GHG Emissions from Solid Waste Disposal - Outside LGU Geopolitical Boundaries (ICLEI)	0.00	0.00%
Total Scope 3 Emissions		
	4,708,349	**99.98%**

II. Background Information

Socio-economic Situation of Davao City

Davao City is a first-class city in the island of Mindanao, Philippines. It is considered as the largest city in the Philippines with a total land area of 2,443.61 km^2 (943.48 sq mi). It is the most populous city in Mindanao with a population of 1,632,991 with a population growth rate of 2.305.[2] Population density is seven (7) persons per hectare. Population projection for 2023 indicated that the population will reach to 1,971,499.[3]

The city is divided into three congressional districts, which are subdivided into 11 administrative districts with a total of 182 barangays.

Table 2: Quick Facts About Davao City

Total population (2015)	1,632,991
Land area (hectares)	244,000
Population Density (per hectare)	7 persons
Population Growth Rate	2.30%
Number of barangays/villages	182
IRA share	3,330,085,561
IRA dependency rate	53.97%
Total LGU income	7,307,595,301.66
Average LGU revenue per capita	4,474.97
Ecosystem type	Watershed
Economy	First-class

Source: Davao City Socio-economic Indicators

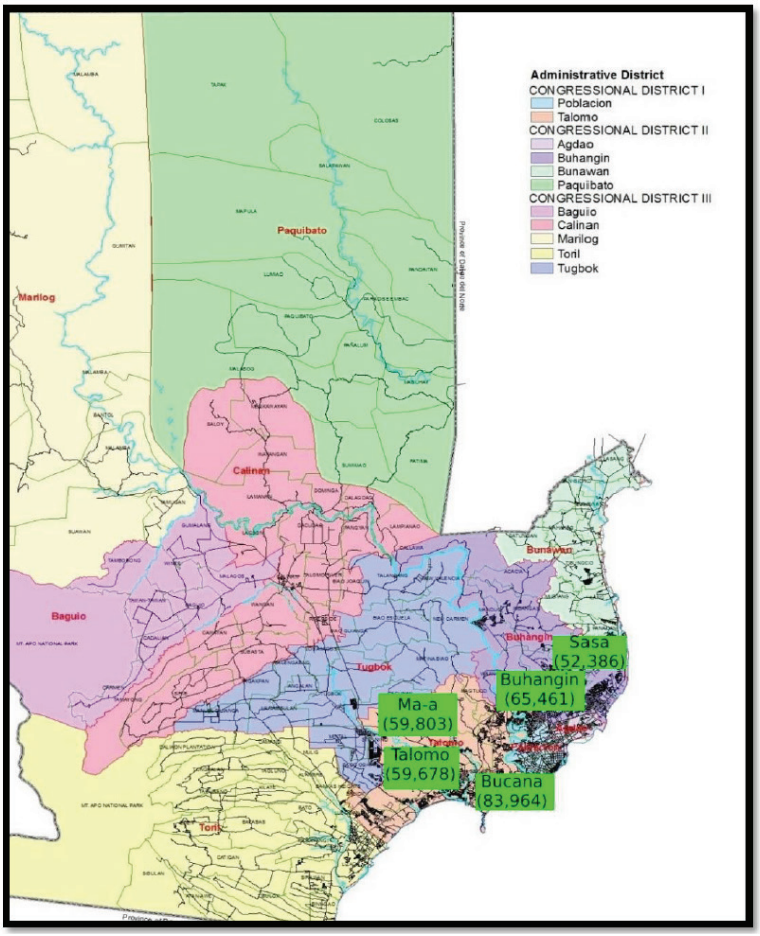
Geography

Davao City is approximately 588 miles (946 km) southeast of Manila over land and 971 kilometers (524 NMI) by sea. The city is located in southeastern Mindanao, on the northwestern shore of Davao Gulf, opposite Samal Island.[4]

2 PSA 2015
3 ibid
4 Wikipedia, Davao City

Davao City is located in the southeastern part of Mindanao, lying in the grid squares of 6 58′ to 7 34′ N latitude, and 125 14′ to 125 40′ E longitude. It is bounded on the north by **Davao** Province; on the east partly by **Davao** Province and **Davao** Gulf; on the south by **Davao del Sur**, and the west by North Cotabato.[5]

Davao City is divided into three (3) congressional districts which are further subdivided into 182 barangays. It has 11 administrative districts situated in the three congressional districts (See Fig. 1-Map)



Source: Office of the City Planning and Development Coordinator

Figure 1: Administrative Map of Davao City by district

Topography

Davao City's land, totaling about 2,443.61 square kilometers (943.48 sq mi), is hilly in the west (the Marilog district) and slopes down to the southeastern shore. Mount Apo, the highest peak in the Philippines, is located at the city's southwestern tip. The Davao River is the city's primary drainage channel. Draining an area of over 1,700 km^2 (660 sq mi), the 160-kilometer (99 mi) river begins in the town of San Fernando, Bukidnon. The mouth of the river is located at Barangay Bucana at Talomo District.[6]

5 Davao City Comprehensive and Land Use Plan 2019
6 CLUP 2018-2022, Ecological Profile of Davao City

Climate

Davao has a tropical rainforest climate (Köppen climate classification *Af*), with little seasonal variation in temperature. The areological mechanism of the Intertropical Convergence Zone occurs more often than that of the trade winds and because it experiences rare cyclones the climate is not purely equatorial but subequatorial. Average monthly temperatures are always above 26 °C (78.8 °F), and average monthly rainfall is above 77 millimeters (3.03 in). This gives the city a tropical climate, without a true dry season; while there is significant rainfall in winter, the largest rainfall occurs during the summer months.[7]

However, climate projections of PAGASA reveal that the city will experience an increase in the average temperature between 0.9 to 1.1 degrees Celsius by 2020 and up to 2.3-degree celsius in 2050. According to the report of the Intergovernmental Panel on Climate Change (IPCC), the effects of a 1-degree Celsius increase in temperature may invade decreased availability of water, reduced farmer's productivity, lower cereal productivity in low altitudes, droughts, malnutrition, and increase morbidity rate. Other effects include storms, floods, increased coral bleaching, increase risk of wildfire, and increase risk of extinction of more than 30% of species in the world.[8]

Economy

The city serves as the main trade, commerce, and industry hub of Mindanao, and the regional center of Davao Region.

Davao is part of the East Asian Growth Area, a regional economic-cooperation initiative in Southeast Asia.

The city has a projected average annual growth of 2.53 percent over 15 years. As the largest economy outside Metro Manila, the city also serves as the largest local economy in the southern Philippines.

Commerce, Trade, and Industry[9]

Agriculture remains the largest economic sector comprising banana, pineapple, coffee and coconut plantations in the city. It is the island's leading exporter of fruits such as mangoes, pomelos, bananas, coconut products, pineapples, papayas, mangosteens, and cacao.

In 2016, production areas for agricultural and industrial crops, fruits, root crops, and vegetables spanned approximately 74,158 hectares with a total production of 630,000 metric tons.

The volume of livestock production for cattle and carabao were estimated to be at 74,570 heads in 2016. The swine production is in part 53.78% (222,341 heads) of the total livestock production with goats totaling 11.26% (46,553 heads) and poultry at 6, 293,775 heads.

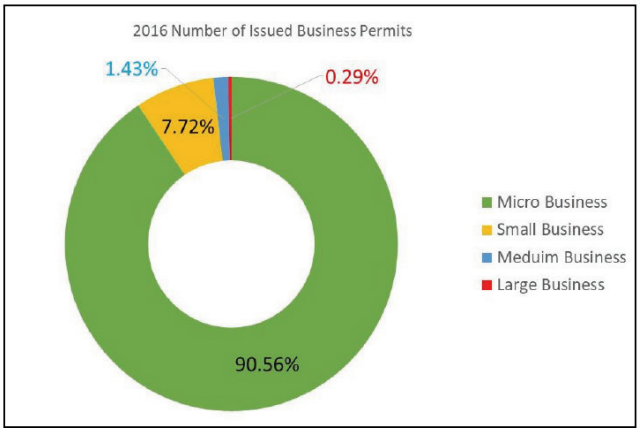
Aquaculture production in Davao City reached 617,020 metric tons in 2016, accounted as: inland fishing at 908.79 metric tons; fishponds at 227,418.92 metric tons; and deep-sea fishing at 388,597.95

7 Wikipedia, https://en.wikipedia.org/wiki/Davao_City
8 Davao City Comprehensive Land Use Plan 2019
9 Davao City Comprehensive Land Use Plan 2019

metric tons.

The chocolate industry is the newest development in the city. Malagos Chocolate, developed by Malagos Agriventures Corp., is now the country's leading artisan chocolate recognized worldwide. On the other hand, Seed Core Enterprises is the country's biggest exporter of cacao to Barry Callebaut. Local corporations like Lorenzo Group, Anflo Group, AMS Group, Sarangani Agricultural Corp. and Vizcaya Plantations Inc. have operations and headquarters in Davao City. Multinational companies like Dole, Sumifru/Sumitomo, and Del Monte have their regional headquarters in the city.[10]

In 2016, the city registered 36,254 establishments with capitalisation of Php 227,395,300,819.52. The majority of the investment (77.83%) are large from large businesses. While micro businesses hired the most number of employees at 122, 389 (64.77%).[11]



Source: Business Bureau

Figure 2: 2016 Number of Issued Business Permits

A total of 60,759 business lines were registered in 2016. Each business establishment may have more business lines. Retailers account for 42.11% of the business lines, services at 18%, wholesalers/distributors at 9.66%, and food handlers composed of restaurants, cafeterias, and refreshment parlors at 6.5%. Moreover, a particular increase in delivery services has been reported at 5.31%.[12]

Table 3. Business Establishments, Capitalization and Employment, by Type of Business, 2015

Type of Business	Issued Permits	Capitalization	No. of Employees
Micro	31,126	14,117,541,772.46	114,196
Small	2,483	16,855,256,666.60	40,488
Medium	482	15,229,207,136.16	18,516
Large	101	167,688,409,516.34	6,703
Davao City	**34,192**	**213,890,415,091.56**	**179,903**

Source: Business Bureau – City Mayor's Office, Davao City

10 Wikipedia, https://en.wikipedia.org/wiki/Davao_City
11 Davao City Business Bureau
12 CPDO, Davao City Socio-economic indicators

III. National and Local Policies for GHGI

In March 2017, the Philippines signed the Paris Climate Agreement. It is a landmark agreement signed by 195 nations during the 21st Conference of Parties (COP 21) in December 2015 with the aim to "holding the increase of global temperature to "well below 2 degrees C above pre-industrial levels... and to pursue efforts to limit the temperature increase to 1.5 degrees C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change." This warming limit is key to prevent the irreversible damages caused by climate change.[13]

The Philippines submitted its Intended Nationally Determined Contributions (INDCs) outlining its target to cut emissions by 70 percent by 2030. The INDCs, now called Nationally Determined Contributions (NDCs) spells out the country's strategy for adaptation and mitigation by pursuing low-carbon development and cutting emissions in energy, transport, forestry, agriculture, industry and waste sectors. Key to achieving this goal is limiting the emission of carbon dioxide and the six green-house gases (GHG), which are released by burning fossil fuels and these gases trap heat in the Earth's atmosphere. The Philippine Climate Change Commission (CCC) highlights the important role of the local government units, as partners in achieving the country's goal to cut carbon emissions through a transparent GHG inventory and reporting mechanism.[14]

As stated under the Climate Change Act of 2012 (RA 10174), the Philippine Government is mandated to strengthen, integrate, consolidate, and institutionalize government initiatives to achieve coordination in the implementation of plans and programs to address climate change in the context of sustainable development.

Section 14 of RA 10174 identifies concrete areas for collaboration:

- LGUs shall be the frontline agencies in the formulation, planning, and implementation of climate change action plans.
- Barangay shall be directly involved with municipal and city governments in prioritizing climate change issues and in identifying and implementing best practices and other solutions.
- Municipal and city governments shall consider climate change adaptation, as one of their regular functions.
- LGUs shall regularly update their respective action plans to reflect changing social, economic and environmental conditions and emerging issues.

The law further annotates on specific roles and support for implementation:

- It shall be the responsibility of the national government to extend financial and technical assistance to LGUs for the accomplishment of their Local Climate Change Action Plans.

13 Climate Change 2017. Philippine GHG Inventory and Reporting Protocol:
Commission. Downloaded at https://climate.gov.ph/files/GHG-Manual-for-Business-2017.pdf
14 Ibid

- The LGU is hereby expressly authorized to appropriate and use the amount from its Internal Revenue Allotment necessary to implement said local plan effectively, any provision in the Local Government Code to the contrary notwithstanding.

Memorandum Circular NO. 2014-135 is a Guideline for the Formulation of the LCCAP as set forth by the Department of Interior and Local Government. The memo lays down the steps for LGUs to identify mitigation options to help reduce carbon footprints and contribute to efforts in addressing climate change.

The development of a greenhouse gas inventory supports better planning for mitigation options by the LGUs. To build the capacity of the LGUs in undertaking GHGI, the Climate Change Commission supports GHGI efforts of the LGUs through coordination, monitoring and evaluating programs; and overall action plans of the government relating to climate change.

A User's Manual on GHGI has been published and provides step-by-step guidance to the LGUs to quantify and manage information data related to the development of their community-level GHG inventories. The User's Manual also comes with a GHG Inventory Quantification Support Spreadsheet. Collectively, the spreadsheet and the manual provide concrete support to facilitate and institutionalize the process of planning, collecting and managing data, quantifying and reporting of an LGUs community-wide GHG emissions.

The scope of the GHG inventory, which Davao City is also using includes the following categories of emission sources:

1. Stationary Combustion from commercial and residential buildings
2. Mobile Combustion
3. Purchased electricity (commercial buildings, residential buildings, others I.e. streetlights
4. Solid Waste in Landfills
5. Wastewater Treatment and Discharge
6. Agriculture (crops and livestock)
7. Forestry
8. Industrial Processes and Products Use for Selected industries

IV. Institutional Arrangements for GHGI

Davao City's GHG Inventory went through the process of planning and design, implementation, checking and reporting.

1. Local Chief Executive's commitment to GHG policy
   - May 15, 2018, kick-off meeting for the preparation of the Davao City Local Climate Change Action Plan (LCCAP)
   - November 28, 2017, MOU signed between the City of Kitakyushu, Japan, and Davao City LGU, establishing Green Sister City Cooperation which promote and expand effective, mutually beneficial cooperation for the development of the two cities such as low carbon society, resource recycling, capacity building for the officials of each city and other fields of cooperation as mutually agreed upon by the both parties.
2. Formation of the GHG management team
   - Executive Order No. 40 series of 2018 created a Technical Working Group (TWG) to facilitate in the preparation of the Local Climate Change Action Plan of Davao City, specifically on greenhouse gas inventory, and identification of mitigation and adaptation options.
3. Established GHG data collection, quality management, and assigned roles and functions
   - TWG Team headed by the City Planning Development Officer went through training preparations in GHGI quantification with the Climate Change Commission and Ateneo de Davao University. The team participated in a 3 day training workshop on GHG Inventory facilitated by the Climate Change Commission, in May 2019.
4. Actual GHGI data collection, calculating emissions, data quality management headed by the TWG, coordinated by the City Planning and Development Office
5. A 2-day preliminary LCCAP workshop was held on January 30-31, 2020 to present initial findings of GHGI and solicit greater stakeholder participation in the identification of community-specific mitigation and adaptation options.
6. Quality Management process to assess/check data collection, quantification and reporting process
7. Review of GHGI Inventory results by the members of the TWG and added improvements
8. Preliminary Greenhouse Gas Inventory Report, outlining lessons and challenges and initial mitigation options. The report and the learnings will be used as a benchmark in improving succeeding GHGI reporting.

V. Tools for GHGI Development

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines) were developed at the invitation of the United Nations Framework Convention on Climate Change (UNFCCC) to update the Revised 1996 Guidelines and associated good practice guidance which provide internationally agreed methodologies intended for use by countries to estimate greenhouse gas inventories to report to the UNFCCC. The IPCC 2006 Guidelines provide an introduction to the 2006 Guidelines for a broad range of users, including countries and inventory compilers setting out to prepare inventory estimates for the first time.[15]

The Memorandum Circular No. 2014-135 or the Guidelines for the Formulation of the LCCAP, provides support to LGUs in reducing its GHG emissions. The rules governing the conduct of GHG Inventories are voluntary and dependent on the choices made by the LGUs but are anchored in internationally recognized standards and protocols on community-level GHG accounting. The main reference document for the conduct of this type of inventory is the IPCC Guidelines for National GHG Inventories. In some cases, the Global Protocol for Community-Scale GHG Emissions (GPC) is also used. The IPCC Guidelines and the GPC have provided good practice approaches in ensuring the quality of the GHG inventory report. The IPCC has identified the principles of relevance, completeness, consistency, transparency, accuracy, and measurability as indicators in the conduct of the inventory.

Davao City LGU made use of the IPCC 2006 quantification as a reference in computing for the standard GHG emissions and default values:

Activity data (A) is any data that pertains to the magnitude of human activity resulting to GHG emissions such as the volume of fuel (measured in Liters), weight of fuel (measured in kilogram units), amount of electricity usage (measured in kilowatt-hour) or distances traveled (measured in kilometers), etc.

Emission factor (EF) is the average emission rate of a given GHG for a given source, relative to units of activity — expressed as ratios, for example, 2.68 kg of CO2 per Liter of diesel.

Activity data were secured from secondary and primary sources and published local or national databases. Emission Factor values were based on IPCC 2006 values and adapted as reference under the Philippine GHG Inventory User's Manual.

15 IPCC Guidelines 2006, https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

VI. Greenhouse Gas Inventory Report[16]

The overall method of the Davao City's Greenhouse Gas Inventory made reference to the steps and processes recommended by the Climate Change Commission in conducting GHGI and from the International Panel for Climate Change Guidelines for National GHGI 2006.

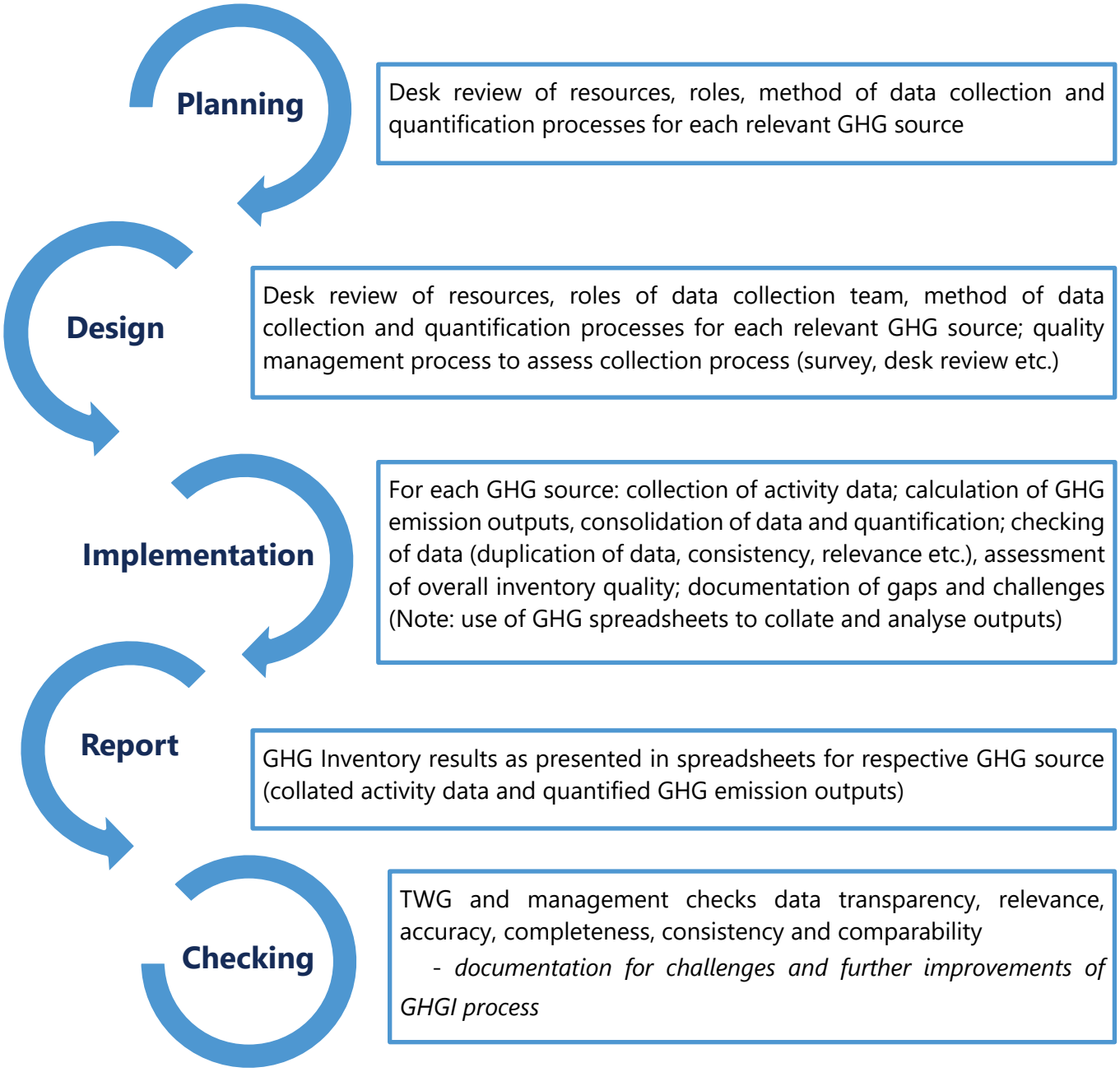


Figure 3: Davao City GHGI Overall Process Flow and Methodology [17]

16 Note: Tabulated results and analysis extracted from the Davao City Greenhouse Gas Inventory Results, 2017
17 With reference from the GHGI User's Manual, Climate Change Commission

1. Stationary Combustion

Combustion of fuels in stationary (non-transport) combustion sources results in the following greenhouse gas (GHG) emissions: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Sources of emissions from stationary combustion include boilers, heaters, furnaces, kilns, ovens, flares, thermal oxidizers, dryers, and any other equipment or machinery that combusts carbon bearing fuels or waste stream materials.[18]

In Davao City's GHG Inventory, stationary combustion fuels are those used by residential and commercial sectors for cooking, lighting, heating and cooling within the geopolitical boundaries of the LGU.[19]

Based on the GHG Inventory for 2017, results showed that the residential stationary combustion has a total of 534,040.8 tonnes CO_2e; emission sources are mainly from wood (77.65%) and charcoal (20.89%). In parallel, GHG inventory in the commercial stationary combustion reported that a significant amount of GHG emissions comes from cooking rather than for power generation, and that 91.24% of GHG Emissions at 72524.06 tonnes CO_2e is attributed to the use of charcoal or biomass for cooking.

A. Quantification of Residential Stationary Combustion

Methodology

1. The TWG reviewed possible primary and secondary sources of data from the City Planning and Development Office, Philippine Statistics Office and others.
2. The most recent data came from the Participatory Rural Appraisal Report in 2015. The TWG analysed and used this baseline to come up with the most relevant information which can be used in the quantification of GHG emissions from the residential stationary combustion fuels. In order to be as accurate as possible, ratio and proportion of households were computed using the information on the different cooking facilities such as firewood, kerosene, LPG and charcoal from the PRA 2015 results. Assumptions were used to be able to compute the projected values: each household uses 3.5 kg of firewood in a day (43 kg/year), 100 liters of kerosene per year, 2 tanks (weigh:11 kgs/tank) of LPG per year; 2 kgs of charcoal per day (24 kg/year). And also based on the growing trend among rural and urban household in terms of fuel usage: *more households in far-flung barangays are using wood, charcoal, and kerosene for cooking, due to availability of wood; high usage of kerosene for cooking is particularly higher in far-flung areas due to lack of electricity, high rates /fluctuating prices of LPG and electricity, accessibility and affordability of kerosene in many far-flung areas of the City*.

18 https://www.epa.gov/sites/production/files/2016-03/documents/stationaryemissions_3_2016.pdf
19 Climate Change Commission GHGI User's Manual

3. The TWG data collection team prepared the summary of the projected data based on the suggestions format of GHG Datasheet 3.1. List of Households included in the inventory per in 11 administrative districts of Davao City.[20] The data on household use of electricity from the PRA 2015 was not included in the computation since a much more recent and accurate data was provided by the Davao Light and Power Company.

Activity Data

Using Data Sheet 5.1, the information on fuel comsumption of the residential sector was collated; data was disaggregated according to types of fuel for cooking such as firewood, kerosene, LPG, and charcoal.

- Based on 2015 PSA Census, 2017 total population was projected at 1,708,972 and the household population at 427,42 multiplied to the annual consumption of firewood, kerosene, LPG, and charcoal [see Table 2].
- Annual residential stationary combustion of 11 administrative districts in Davao City revealed that the most prominent cooking practices in the households are (1) firewood (2) charcoal, (3) LPG and (4) Kerosene. According to the report, the use of firewood is most common among rural or far-flung households in Davao City.
- PRA 2015 trend: more households in far-flung barangays are using wood, charcoal, and kerosene for cooking, due to availability of wood; high usage of kerosene for cooking is particularly higher in far-flung areas due to lack of electricity, high rates /fluctuating prices of LPG and electricity, accessibility and affordability of kerosene in many far-flung areas of the City.

20 GHG User's Manual , p. 20

Table 4. Types of Household Cooking Facilities in the Administrative Districts of Davao City

District	Projected Population 2017	Estimated Number of Households 2017	Cooking Facility of Households				
			Firewood	Kerosene Stove	LPG Stove	Electric Stove	Charcoal
Poblacion	182,223	45,556	7,289	4,556	23,233	1,367	9,111
Talomo	438,093	109,523	31,762	9,857	53,666	3,286	10,952
Agdao	107,025	26,756	4,013	4,013	12,040	803	5,886
Buhangin	306,756	76,689	15,338	2,301	46,780	3,068	9,203
Bunawan	159,179	39,795	17,908	5,571	11,540	1,592	3,184
Paquibato	46,846	11,711	11,243	117	117		234
Baguio	35,449	8,862	7,444	177	1,152	89	No data
Calinan	96,359	24,090	20,476	482	2,650	241	241
Marilog	54,630	13,657	13,009	98	470	34	46
Toril	155,433	38,858	21,372	2,720	10,880	777	3,109
Tugbok	126,980	31,745	21,456	851	6838	613	1,987
TOTAL	**1,708,973**	**427,242**	**171,310**	**30,743**	**169,366**	**11,870**	**43,953**

Source: CPDO, Participatory Rural Appraisal 2015

Table 5. Annual household consumption according to Emission Sources for Residential Sector, 2017

Types of Fuel	Annual Volume of Emission	Unit
Wood or Wood Waste (Biomass, International)	218,848,525	kg
Kerosene (International)	3,074,300	l
Propane or Liquified Petroleum Gases (International)	5,589,078.00	kg
Charcoal (Biomass, International)	32,085,690.00	kg

Emission Factor

Using the spreadsheet in quantifying GHG emissions, the disaggregated activity data was quantified according to emission sources and annual volume measured in liters and kilograms. The emissions factors used to determine the total CO_2 Emissions (tonnes CO_2) were based on IPCC 2006 GHGI guidelines.

Table 6. Total Greenhouse Gas Emissions in the Residential Sector, 2017

Fuel Type	Quantity	Units	CO_2 Emission Factor	Units	CO_2 Emissions (tonnes CO_2)	CH_4 Emission Factor	Units	CH_4 Emissions (tonnes CH_4)	N_2O Emission Factor	Units	N_2O Emissions (tonnes N_2O)	GHG Emissions (tonnes CO_2e)	Proportion of Emissions
Wood or Wood Waste (Biomass, International)	218848525.0	kg	1.75E+00	kg/kg	382372.14	4.68E-03	kg/kg	1.02E+03	6.24E-05	kg/kg	1.37+01	414,668.93	77.65%
Kerosene (International)	3074300.0	l	2.52E+00	kg/L	7745.32	3.50E-04	kg/L	1.08E+00	2.10E-05	kg/L	6.46-02	7,792.61	1.46%
Propane or Liquified Petroleum Gases (International)	5589078.0	kg	2.98E-03	kg/kg	16.68	2.37E-07	kg/kg	1.32E+03	4.73E-09	kg/kg	2.64-05	16.73	0.00%
Charcoal (Biomass, International)	32085690.0	kg	3.30E+00	kg/kg	106011.12	5.90E-03	kg/kg	1.89E+02	2.95E-05	kg/kg	9.47-01	111,562.51	20.89%

Source: GHGI 2017, Davao City

B. Commercial Stationary Combustion

Methodology

1. The lack of an updated secondary data and reports on types on the amount of fuel consumption among commercial establishments in Davao City prompted for the conduct of an actual survey. The sampling was conducted in two categories — a list of Major Food Chains in Davao City and a list of kitchenettes and eateries, hotels and restaurants registered in Davao City from the Local Business Bureau.
2. To find out about the weekly average consumption of LPG and Coal for cooking and fuel for generators among commercial establishments in Davao City, the team led by the CPDO-Research and Statistics Department interviewed 7 Major Food Chains and 5 kitchenettes and eateries, 5 hotels and 5 restaurants. The data gathering was conducted via phone for Major Food Chains and face-to-face interviews for kitchenettes and eateries, hotels and restaurants.
3. However, information or data on the annual consumption of diesel to run generators of the business establishments in Davao City was obtained from the Davao Light and Power Company upon request.
4. GHG Quantification: The data was further quantified to get the annual consumption of fuel usage in the commercial sector.

Table 7. Annual Volume of Fuel Consumption
among Major Food Chains, Restaurants,. Eateries and Hotels in Davao City, 2017

District of Barangay	Data Source Identifier (e.g. Business Survey Number)	Type of Data (e.g. Individual Business Surveys, National Census Averages, Other) - *please select from drop-down*	Application (e.g. cooking, lighting, generators) - please select from drop-down	Fuel Type (*please select from drop-down*)	*Annual* Total Consumption	Units (e.g. litres, kg, tonnes, m^3) - *metric only*
Davao City	Davao Light and Power Company	Other (e.g. Fuel Supplier Totals)	Generator(s)	Diesel (International)	293,518.00	l
	CPDO-RSD	Individual Business Surveys	Cooking	Propane or LPG (International)	2,062,571,536.24	kg
				Charcoal (Biomass, International)	20,858,124.00	kg

Source: GHGI 2017, Davao City

Emission factor

For Commercial Stationary Combustion, Emission Factor based on the IPCC 206 Guidelines for National Greenhouse Gas Emissions. Using Data Sheet 5.1, the data was collated according to emission sources: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and bulk GHG emissions are as follows:

Table 8. GHG Emissions in the Commercial Sector per Fuel Type

Fuel Type	Quantity	Units	CO_2 Emission Factor	Units	CO_2 Emissions (tonnes CO_2)	CH_4 Emission Factor	Units	CH_4 Emissions (tonnes CH_4)	N_2O Emission Factor	Units	N_2O Emissions (tonnes N_2O)	GHG Emissions (tonnes CO_2e)	Proportion of Emissions
Diesel (International)	293,518.0	l	2.68E+00	kg/L	785.60	3.61E-04	kg/L	1.06E-01	2.17E-05	kg/L	6.36E-03	**790.25**	0.99%
Propane or Liquified Petroleum Gases (International)	2,062,571,536.2	kg	2.98E-03	kg/kg	6156.01	2.37E-07	kg/kg	4.88E-01	4.73E-09	kg/kg	9.76E-03	**6172.26**	7.77%%
Charcoal (Biomass, International)	20,858,124.0	kg	3.30E+00	kg/kg	68915.24	5.90E-03	kg/kg	1.23E+02	2.95E-05	kg/kg	6.15E-01	**72524.06**	91.24%%

Source: GHGI 2017, Davao City

Quality control/quality assurance

In terms and quality control and quality assurance, the following protocols were implemented by the data collection team:

(1) Activity data collected were cleaned and checked for consistency/inconsistencies by the respective heads of CPDO, as members of the GHG data collection team and TWG.

(2) Data were then collated by the CPDO-Project and Evaluation Department for another round of checking and quality assurance

(3) The spreadsheet was also checked by an external member of the GHG -TWG for fact-checking and analysis of trends and consistencies. TWG member, Dr. Doris Montecastro from the Ateneo de Davao University provided technical support in reviewing the initial results.

Uncertainty assessment

Data may be under-reported:

- Data collected from the Local Business Bureau in 2017 lack disaggregated information on the nature of business per establishment and were only categorized as manufacturing and industry.
- The sampling frame for food businesses was not stratified into subcategories e.g. Food distributor of major food chains and commissaries. Some major food chains included in the sampling did not do actual food preparation and cooking in their premises.

Further improvements

- Further improvement in the collection of data by identifying the nature of business for the list of establishments in Davao City from the Business Bureau.
- To get the exact amount of consumption on fuel types by the major food chains, stratified random sampling needs to be used in identifying list of samples; as consumption of major food chains varies, not all establishments do cooking and food preparation on-site — major food chain business such as KFC, Jollibee and McDonalds are catered by food commissaries[21] or, strategically located per area of business, or region. Hence, to get a good representative of the consumption of establishments in terms of LPG and coal, further refinements on the sampling technique will have to be applied in the next round of data collection.
- In collecting data for the residential stationary combustion, household survey and profiling on types of fuel usage need to be done at the barangay level to get a more accurate value and representation (i.e. rural vs. Urban households).

21 A **commissary** is a licensed or permitted **food** service establishment that provides required services to a mobile **food** dispensing vehicle (MFDV). ... A **commissary** provides the necessary support for the MFDV to operate in a safe and sanitary manner

2. Mobile combustion

Greenhouse gas (GHG) emissions are produced by mobile sources as fuels are burned. Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are emitted directly through the combustion of fuels in different types of mobile equipment.

GHG Inventory for mobile combustion in Davao City accounted for 1,405,481.84 tonnes CO_2e. Of the total volume of emissions, 67.25% comes from the on-road diesel and gasoline fuel at 32%.

Methodology

The only available data on mobile combustion is based on the historical demand of petroleum products in Region XI (2017), secured from the Department of Energy, Mindanao Field Office.

A meta analysis and assumptions were made to extract the annual fuel consumption of Davao City based on the reported Regional historical demand of petroleum products namely gasoline, diesel and fuel oil in Region XI in 2017.

- PSA reports that 69.5%[22] of the total revenue of Davao City in 2017 is attributed to Davao City's economic activities.
- Since fuel sales are also an indicator of Davao City's income, the annual fuel consumption of Davao City were disaggregated from the total region XI demand for petroleum products (i.e. gasoline, diesel and fuel oil) using the 69.5% baseline (See Box 1).

Activity data

The annual consumption per litre computation:
Gasoline projected demand 2017 (2424.34 MB) x 0.1172 metric tons gasoline x 69.5% (0.695) Davao City share x 1000 = 197,472,190.36 kg/liter

The conversion of data from thousand barrel liters is based on the following unit weight and measurement:[23]

a. 1 barrel of Gasoline is equal to .1172 metric tons.
b. 1 barrel of Diesel is equal to .1341 metric tons.
c. 1 barrel of Fuel Oil is equal to .1364 metric tons.
d. 1 metric ton is equivalent to 1000 liters.

The same equation was used to get the annual fuel consumption of diesel and fuel oil.

22 PSA 2017. Downloaded at http://rsso11.psa.gov.ph/sites/default/files/attachments/2017%20RSET%20Davao%20Region.pdf

23 Note: The data based on historical demand of fuel is based on Davao Region. To account the Davao consumption only; 69.5% of the total consumption is accounted to Davao City based on the Davao City's percentage revenue of the total revenue of Region XI. Thus, conversion of data is done in a mathematical approach (Source: extension.iastate.edu)

Box 1: Annual Fuel Consumption derived from the Region XI Historical Demand of Petroleum Products and 69.% revenue income of Davao City

	GASOLINE	DIESEL	FUEL OIL
	2424.34	3789. 26	159.65
1000			
	Source: PSA baseline 2017		
	1. Davao City is the largest revenue earner with a 69.5%		
	Share of total revenue generated in the region.		
Note:	1 bbl = .1172 metric tons (Gasoline)	1mt =	1,000 L = 1,000kg
	1bbl= .1341 metric tons (Diesel)		
	1bbl= .1364 metric tons (Fuel Oil)		
	197,472,190.36	kg/l	
	353,157,137.37	kg/l	
	15,134,500.70	kg/l	
	Conversion of Thousand Barrels into Barrel is multiplied by the number		

Emission factor

In computing for GHG, Emission Factors are based on recommended EF for carbon dioxide, methane and nitrous oxide by IPCC 2006 and as adapted by Climate Change Commission GHG Manual. Only emissions from carbon dioxide were factored in.

Table 9. GHG Emissions from the Commercial Stationary Combustion by fuel type

Fuel Type (if only Fuel Type and Amount is Available)	CO_2 Emission Factor	Units	CO_2 Emissions (tonnes CO_2)	GHG Emissions (tonnes CO_2e) %	Proportion of Emissions
Gasoline/Petrol	2.272	kg CO2 / liter	**448567.27**	**448567.27**	31.92%
On-Road Diesel Fuel	2.676	kg CO2 / liter	**945164.45**	**945164.45**	67.25%
Residual Fuel Oil (3s 5 and 6)	2.939	kg CO2 / liter	**11750.00**	**11750.00**	0.84%

Source: GHGI 2017, Davao City

Quality control/quality assurance

To ensure quality data the following consideration were put in placed:

- Assumed that all vehicles operating within the LGU frequented the fuel service providers listed in the collected data;
- Subtracted diesel consumption for stationary combustion (e.g. for back-up generators) from the total fuel sales data provided by the fuel suppliers; since these fuel suppliers also serviced residential and commercial customers for stationary sources; and
- Assumed that vehicles registered within the LGU are not frequently purchasing fuel from suppliers operating outside of the LGU.

Uncertainty assessment

- Disaggregation of Davao City's petroleum consumption for 2017 from the aggregate Regional demand using the baseline of 69.5% revenue earnings might have generated underreporting or bloating of the actual figure.
- Residual fuel: not specified in the GHG manual. The team relied on the google definition of the words "residual fuel" which is translated as fuel oil

Further improvements

- There is a need to design an activity data that would capture disaggregated yearly consumption of petroleum for Davao City only;
- The collection of data on distance traveled is the most appropriate measurement to compute mobile combustion. But it is challenging to identify which vehicles are plying within Davao City boundaries with porous entrance and exits from Davao to other local government unit areas. As Davao is the center of trade in the Mindanao region, vehicles from other LGUs visit Davao daily. There are uncertainties in the reliability of registered private vehicles in Davao since there are vehicles that are registered in Davao City but not owned by Davao City residents;
- Emissions from public vehicles such as buses plying within and around city limits are easier to calculate compared to private vehicles; and
- Calculating GHG based on Fuel sales of petrol stations/business is reliable and also a preferred method for the team.

3. Electricity consumption

According to the Davao Light and Power Company, demand for energy supply in Davao City has been increasing in the last 3 years. About 60-70% of the demand comes from the Commercial and Industrial sector.

Table 10. Monthly Electricity Consumption of Davao City per sector from 2016 to 2018

Type of Consumers	2016 monthly			2017 monthly consumption			2018 monthly		
	No. of Connections	kWh	%	No. of Connections	kWh	%	No. of Connections	kWh	%
Residential	257,319	50,442,484	31.38	270,736	51,229,136	30.16	285,790	55,258,306	30.32
Commercial	39,147	18,093,647	11.25	41,542	18,453,924	10.86	43,343	19,523,096	10.71
Industrial	3,671	89,396,834	55.61	3,065	97,341,303	57.30	4,239	104,537,266	57.31
Other: Street Lights	80	2,833,565	1,76	85	2,851,467	1,68	81	2,903,979	1.59
Total	**300,217**	**160,766,530**	**56**	**315,428**	**169,875,830**	**100**	**333,453**	**182,222,646**	**98**

Source: Davao Light and Power Company

Note: • Type of consumers are based on the total appliance load upon application.

- Lower than 20 kW that are not residential are classified under commercial.
- Larger than 20 kW are classified as industrial.

• % = (kW per type of consumer/Total kW) x 100

Davao City GHG Emissions for Electricity Consumption is about 616,999.5 tonnes CO_2e. The bulk of the emissions comes from the commercial and industry sector (55%) followed by the residential sector (24%) and boilers(19.27%) and streetlights (1.4%)

Methodology

Electricity Consumption refers to electricity consumed within the geopolitical boundaries of the Davao City LGU.

Data on total community electricity consumption were secured from the Davao Light Power Company (sole electricity provider of Davao City). While, additional data about establishment using boilers were secured from the City Engineer's Office on the assumption that it is kept running for 24 hours and 7 days a week.

Activity data

Emissions were categorized into residential, commercial and industrial, and others which refer to street lights. The annual consumption of electricity based on types of sectors where secured from the DLPC (Davao Light Power Company).

The team also considered the energy mixed sourcing in generating electricity for Mindanao which is 40% coal and 60% hydro energy.

Calculated as: 51,229.136 monthly consumption of electricity among residents multiplied by 12 months and multiplied by 0.40 coal energy-powered grid to get the annual residential electricity consumption.

Of the total annual electricity consumption in 2017, 40% of the total consumption from coal was used in the calculation.

Table 11. Residential Annual Electricity Consumption, Davao City 2017

Residential Electricity Consumption - Community (kWh)					
District or Barangay *- please select from drop-down*	Data Source Identifier (e.g. Residential Survey Number or Utility Name and Source Identfier)	Data Type – (e.g. Individual Household Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh) - enter "N/A" if electricity data is estimated	Units (e.g. kWh/household)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)
Davao City	Davao Light and Power Company	Electricity Utilities Provider	245,899,852.80	kWh	Only 40% of the total consumption were calculated since it is coming from the coal power plant and diesel power plant. The other 60% of the total consumption were supplied by the hydro electric power.

Source: GHGI 2017, Davao City

Table 12. Commercial Annual Electricity Consumption, Davao City 2017

District or Barangay *- please select from drop-down*	Data Source Identifier (e.g. Commercial Survey Number or Utility Name and Source Identfier)	Data Type - (e.g. Individual Business Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh) - coal, diesel and hydro power	Estimated Annual Consumption for Emissions Source - 40% coal and diesel generated source	Units (e.g. kWh)
Davao City	Davao Light and Power Company - Commercial and Industrial	Electricity Utilities Provider	1,389,543,000.00	555,817,090	kWH

Source: GHGI 2017, Davao City

Table 13. Annual Electricity Consumption from Streetlights, Davao City 2017

District or Barangay *- please select from drop-down*	Data Source Identifier (e.g. Streetlights, MRT line, Utility Name and Source Identfier)	Data Type - (e.g. Individual Business Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh) mixed source - coal, diesel, hydro power	Estimated Annual Consumption for Emissions Source- 40% coal and diesel	Units (e.g. kWh/ household)
Davao City	DLPC - Streetlights	Electricity Utilities Provider	34,217,605	13,687,042	kWh
Davao City	City Engineer's Office	Business Surveys	488,231645	195,292,658	kWh

Source: GHGI 2017, Davao City

Emission factor

Philippines (National default) Emission Factor was used in quantifying GHG Emissions.

For electricity, Davao City's total GHG emissions are at 616,999.5 tonnes CO_2e. The bulk of the emissions comes from the commercial and industry sector (55%) followed by the residential sector (24%), boilers (19%) and public streetlights (20%).

Table 14. GHG Emissions from Electricity Consumption per sectors, Davao City

	Quantity kWh	CO_2 Emission Factor	CO_2 Emissions (tonnes CO_2)	CH_4 Emission Factor	CH4 Emissions (tonnes CH_4)	N_2O Emission Factor	N_2O Emissions (tonnes N_2O)	Total GHG Emissions in District/Barangay (tonnes CO_2e)	Proportion of Emissions
Residential	245,899,853	0.609 kg GHG/kWh	149728.4	9.36E-06	2.30	7.13E-06	1.75	150,257.2	24.35
Commercial/ Industrial	555,817,090	0.609 kg GHG/kWh	338437	9.36E-06	5.20	1.50E+05	3.96	338,965.8	54.93
Others: streetlights (DLPC	13,687042	0.609 kg GHG/kWh	8334.0	9.26E-06	0.13	7.13E-06	0.10	8,862.8	1.46
Others: City Engineers	195,292,658		118913.7	9.26E-06	1.83	7.13E-06	1.39	118,913.7	19.27
								616,999.5	1

Source: GHGI 2017, Davao City

Quality control/quality assurance

TWG recommended the disaggregation of the electricity consumption for Mindanao into coal and diesel and hydro upon review. The team revised the activity data and segregated the 2017 electricity consumption accordingly.

Uncertainty assessment

Not evaluated

Further improvements

Comprehensive data needs to be collected for off-the-grid areas in Davao City including types of fuel used for lighting.

4. Agriculture

Agriculture is the backbone of the social economy. It provides sufficient food and livelihood for billions of people around the world. Despite its importance in people's general welfare, food production processes has significant impacts on the environment through deforestation and water pollution. It's also a major contributor of greenhouse gas emissions. As countries work to cut their emissions overall, agricultural emissions need to also cut back.[24]

Agriculture is a major contributor to global emissions of the greenhouse gases (GHGs) that drive climate change. The international community has adopted a goal to restrict global warming to 2oC above pre-industrial levels 2. Temperature rise above 2oC will produce increasingly unpredictable and dangerous impacts for people and ecosystems, but particularly for agricultural systems. Impacts on the agricultural sector that are already occurring but expected to intensify include increased irrigation water needs, increased spread of animal and crop diseases and pests, reduced forage quality, and reduced crop and pasture yields.[25] These impacts stem from changes in surface temperatures, the timing of seasons, and in the frequency and severity of severe weather events, such as droughts, floods, and heatwaves.[26]

Achieving the 2oC goal will require drastic reductions in GHG emissions. The agricultural sector plays an important role in reduction climate change impacts. A wide range of agricultural activities emit GHGsdirectly contributed about 11%3 of total global anthropogenic emissions in 2010, and roughly 60% of all nitrous oxide (N2O) emissions and 50% of all methane (CH4) emissions in 2007.[27] Land use change (LUC), caused by the conversion of native habitats to farmland, contributes a comparable amount of emissions.[28] Finally, the production of agricultural inputs and various downstream activities, such as the processing and transport of agricultural products, contributes a further 3 - 6 % of global emissions.[29]

Davao City's main economic driver is agriculture, hence, mitigation measures need to account for the GHG emissions of the sector, at the same time steer the city's economic development sustainably.

As an effort to initiate the first the GHGI in Davao City, the GHG-TWG started with the inventory of emissions from agriculture through quantifying rice production emissions in various cultivation practices. As reported, GHGI emissions output in the agricultural sector reached 12,847.8 tonnes of CO_2e. Of the total proportion of emissions, about 65.6% were from cultivating irrigated rice during the wet season; while less than half of the emissions were from cultivating rainfed rice in the wet season (31.5%). While rice cultivation using rainfed rice during the dry season is at 20% of the overall emissions. Emissions from crop residues were minimal at 2.7%.

The GHGI emissions from livestock production is much higher than emissions from crop or rice

24 World Resources Institute. Downloaded at https://www.wri.org/blog/2019/07/5-questions-about-agricultural-emissions-answered
25 Easterling et al., 2007. Cited in GHG Protocol Agricultural Guidance
26 GHG Protocol Agricultural Guidance. Downloaded at https://ghgprotocol.org/sites/default/files/standards/GHG%20Protocol%20Agricultural%20Guidance%20%28April%2026%29_0.pdf
27 Smith et al., 2007a. Cited in GHG Protocol Agricultural Guidance
28 Houghton, 2012. Cited in GHG Protocol Agricultural Guidance
29 Vermuelen et al., 2012. Cited in GHG Protocol Agricultural Guidance

production at 305,171.5 tonnes of CO_2e. Of the total proportion, the highest recorded emissions are from swine production (32%), followed by buffalo (24.4%), cattle (20.8%), and poultry (19.3%). Emissions from goat raising are lowest at 3.7%.

Methodology

The members of the research team secured secondary data from the City Agriculturist Office such as total hectares under agricultural crop/rice production, including growing season and irrigation practices, and livestock headcounts of farms inside the LGU's geopolitical boundaries. This data also includes the land area designated to each crop-type and corresponding irrigation practice and growing season (e.g. rice, dry season, irrigated), and livestock headcounts for the LGU by animal type.

Headcount (livestock) refers to the average population in a given year based on the census of animals conducted by the City Veterinarian's Office.

Activity data

GHG emissions were calculated using the latest crop data and livestock from the City Agriculturist's Office.

Table 15. Annual Rice Production based on method of cultivation, Davao City 2017

District or Barangay	Data Source Identifier	Type of Data	Application (Crops)	Total Hectares Under Production (hectares, ha)
Davao City	City Agri Office	Data from Government Agricultural Agency	Rice (Wet Season, Irrigated)	923
Davao City	City Agri Office	Data from Government Agricultural Agency	Rice (Wet Season, Rainfed)	1039
Davao City	City Agri Office	Data from Government Agricultural Agency	Rice (Dry Season, Rainfed)	22
Davao City	City Agri Office	Data from Government Agricultural Agency	Crop Residues (tonnes of dry weight)	6845

Source: GHGI 2017, Davao City

Table 16. Total number of livestocks based on 2017 headcount, Davao City

District or Barangay	Data Source Identifier	Type of Data	Application (Livestocks)	headcount
Davao City	City Vet Office	Data from Government Agricultural Agency	Buffalo	38642
Davao City	City Vet Office	Data from Government Agricultural Agency	Cattle	36318
Davao City	City Vet Office	Data from Government Agricultural Agency	Swine	229854
Davao City	City Vet Office	Data from Government Agricultural Agency	Goat	46867
Davao City	City Vet Office	Data from Government Agricultural Agency	Poultry	6905140

Source: GHGI 2017, Davao City

Emission factor

Emission Factor and quantified results are as follows:

Table 17. GHG Emission from Rice Production as per types cultivation, Davao City

	CH_4 Emission Factor	Units	CH_4 Emissions (tonnes CH_4)	N_2O Emission Factor	Units	N_2O Emissions (tonnes N_2O)	GHG Emissions (tonnes CO_2e)	Proportion of Emissions
Rice (Wet Season, Irrigated)	326.0	kg GHG/ hectare	300.93	0.00	kg GHG/ hectare		8426.1	65.6%
Rice (Wet Season, Rainfed)	139.0	kg GHG/ hectare	144.00	0.00	kg GHG/ hectare		4045.3	31.5%
Rice (Dry Season, Rainfed)	52.0	kg GHG/ hectare	1.13	0.00	kg GHG/ hectare		31.7	20.0%
Crop Residues (tonnes of dry weight)	0.0	kg GHG/ ton	-	0.19	kg GHG/ton	1.30	344.6	2.7%

Source: GHGI 2017, Davao City

Table 18. GHG Emissions from Livestock Production, Davao City

		CH_4 Emission Factor	Units	CH_4 Emissions (tonnes CH_4)	N_2O Emission Factor	Units	N_2O Emissions (tonnes N_2O)	GHG Emissions (tonnes CO_2e)	Proportion of Emissions
Buffalo	38642	57.0	kg GHG /head	2,202.59	1.25	Kg GHG /head	48.30	74,472.80	24.4%
Cattle	36318	48.0	kg GHG /head	1,1743.26	1.47	Kg GHG /head	53.39	62,959.10	20.8%
Swine	229854	8.0	kg GHG /head	1,838.83	0.76	Kg GHG /head	174.69	97,779.90	32.0%
Goat	46867	5.2	kg GHG /head	244.65	0.35	Kg GHG /head	16.40	11,197.00	3.7%
Poultry	6905140	0.0	kg GHG /head	138.10	0.03	Kg GHG /head	207.15	58,762.70	19.3%

Source: GHGI 2017, Davao City

For crops, 12,847.8 tonnes of **CO_2e** were released to the environment. Of the total proportion of emissions, about 65.6% were from cultivating irrigated rice during the wet season. While less than half of the emissions were from cultivating rainfed rice in the wet season (31.5%) and as well as rainfed rice during the dry season (20%). Emissions from crop residues were minimal at 2.7%.

For livestock, about 305,171.5 tonnes of CO_2e of GHG Emissions were recorded. Of the total proportion, the highest recorded emissions are from swine production (32%), buffalo (24.4%), cattle (20.8%), poultry (19.3%). Emissions from goat raising are lowest at 3.7%.

Quality control/quality assurance

The data obtained from the City Agriculturist's Office were rigorously researched and checked by the concerned team.

Uncertainty assessment

Not evaluated by the TWG.

Further improvements

Comprehensive data on other major crops, backyard aquaculture farms and land-use changes or conversion will need to be factored in.

5. Solid waste

According to the report on Waste Analysis and Characterization Study (WACS), Davao City generates 900 tons per day making it the biggest waste generator in Davao Region. Every person in the city contributes half a kilogram of garbage waste per day.

Out of 182 barangays in the city, only 112 are reached by the garbage trucks of the City Environment and Natural Resources Office (Cenro).[30] The research also revealed that 50% of the generated garbage of the city is biodegradable or capable of being decomposed by bacteria or other living organisms. The collected garbage is deposited at the 11-hectare sanitary landfill in Tugbok District. The city also processes biodegradable waste through composting in its facility. The composting facility can process five tons of biodegradable wastes one. Materials recovery facilities for recyclable waste are also set up in 14 barangays,[31] although a few are fully functional.

Methodology

In Davao City, solid waste refers to municipal solid waste ("MSW") generated within the LGU's geopolitical boundaries and that may cause GHG emissions inside the LGU's geopolitical boundaries

Emissions from waste facilities were calculated using the ICLEI-based waste quantification methodology.

The team obtained secondary data from the Davao City Environmental and Natural Resources Office. The data was based on CENRO's latest Waste Characterization Study in Davao City.

Activity data

Solid waste analysis of data based on ICLEI method are as follows:

a.) General solid waste data in sanitary landfill:

In calculating GHG values for a specific type of solid waste management in Davao City, IPCC 2006 classification was referred to RA 9003 classification which most LGUs are familiar with[32] — sanitary landfills are classified as anaerobic, managed; while open dumpsites are labeled as unmanaged, deep type.

[30] Hidalgo: Garbage disposal, a problem. https://www.sunstar.com.ph/article/1786149
[31] Ecological Profile of Davao City
[32] GHGI Manila page 33

Table 19. Volume of Collected and Uncollected Waste Per Capita based on IPCC Classification, Davao City

Data Source Identifier	District/ Barangay	Total Population of District/ Barangay	Waste Per Capita (If Estimating Total Solid Waste)--	Total Solid Waste for District/ Barangay (Estimate)	Total Solid Waste	Fraction of Total Solid Waste Disposed in Solid Waste Disposal Sites	Amount Sent to Landfills in District/ Barangay	Fraction of Total Waste Sent to Specific Landfill Type -	Specific Landfill Type (IPCC)
		inhabitants	*Tonnes /capita /year*	*tonnes*	*tonnes*	*%*	*tonnes*	*%*	
DAVAO CITY (Collection Area)	Davao City	1,461,480	0.21	306,910.8	-	69%	211768.5	**100%**	**Managed - anaerobic**
DAVAO CITY (Non-collection Area)	Non-collection Area	246,629	0.21	51,792.1		69%	35736.5	**100%**	**Un-managed - deep**

Source: GHGI 2017, Davao City

b.) General solid waste composting data with ICLEI method:

Table 20. Total Amount of Solid Waste Composted, Davao City

Data Source Identifier	Total Population	Waste Per Capita (If Estimating Total Solid Waste)-	Total Solid Waste for District /Barangay (Estimated)	Total Solid Waste (Actual) for District/Baranga	Fraction of Total Solid Waste Sent for Composting - *default value of 10% for Philippines* -	Fraction of Total Solid Waste Sent for Anaerobic Digestion Facilities -	Fraction of Total Solid Waste Sent for Open Burning -	Fraction of Total Solid Waste Other/Unspecified -	Amount of Total Solid Waste Composted -
	inhabitants	*Tonnes /capita /year*	*tonnes*	*tonnes*	*%*	*%*	*%*		*tonnes wet weight*
CENRO	1708972	0.21	358,884.1	358,884.1	10.0%	0.0%	2.0%	3.0%	10,766.5

Source: GHGI 2017, Davao City

Table 21. Amount of Solid Waste per type of disposal, Davao City

Amount of Total Solid Waste Sent to Anaerobic Digestion Facilities	Amount of Total Solid Waste Sent for Open Burning-	Amount of Total Solid Waste Sent for Other/Unspecified
tonnes wet weight	*tonnes wet weight*	*tonnes wet weight*
0.0	7,177.7	10,766.5

Source: GHGI 2017, Davao City

Emission factor

GHG quantification using the data from CENRO was done using the ICLEI method. In calculating GHG emissions, the IPCC 2006 default values were used according to specific types of solid waste management.

GHG Emissions from the biological treatment of solid waste in Davao City is at 18,285.1 tonnes CO_2e. Out of the total emissions, 78% are N_2O released and 22% are released from methane.

Table 22. GHG Emissions from Solid Waste (ICLEI Method), Davao City

Methane Recovered (tonnes) - *enter 0 if no methane recovery used at site*	Methane Released (tonnes)	**Total CO_2 Emissions (tonnes CO_2)**	Proportion of all GHG Emissions from Biological Treatment Emissions (%)	**GHG Emissions (tonnes CO_2e)**
0.0	143.55	4019.5	22.0%	4,019.5
	N_2O Released (tonnes)	**Total CO_2 Emissions (tonnes CO_2)**	Proportion of all GHG Emissions from Biological Treatment Emissions (%)	**GHG Emissions (tonnes CO_2e)**
	53.83	14265.6	78.0%	14,265.6
Methane Recovered (tonnes) - *enter 0 if no methane recovery used at site*	Methane Released (tonnes)	**Total CO_2 Emissions (tonnes CO_2)**	Proportion of all GHG Emissions from Biological Treatment Emissions (%)	**GHG Emissions (tonnes CO_2e)**
0.0	0.00	0.0	0.0%	0.0
	N_2O Released (tonnes)	**Total CO_2 Emissions (tonnes CO_2)**	Proportion of all GHG Emissions from Biological Treatment Emissions (%)	**GHG Emissions (tonnes CO_2e)**
	0.00	0.00	0.0%	0.00
18285.1				

Source: GHGI 2017, Davao City

In terms of combusted waste by open burning, GHG calculation yielded 49.2 CO_2e.

Table 23. GHG Emission from Solid Waste by Open Burning, Davao City

Emissions Source Indicator	Total Fossil Carbon in Combusted Waste (tonnes fossil carbon in dry waste)	Default Oxidation Factor (%) - *IPCC default*	Oxidation Factor Used in Calculation *(e.g. Philippines national factor)*	Conversion of Carbon to CO_2 Factor (ratio)	Total CO_2 Emissions (tonnes CO_2)
Davao City	84.9	58.0%	58.0%	3.67	49.2
-		58.0%	58.0%	3.67	

Source: GHGI 2017, Davao City

Quality control/quality assurance

Checking of calculations was done. The CENRO data was based on the latest waste characterization study of the city.

Uncertainty assessment

Not evaluated due to lack of experience in accounting for uncertainties in this area.

Further improvements

- A more comprehensive data on solid waste is being processed. CENRO is putting together and finalizing a 7-year data/trend report on solid waste in Davao City.
- CPDO and GHG TWG will use the data to improve the reporting and quantification of GHG using the IPCC Method as well.

6. Wastewater

Wastewater as well as its sludge components can produce methane if it degrades anaerobically. The extent of methane production depends primarily on the quantity of degradable organic material in the wastewater, the temperature, and the type of treatment system. With increases in temperature, the rate of methane production increases. This is especially important in uncontrolled systems and in warm climates. Nitrous Oxide (N2O) N2O is associated with the degradation of nitrogen components in the wastewater, e.g., urea, nitrate and protein. Domestic wastewater includes human sewage mixed with other household wastewater, which can include effluent from shower drains, sink drains, washing machines, among others.[33]

Based on 2017 GHGI emissions report in Davao City, the total GHG emissions from wastewater is around 186,067 tonnes CO2e; where 99.65% is factored in as methane releases into the environment.

Methodology

Using Scope 1, wastewater generated in Davao City were collected. Secondary data on the type of wastewater management system among the residents in Davao City were provided by the City Health Office.

Activity data

Data shows that wastewater in residential areas were largely uncollected with no system of sewage and sludge treatment being done. Instead, wastewater is stored septic tanks at 86.4%, in an open pit at 10.5%, and residents with no facilities at 3.8%.

33 Greenhouse Gas Emissions From Wastewater Treatment Plants: A Case Study of Noida.
https://www.researchgate.net/publication/267554945_Greenhouse_Gas_Emissions_From_Wastewater_Treatment_Plants_A_Case_Study_of_Noida

Table 24. Mode of Wastewater treatment and disposal in Davao City, 2017

					CH_4 Emissions Potential	N_2O Emission Potential	Is the system used in the LGU?	% population using the	Population using the system
					See legend below	*See legend below*	*Yes or No*	*%*	*Number*
Uncollected	Septic tanks						Yes	86.4%	1,476,059
	Open Pits /latrines	dry climate, ground water table lower than latrine, small family (2-5 people)					Yes	10.5%	179,245
		dry climate, ground water table lower than latrine, communal					No		- 0
		wet climate/flush water use, ground water table than latrine					No		- 0
		regular sediment removal for fertilizer					No		- 0
	River Discharge	Stagnant oxigen deficientrivers and lakes					No		- 0
		Rivers, lakes and estuaries					Yes	3.8%	65,600
Collected	Untreated	River Discharg	Stagnant oxigen deficientrivers and lakes				No		- 0
			Rivers, lakes and estuaries				No		- 0
		Sewers (closed and under ground)					No		- 0
		Open Sewers					No		- 0
	Treated	Aerobic	Centralized aeribic well managed				No		- 0
			Centralized aeribic not well managed - overloaded				No		- 0
			Sludge anaerobic treatment in aerobic plant				No		- 0
			Aerobic shallow ponds				No		- 0
		Anaerobic	Anaerobic lagoons	Shallow (less than 2 m)			No		- 0
				Shallow more than 2 m)			No		- 0
			Anaerobic reactors				No		- 0
Totals								**101%**	**1,720,904**

Source: GHGI 2017, Davao City

Emission factor

GHG emissions from waste water and sewage such as methane and Nitrous Oxide were factored in using IPCC 2006 Guidelines for National Greenhouse Gas Inventories.

LGU specific data were used to calculate the LGU wastewater GHG emissions from the annual per capita protein consumption, the fraction of nitrogen in protein, factor of non-consumed protein added to wastewater, nitrogen removed from sludge, etc.

The total GHG emissions from wastewater is around 186,067 tonnes CO_2e where 99.65% are from methane.

Table 25. GHG Emissions from Residential Wastewater in Davao City, 2017

LGU	Total Emissions from CH_4 Generated (in tonnes CO_2e)	Total Emissions from N_2O (in tonnes CO_2e)	Total LGU Wastewater GHG Emissions (All Sources, tonnes CO_2e)
General wastewater default and Custom Data for own LGU	185420.4	647.1	186067.5
General wastewater default and custom data for other sources (e.g. other LGU wastewater	0.0	0.0	0.0
Total GHG emissions from Wastewater Treatment and Disposal			**186067.5**

Source: GHGI 2017, Davao City

Quality control/quality assurance

The data only covers residential wastewater in Davao City. The data were collected and updated by the City Health Office regularly, as part of their health and sanitation monitoring in all communities/barangays in Davao City.

Uncertainty assessment.

Not evaluated

Further improvements

The need for comprehensive data covering industrial and commercial wastewater treatment and discharge. The TWG team intends to work with the Environment Management Bureau of the Department of Environment and Natural Resources in this area.

Other means to collect data. There are private businesses that collect wastewater in residential and commercial areas for treatment and discharge — for a fee and the amount starts at Php 3,500 depending on the size of the septic tank.

Sampling in the next reporting may include data from these businesses. In a household of 2-5 people, septic tanks get filled up in more or less 10 years, the services of the private companies to collect the discharge are usually needed in this case.

7. Forest and land-use change

According to the United Nations Climate Change 9UNFCC), the forest has a very important role in combating climate change. As such, human activities, through land use, land-use change and forestry (LULUCF) activities, affect changes in carbon stocks between the carbon pools of the terrestrial ecosystem and between the terrestrial ecosystem and the atmosphere. Management and/or conversion of land uses (e.g. forests, croplands and grazing lands) affects sources and sinks of CO2, CH4 and N2O.[34] The role of LULUCF activities in the mitigation of climate change has long been recognized. Mitigation achieved through activities in the LULUCF sector, either by increasing the removals of GHGs from the atmosphere or by reducing emissions by sources, can be relatively cost-effective.[35]

Davao City's forest cover is only 16% of its total land area due to over exploitation causing further degradation or depletion of the city's forest resources.

Davao City GHG emissions (2017) from forest and land-use change is computed at 175,203.5 tonnes CO_2e. Whereas, GHG removal from Forestry and other sources are calculated at 1,485,732.76 tonnes CO_2e.

Methodology

The data on Forest and Land Use change were taken from the Davao City Land Use Plan report.

Activity data

Data shows that the conversion of forestland into agriculture is the most prominent source of GHG emission at 12,458 hectares.

34 UNFCC. https://unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf/land-use--land-use-change-and-forestry

35 Ibid

Table 26. Forest and Land-use changes due to man-made activities, Davao City

District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g., Others) - *please select from drop-down*	Emission Type	Emission Source (*please select from drop-down)*	*Annual* Total Consumption	Units (*please select from drop-down*)
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Fuelwood	2	cubic meters
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Charcoal	51	cubic meters
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Construction	30	cubic meters
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Changes in the Use of the Forestlands	Used for Agriculture	12,458	hectares
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Changes in the Use of the Forestlands	Left as Barren Areas	19	hectares

Source: GHGI 2017, Davao City

While GHG removal by carbon sink was also quantified: remaining brush lands account for 79,188 hectares of GHG removal source.

Table 27. Amount of carbon removed (in hectares) from the environment based on sources (carbon sink), Davao City

Forest Removal Sources						
District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g. , Others) - *please select from drop-down*	Removal Type (*please select from drop-down*)	Removal Source (*please select from drop-down)*	*Annual* Total Removal	Units (*please select from drop-down*)
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Protection Forest/ Old Growth/ Mossy/Pine/ Submarginal Mangrove	4,920	hectares
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Secondary Growth	13,651	hectares
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Brushland – for wood	79,188	hectares
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Tree Plantation – S. macrophylla	3,225	hectares
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Grassland	15,636	hectares

Source: GHGI 2017, Davao City

Emission factor

Emissions Factors for CO2 were based on the IPCC 2006 guidelines and adopted by the Philippines GHGi manual.

Total GHG emissions from the Forestry sector stands at 175,203.5 tonnes CO_2e. Whereas, GHG sinks from Forestry is calculated at 1,485,732.76 tonnes CO_2e.

Table 28. GHG Emissions from Forest and Land-use Change, Davao City 2017

District within LGU	Data Source Identifier (Sort Alphabetically)	Emission Type	Type of Data (e.g. , Other)	Emission Source	Quantity	Units	CO_2 Emission Factor	Units	CO_2 Emissions (tons CO_2)	GHG Emissions (tons CO_2e)	Proportion of Emissions
Davao City	Forest Land Use Plan	Wood and Wood Products Harvesting	Census Average	Fuelwood	2.2	cubic meters	0.74	tons CO2/ cubic meter	1.64	**1.64**	0.00%
				Charcoal	51.4	cubic meters	1.80	tons CO2/ cubic meter	92.40	**92.40**	0.05%
				Construction	29.7	cubic meters	1.10	tons CO2/ cubic meter	32.56	**32.56**	0.02%
		Changes in the Use of the Forestlands	Census Average	Used for Agriculture	12,458.4	hectares	14.03	tons CO2/ hectare	174815.29	**174815.29**	99.78 %
				Left as Barren Areas	18.6	hectares	14.03	tons CO2/ hectare	261.56	**261.56**	0.15%

Source: GHGI 2017, Davao City

Table 29. Total Forestry GHG Removal by source , Davao City 2017

District within LGU	Data Source Identifier (Sort Alphabetically)	Emission Type	Type of Data (e.g. , Other)	Emission Source	Quantity	Units	CO_2 Removal Factor	Units	CO_2 Removal (tons CO_2)	GHG Removal (tons CO_2e)	Proportion of Emissions
Davao City	Forest Land Use Plan	Remaining Forestland	Other (e.g. Fuel Supplier Totals)	Protection Forest/ Old Growth/Mossy/ Pine/Submarginal Mangrove	4,920.4	hectares	3.44	tons CO2 / hectare	16935.56	**16935.56**	1.14%
				Secondary Growth	13,651.0	hectares	10.49	tons CO2 / hectare	143153.49	**143153.49**	9.64%
				Brushland - for wood	79,188.0	hectares	15.61	tons CO2 / hectare	1236393.92	**1236393.92**	83.22%
				Tree Plantation – S. macrophylla	3,225.0	hectares	11.85	tons CO2 / hectare	38224.31	**38224.31**	2.57%
				Grassland	15,636.0	hectares	3.26	tons CO2 / hectare	51025.48	**51025.48**	3.43%

Source: GHGI 2017, Davao City

Quality control/quality assurance

Data were sourced from the Department of Environment and Natural Resources and referenced in the Forest and Land Use Plan of Davao City.

Uncertainty assessment

Not evaluated.

Further improvements

Data may be underestimated on Forest Emissions. A lot of unmonitored timber harvesting for timber, charcoal making, and other uses go unmonitored.

Also, there have been several urban greening initiatives by private businesses and non-profit organizations in the city for the last few years. A lot of these areas reforested and/or planted with trees may also be considered.

8. Industrial processes and products use (IPPU)

There are 2 ways in generating Greenhouse gas emissions from industrial processes. First, they may be generated and emitted as the byproducts of various non-energy- related industrial activities. Second, they may be emitted due to their use in manufacturing processes or by end- consumers. In the case of byproduct emissions, the emissions are generated by an industrial process itself, and are not directly a result of energy consumed during the process. For example, raw materials can be chemically or physically transformed from one state to another. This transformation can result in the release of greenhouse gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated greenhouse gases (e.g., HFC-23).[36]

GHG emissions from IPPU of a cement company in Davao City is at 2,860,448 tonnes CO_2e. Although only one industry was sampled in this baseline, the GHG emission from this category records the highest carbon emission output.

Methodology

The team identified HG intensive industries registered in the City's Business Bureau. A list of possible industries to collaborate were drawn and contacted by the team to provide relevant information related to GHGI.

The selection of industries is based on the IPCC categories of industrial processes: mineral industry, chemical industry. Metal industry, non-energy products from fuels and solvent used, electronics industry, products used as a substitute for ozone-depleting substances, other products, and manufacture use, and others such as pulp and paper and food industry.

Activity data

The City was only able to get the response of an industrial company mainly processing raw materials for cement production.

36 EPA. Industrial Processes and Products Use. At https://www.epa.gov/sites/production/files/2019-04/documents/us-ghg-inventory-2019-chapter-4-industrial-processes_and_product_use.pdf

Table 30. Annual Cement Production of Holcim Philippines, Davao City 2017

District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g. , Others) - *please select from drop-down*	Industry Type (*please select from drop-down*)	Operation (*please select from drop-down)*	*Annual* Total Production	Units (*please select from drop-down*)
Davao City	Holcim Philippines	Individual Business Surveys	Mineral Industry	Cement Production - Portland	1,430,224	tons

Source: GHGI 2017, Davao City

Emission factor

The EF values for CO2 were based on IPCC 2006.

GHG emissions for Industrial processes of 1 cement company in Davao City is at 2,860,448 tonnes CO_2e. Although only one industry was sampled in this baseline, the GHG emission from this category records the highest carbon emission source.

Table 31. GHG Emissions from Industrial Processes and Products Use, Davao City 2017

District within LGU	Data Source Identifier (*Sort Alphabetically*)	Industry Type	Type of Data (e.g. , Other)	Operation	Quantity	Units	CO_2 Emission Factor	Units	CO_2 Emissions (tons CO_2)
Davao City	Holcim Philippines	Mineral Industry	Individual Business Surveys	Cement Production - Portland	1,430,224.0	tons	2.00	tons CO2 / ton	2860448.00

Source: GHGI 2017, Davao City

Quality control/quality assurance

Data was provided/self-reported by the Holcim company. As there is no basis for comparison, the team deemed this sufficient baseline for this GHG accounting period.

Uncertainty assessment

Not evaluated

Further improvements

There is a need to disaggregate data from the Business Bureau and for the team to include other local industrial processes based on the recommendation of IPCC for selecting industrial processes for GHG quantification.

VII. Challenges, Scope and Limitations

As Davao City accounts for its GHG emissions for the first time there were a few challenges encountered. Articulating these impediments will contribute to the improvement of the GHGI inventory in the next reporting period.

1. Filtering of data. Some figures such as the specific business line of establishments were not disaggregated according to the required values of the GHG inventory. The team had to use their best judgment and use published reference baselines to extract the data accordingly. There is a need to work with the City Business Bureau to collect a more accurate classification of data that would be useful for the GHGI process and reporting for the succeeding period.
2. Difficulties in securing the total production values of commercial and industrial processes as most businesses would prefer not to divulge such information easily. In the case of electricity consumption, there is a need to work with the Department of Energy to get more meaningful data and disaggregated information.
3. More capacity building for the GHGI team in learning the tools especially in the quantification process and identification of uncertainties per parameter and categories. As part of the learning curve, there were a few difficulties in interpreting information that is not covered in the GHGI User's Manual, the team needs further coaching and mentoring to be able to be more effective in their roles.
4. Partnership and linking with other Government Agencies. In the next reporting period, the quantification of GHG emissions in solid waste and wastewater treatment/discharge needs more preparation on the part of the Davao City TWG Team. A more comprehensive baselining and data collection is needed to be able to secure the required information for GHG emission accounting.

In all areas of concern, it is strategic fro the team to work, get support, mentoring and collaboration with the Environmental Management Bureau, Barangay Local Government Units and all other national government agencies. A lot of information has been gathered in these institutions and agencies and it would be a matter of synchronising data collection in the succeeding period to be able to do a more comprehensive GHG Inventory.

VIII. References

Climate Change Commission of the Philippines & USAID (2015) “User’s manual – community-level GHG inventory for local government units (LGUs) in the Philippines”.
https://climate.gov.ph/files/Users%20Manual%20as%20of%20February%202016.pdf

Climate Change 2017. Philippine GHG Inventory and Reporting Protocol:
Commission. Downloaded at https://climate.gov.ph/files/GHG-Manual-for-Business-2017.pdf

Comprehensive Land Use Plan of Davao City 2019.

Ecological Profile of Davao City, CLUP Volume 1

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EPA..https://www.epa.gov/sites/production/files/2016-03/documents/stationaryemissions_3_2016.pdf

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IPCC Guidelines 2006, https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

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Wikipedia, https://en.wikipedia.org/wiki/Davao_City

World Resources Institute. Downloaded at https://www.wri.org/blog/2019/07/5-questions-about-agricultural-emissions-answered

IX. Annex - Davao GHGI Outputs (in Spreadsheets)

Instructions: Spreadsheet for Community-Level Greenhouse Gas (GHG) Inventory Quantification in the Philippines

This GHG Inventory Quantification Support Spreadsheet is a tool created to assist local government units (LGU) in the quantification of greenhouse gas (GHG) emissions at the community-level.

To use this tool, follow the instructions on each tab. Input values required from the user are entered in the yellow cells located on the yellow tabs. Once the activity data and uncertainty estimates have been entered on the yellow tabs, the user should sort the output data on the blue community "GHG" tabs according to the instructions on each tab. The final list of key source categories for the community-level emissions can be found on the green "Summary - Overall" and "Summary by Source" tabs.

Separate worksheets have been developed to record the data for GHG source categories and sources within the community, including emissions outside the LGU geopoltical boundaries resulting from activities inside the LGU geopolitical boundaries. The community sectors include stationary combustion for residential and commercial users, electricity consumption (from scope 2 sources) for residential and commercial users, mobile combustion for road transportation, waste and waste water and agriculture. A summary of the community GHG emissions is provided in a separate worksheet and will be automatically filled in as the user inputs the data into each sector's worksheet.

Tab Key:

Tabs highlighted in blue are GHG emissions calculations for source categories (e.g. purchased electricity)
Tabs highlighted in yellow require user input of activity data
Tabs highlighted in purple are for emission factors and other reference information
Tabs highlighted in green are summary tabs or general user information tabs

Cell Key:

Cells highlighted in grey are static identifiers, transcribed directly from another tab/cell, instructional boxes, or titles and should not be altered
Cells highlighted in yellow should be inputted by the user to calculate GHG emissions and document inventory development and quality management
Cells highlighted in orange *can* be filled in (e.g. with regional/custom factors), but should have default values already input
Cells highlighted in green *can* be altered with empirical data if available.
Cells highlighted in blue contain values or data (e.g. GHG emissions or otherwise) which are automatically calculated based on the information inputted by the user.

Dropdown Lists									District and Barangay
General Info			GI	Wastewater-Data-Scope1					Davao City
GHG Inventory Year									
2008									
2009									
2010									
2011									
2012									
2013									
2014									
2015									
2016									
2017									
2018									
2019									
2020									
Stat Comb-Residential Data				Wastewater-Data-Scope3					
Type of Data	Application	Fuel Type	Units						
Census Averages (e.g. National or Provincial Per Capita Consumption)	Cooking	Biodiesels (International)	kg						
Individual Household Surveys	Cooking/Heating	Blended Diesel Industrial (Philippines)	l						
Other (e.g. Fuel Supplier Totals)	Generator(s)	Blended Diesel Residential/Commercial (Philippines)							
	HVAC	Blended Gasoline Residential/Commercial (Philippines)							
	Lighting	Charcoal (Biomass, International)							
	Other	Diesel (International)							
		Kerosene (International)							
		Motor Gasoline (International)							
		Natural Gas (International)							
		Propane or Liquified Petroleum Gases (International)							
		Residual Fuel Oil (International)							
		Wood or Wood Waste (Biomass, International)							
Stat Comb-Commercial Data				Stat Comb-Residential GHG					
Type of Data	Application	Fuel Type							
Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Cooking	Biodiesels (International)							
Individual Business Surveys	Cooking/Heating	Blended Diesel Industrial (Philippines)							
Other (e.g. Fuel Supplier Totals)	Generator(s)	Blended Diesel Residential/Commercial (Philippines)							
	HVAC	Blended Gasoline Residential/Commercial (Philippines)							
	Lighting	Charcoal (Biomass, International)							
	Other	Diesel (International)							
		Kerosene (International)							
		Motor Gasoline (International)							
		Natural Gas (International)							
		Propane or Liquified Petroleum Gases (International)							
		Residual Fuel Oil (International)							
		Wood or Wood Waste (Biomass, International)							
Mobile Comb-Community-All Data				Stat Comb-Commercial GHG					
Type of Data	Application	Application if Using Fuel Consumption-Based Method	Units						
Fuel Supplier Data	Bus - Diesel	100% Biodiesel	kg						
National or Provincial Census/Statistics	Bus - Ethanol	Aviation Gasoline	l						
Transportation/District Survey Data	Bus - Gasoline	B20 Biodiesel/Diesel							
Other	Heavy Duty Vehicle - Articulated - CNG	CNG							
	Heavy Duty Vehicle - Articulated - Diesel - Year 1960-present	E85 Ethanol/Gasoline							
	Heavy Duty Vehicle - Articulated - Ethanol	Ethanol							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1985-1986	Gasoline/Petrol							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1987	Jet Fuel							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1988-1989	LNG							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1990-1995	LPG							

Dropdown Lists								District and Barangay
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1996	On-Road Diesel Fuel						
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1997	Residual Fuel Oil (3s 5 and 6)						
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1998							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 1999			Mobile Combustion-GHG				
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2000							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2001							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2002							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2003							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2004							
	Heavy Duty Vehicle - Articulated - Gasoline - Year 2005-present							
	Heavy Duty Vehicle - Articulated - LNG							
	Heavy Duty Vehicle - Articulated - LPG							
	Heavy Duty Vehicle - Rigid - Diesel - Year 1960-present							
	Heavy Duty Vehicle - Rigid - Ethanol							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1985-1986							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1987							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1988-1989							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1990-1995							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1996			Elec-Residential GHG				
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1997							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1998							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 1999							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2000							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2001							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2002							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2003							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2004							
	Heavy Duty Vehicle - Rigid - Gasoline - Year 2005-present							
	Heavy Duty Vehicle - Rigid - LNG							
	Heavy Duty Vehicle - Rigid - LPG							
	Light Goods Vehicle - Diesel - Year 1960-1982							
	Light Goods Vehicle - Diesel - Year 1983-1995							
	Light Goods Vehicle - Diesel - Year 1996-present							
	Light Goods Vehicle - Ethanol			Elec-Commercial GHG				
	Light Goods Vehicle - Gasoline - Year 1987-1993							
	Light Goods Vehicle - Gasoline - Year 1994							
	Light Goods Vehicle - Gasoline - Year 1995							
	Light Goods Vehicle - Gasoline - Year 1996							
	Light Goods Vehicle - Gasoline - Year 1997							
	Light Goods Vehicle - Gasoline - Year 1998							
	Light Goods Vehicle - Gasoline - Year 1999							
	Light Goods Vehicle - Gasoline - Year 2000							
	Light Goods Vehicle - Gasoline - Year 2001							
	Light Goods Vehicle - Gasoline - Year 2002							
	Light Goods Vehicle - Gasoline - Year 2003							
	Light Goods Vehicle - Gasoline - Year 2004							
	Light Goods Vehicle - Gasoline - Year 2005-present							
	Light Goods Vehicle - LPG							
	Motorbike - Control Unknown			Elec-All Other GHG				
	Motorbike - Non-Catalyst Control							
	Motorbike - Uncontrolled							
	Passenger Car - Diesel - Year 1960-1982							
	Passenger Car - Diesel - Year 1983-present							
	Passenger Car - Gasoline - Year 1984-1993							
	Passenger Car - Gasoline - Year 1994							
	Passenger Car - Gasoline - Year 1995							
	Passenger Car - Gasoline - Year 1996							
	Passenger Car - Gasoline - Year 1997							
	Passenger Car - Gasoline - Year 1998							
	Passenger Car - Gasoline - Year 1999							
	Passenger Car - Gasoline - Year 2000							
	Passenger Car - Gasoline - Year 2001							
	Passenger Car - Gasoline - Year 2002							
	Passenger Car - Gasoline - Year 2003			Agriculture-Crops GHG				
	Passenger Car - Gasoline - Year 2004							
	Passenger Car - Gasoline - Year 2005-present							
Elec-Residential Data				Agriculture-Livestock GHG				
Type of Data								
Electricity Utilities Provider								

Dropdown Lists									District and Barangay
Household Surveys									
National or Provincial Electricity Averages									
Other									
Elec-Commercial Data				**Solid Waste-GHG-Landfill**					
Data Type									
Electricity Utilities Provider									
Business Surveys									
National or Provincial Electricity Averages									
Other									
Elec others				**Solid Waste-GHG-Other-ICLEI**					
Data Type									
Electricity Utilities Provider									
Business Surveys									
National or Provincial Electricity Averages									
Other									
Agriculture-Crops Data				**Solid Waste-GHG-Open Burning**					
Data Type	**Application**								
Census Averages (e.g. National or Provincial Per Capita Consumption)	Rice (Dry Season, Irrigated)								
Data Directly from Government Agricultural Agency	Rice (Dry Season, Rainfed)								
Sampling Surveys	Rice (Wet Season, Irrigated)								
	Rice (Wet Season, Rainfed)								
	Crop Residues (tonnes of dry weight)								
	Other Crop Type (Custom Emission Factor)								
	Other Crop Type (Custom Emission Factor)								
Agriculture-Livestock Data				**Solid Waste-GHG Calc-IPCC**					
Data Type	**Application**								
Census Averages (e.g. National or Provincial Per Capita Consumption)	Buffalo								
Data Directly from Government Agricultural Agency	Cattle								
Sampling Surveys	Goat								
	Horse								
	Other (must enter livestock-specific emission factor)								
	Poultry								
	Swine								
Solid Waste-Parameters-IPCC FOD				**Solid Waste-GHG_Results-IPCC**					
Solid Waste-MCF-IPCC FOD				**Wastewater-GHG-Scope1**					
Solid Waste-Activity-IPCC FOD				**Wastewater-GHG-Scope3**					
Solid Waste-Landfill-ICLEI				**GWPs and Conversion Factors**					
LandfillLocation	**LandfillType**	**Impact of waste site - % DOCf formation default value**	**Impact of waste site - % DOCf used in the calculation**						
Inside	Managed - anaerobic	1	1						
Outside	Managed - semiaerobic	0.5	0.5						
	Uncategorized	0.6	0.6						
	Unmanaged - deep	0.8	0.8						
	Unmanaged - shallow	0.4	0.4						
Solid Waste-Other Methods-ICLEI				**Emission Factors**					
Solid Waste-Open Burning-ICLEI									
Forestry									
Data Type	**Emission Source**		**Units**						
	Wood and Wood Products Harvesting	**Changes in the Use of the Forestlands**	cubic meters	tons CO2/cubic meter					
	Fuelwood	Used for Agriculture	tons	tons CO2/ton					
	Charcoal	Used as Grasslands	hectares	tons CO2/hectare					
	Construction	Left as Barren Areas							
	Novelties								

Dropdown Lists								District and Barangay
Data Type	Removal Source		Units					
	Remaining Forestland	Land Use Change	hectares	tons CO2/hectare				
	Protection Forest/Old Growth/Mossy/Pine/Submarginal Mangrove	Barren to Forestland						
	Secondary Growth	Grassland to Forestland						
	Brushland - for wood	Wetlands to Forestland						
	Grassland	Settlement to Forestland						
	Tree Plantation - S. macrophylla	Cropland to Forestland						
Industrial Processes								
Data Type	Industry Type					Units		
	Mineral Industry	Chemical Industry	Metal Industry	Electronics Industry	Others	tons	tons CO2/ton	
	Cement Production - *Portland*	Ammonia Production	Iron and Steel Production from *Integrated Facilities*	Integrated Circuit or Semiconductor	Pulp and Paper Industry			
	Cement Production - *Blended*	Soda Ash Production	Iron and Steel Production from *Non-integrated Facilities*	TFT Flat Panel Display	Food and Beverages Industry			
	Lime Production	Petrochemical and Carbon Black Production - *Methanol*		Photovoltaics	Other			
	Glass Production	Petrochemical and Carbon Black Production - *Ethylene*		Heat Transfer Fluid				
		Petrochemical and Carbon Black Production - *Ethylene Dichloride and Vinyl Chloride Monomer*						
		Petrochemical and Carbon Black Production - *Ethylene Oxide*						
		Petrochemical and Carbon Black Production - *Acrylonitrile*						
		Petrochemical and Carbon Black Production - *Carbon Black*						

General Information

Name of GHG Inventory Manager:		ENGR. IVAN C. CORTEZ, EnP.
GHG Inventory Manager(s) Contact Information	**Organization:**	CPDO
	Title:	Officer-in-Charge
	Email:	cpdo.pmed@gmail.com
	Telephone:	(0820) 241-1000 loc.280
Name of Community:		DAVAO CITY
GHG Inventory Year:		2017
Reporting Date:		2019/2/5
Population (year round residents):		1,708,972
Land Area (sq. kilometers):		2,440
Urbanized Area (sq. kilometers)*:		156
Heating Degree Days (18ºC base)*:		highest: 34.3 lowest:23.4
Building Gross Floor Area (m^2)*	**Residential:**	
	Commercial:	
	Industrial:	
Name, Status and Adress of Third Party Verifier (if applicable):		
Other Information (e.g. websites of fuller inventory report or emissions reduction program):		
File Date:		
File Number:		
Version Number:		
Work performed by:		
Work reviewed by:		

*** Optional reporting data that helps with interpretation of GHG sources**

Summary－Overall

Emission Source	GHG Emissions (tonnes CO_2e)	Proportion of Total Emissions	Weighted Uncertainty
Scope 1 Emissions (Net of Forestry and Land Use)			
GHG Emissions from Community-Level Residential Stationary Fuel Use	534040.77	11.34%	0%
GHG Emissions from Community-Level Commercial Stationary Fuel Use	79486.57	1.69%	0%
GHG Emissions from Community Mobile Combustion	1405481.84	29.85%	0%
GHG Emissions from Solid Waste Disposal - IPCC FOD Method*	0.00	0.00%	0%
GHG Emissions from Other Solid Waste Treatment (ICLEI)*	18285.15	0.39%	0%
GHG Emissions from Solid Waste Open Burning (ICLEI)*	49.24	0.00%	0%
GHG Emissions from Wastewater Treatment and Discharge	186067.53	3.95%	0%
GHG Emissions from Community-Level Agriculture (Crops)	12847.80	0.27%	8%
GHG Emissions from Community-Level Agriculture (Livestock)	305171.49	6.48%	6%
GHG Emissions from Solid Waste Disposal - Inside LGU Geopolitical Boundaries (ICLEI)	25.20	0.00%	0
GHG Emissions from Wastewater Treatment and Discharge (Other Sources)	0.00	0.00%	
GHG Emissions from Industrial Processes and Product Use	2860448.00	60.75%	
Scope 1 Emissions/Removal (Forestry and Land Use)			
GHG Emissions from Forestry and Land Use	175203.45	3.72%	
GHG Removal from Sink	-1485732.76	-31.56%	
Total Scope 1 Emissions	**4,091,374**	**86.90%**	**1%**
Scope 2 Emissions			
GHG Emissions from Purchased Electricity at Community-Level Residential Sites	150257.18	3.19%	0%
GHG Emissions from Purchased Electricity at Community-Level Commercial Sites	338965.79	7.20%	10%
GHG Emissions from Purchased Electricity at Community-Level for All Other Sources	127776.50	2.71%	10%
Total Scope 2 Emissions	**616,999**	**13.10%**	**6%**
Scope 3 Emissions			
GHG Emissions from Solid Waste Disposal - Outside LGU Geopolitical Boundaries (ICLEI)	0.00	0.00%	
Total Scope 3 Emissions			
Total Emissions	**4,708,374**	**100.00%**	**3%**

*Either the **IPCC First Order Decay (FOD)** method *AND*/*OR* the **ICLEI** method may be used for determining GHG emissions from municipal solid waste disposal. For example, the IPCC FOD method may be used for solid waste disposal at managed sites in conjunction with the ICLEI methods for waste incineration/biological treatment, which are IPCC compliant. The user must however choose only one method for determining GHG emissions from disposal at solid waste disposal sites (SWDS).

The main differences between the IPCC FOD method and the ICLEI method is that the FOD method produces a time-dependent emission profile that better reflects the true pattern of the degradation process over time, whereas the ICLEI method is based on the assumption that all potential CH_4 is released in the year the waste is disposed of. The ICLEI method will give a reasonable annual estimate of actual emissions if the amount and composition of deposited waste have been constant or slowly varying over a period of several decades. If the amount or composition of waste disposed of at SWDS is changing more rapidly over time, however, the ICLEI default method will not provide an accurate trend. For example, if there is a reduction in the amount of carbon deposited at SWDS, the default method will underestimate emissions and overestimate reductions.

It is good practice to use the FOD method*, *if possible, because it more accurately reflects the emissions trend. The use of the FOD method requires data on current, as well as historic waste quantities, composition and disposal practices for several decades. It is good practice to estimate this historical data, if such data are unavailable, when this is a key source category (see Chapter 7, Methodological Choice and Recalculation) or if there have been significant changes in waste management practices. Inventory agencies (LGUs) are encouraged to obtain data from country-specific or regional research if available.

Data Collection Guidance: Residential Stationary Combustion (Scope 1) Activity Data

Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assuming that the total Cooking Facility Households follows the consumption pattern as follows:
1. A 3.5 kg/day of firewood
2. A 100 L/year of Kerosene
3. Two (2) tanks of Liquefied Petroleum Gas (LPG) weighing 11 kg/each
4. Two (2) kgs/ day of Charcoal.

District or Barangay	Total Population in District or Barangay	Total Number of Residential Households in District/Barangay (enter "N/A" if no survey data)	Number of Households Surveyed (enter "N/A" if no data)	Representative Sample of Household Surveys	Notes
Davao City	1708972	N/A	N/A	N/A	
%%%%%					

Community-Level Residential Stationary Combustion Emissions Sources << Click to update the "District and Barangay" dropdown list below.

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Residential Survey Number)	Type of Data (e.g. Individual Household Surveys, National Census Averages, Other) - *please select from drop-down*	Application (e.g. cooking, lighting, generators) - *please select from drop-down*	Fuel Type - *please select from drop-down*	*Annual* Total Consumption	Units (e.g. litres, kg, tonnes, m^3) - *metric only*	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Reference in Applicable Checklist	Basis of Data Uncertainty
Davao City	Participatrory Resource Appraisal	Census Averages (e.g. National or Provincial Per Capita Consumption)	Cooking	Wood or Wood Waste (Biomass, International)	218,848,525	kg		CPDO (Research and Statistics Division)	2019/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
Davao City	Participatrory Resource Appraisal	Census Averages (e.g. National or Provincial Per Capita Consumption)	Cooking	Kerosene (International)	3,074,300	l		CPDO (Research and Statistics Division)	2019/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
Davao City	Participatrory Resource Appraisal	Census Averages (e.g. National or Provincial Per Capita Consumption)	Cooking	Propane or Liquified Petroleum Gases (International)	5,589,078.00	kg		CPDO (Research and Statistics Division)	2019/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
Davao City	Participatrory Resource Appraisal	Census Averages (e.g. National or Provincial Per Capita Consumption)	Cooking	Charcoal (Biomass, International)	32,085,690.00	kg		CPDO (Research and Statistics Division)	2019/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
*z... Add rows **above** as necessary*												

Data Collection Guidance: Commercial Stationary Combustion (Scope 1) Activity Data

Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumption:

1. Fuel type used for most generators is Diesel.
2. Every Generator, 6.81 Operating Hours per year per Davao Light and Power Company data on Power Interruption.

District or Barangay	Total Population in District or Barangay	Total Number of Registered Businesses in District or Barangay (enter "N/A" if no survey data used)	Number of Businesses Surveyed (enter "N/A" if no data)	Representative Sample of Businesses Surveyed	Notes
Davao City	1,708,972				

Community-Level Commercial Stationary Combustion Emissions Sources

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Business Survey Number)	Type of Data (e.g. Individual Business Surveys, National Census Averages, Other) -*please select from drop-down*	Application (e.g. cooking, lighting, generators) - please select from drop-down	Fuel Type (*please select from drop-down*)	*Annual* Total Consumption	Units (e.g. litres, kg, tonnes, m^3) - *metric only*	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	Davao Light and Power Company	Other (e.g. Fuel Supplier Totals)	Generator(s)	Diesel (International)	293,518.00	l		Davao Light and Power Company	2017/5/1	Davao Light and Power Company	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
Davao City	CPDO-RSD	Individual Business Surveys	Cooking	Propane or Liquified Petroleum Gases (International)	##############	kg		CPDO (Research and Statistics Division)	2017/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
Davao City	CPDO-RSD	Individual Business Surveys	Cooking	Charcoal (Biomass, International)	20,858,124.00	kg		CPDO (Research and Statistics Division)	2017/5/1	CPDO (Research and Statistics Division)	N/A	The data are limited to the projections of household for the base year and assumptions given by the DENR-EMB.
*z... add rows **above** as necessary*												

Data Collection Guidance: Community-Level Mobile Combustion (Scope 1) Activity Data

Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :

- Assumed that all vehicles operating within the LGU frequented the fuel service providers listed below
- Subtracted diesel consumed for stationary combustion (e.g. for back-up generators) from the total fuel sales data provided by the fuel suppliers, since these fuel suppliers also erviced residential and commercial customers for stationary sources
- Assumed that vehicles registered within the LGU are not frequently purchasing fuel from suppliers operating outside of the LGU

Barangay or District	Population of Barangay or District	Total Number of Registered Vehicles within the District (Government Agency)	Number of Vehicles Captured in Survey Data (enter "N/A if no survey data was used)	Representative Sample	Notes
Davao City	1708972				

Community-Level Mobile Combustion

District or Barangay (*please select from dropdown*)	Vehicle Type or Mobile Emissions Source Identifier (e.g. annual diesel sales from fuel supplier)	Type of Data (e.g. Transportation Surveys, National Census Averages, Fuel Supplier) - *please select from drop-down*	Application (Vehicle Type) if Using Distance-Based Method - *select from drop-down, e.g. bus - diesel, otherwise leave blank*	Application if Using Fuel Consumption-Based Method (Mobile Fuel Combustion - All Applications) - *otherwise leave blank*	Annual Distance Travelled (kilometers, if distance-based methodology being used) - *otherwise leave blank*	Annual Fuel Consumption or Fuel Sold by Fuel Supplier (Litres or Kg) - *otherwise leave blank*	Amount of Fuel Used for Stationary Combustion Purposes (litres) from Fuel Supplier - *otherwise enter "N/A"*	Annual Amount of Fuel Consumed for Mobile Combustion (litres)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	Historical Demand of Petroleum Products of Region XI per Product	National or Provincial Census/Statistics		Gasoline/Petrol		197,472,190	N/A							
Davao City	Historical Demand of Petroleum Products of Region XI per Product	National or Provincial Census/Statistics		On-Road Diesel Fuel		353,157,137	N/A							
Davao City	Historical Demand of Petroleum Products of Region XI per Product	National or Provincial Census/Statistics		Residual Fuel Oil (3s 5 and 6)		15,134,501	N/A							
*z... add rows **above** as necessary*														

Data Collection Guidance: Commercial Electricity Consumption (Scope 2) Activity Data										
Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*			
LGU-Specific Assumptions and Notes on Methodology										
Assumptions : • Actual Annual Electricity Consumption (kWh) is based on actual monthly consumption. • Type of consumers are based on the total appliance load upon application. • Lower than 20 kW that are not residential are classified under commercial.										

District or Barangay	Total Number of Commercial Institutions in District or Barangay (enter "N/A" if no survey data used)	Number of Businesses Surveyed (enter "N/A" if no data)	Representative Sample of Business Surveys	Notes
Davao City				

Commercial Electricity Consumption - Community (kWh)

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Commercial Survey Number or Utility Name and Source Identfier)	Data Type - (e.g. Individual Business Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh)	Estimated Annual Consumption for Emissions Source (enter "N/A" if actual consumption/utility values provided)	Units (e.g. kWh)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	Davao Light and Power Company - Commercial and Industrial	Electricity Utilities Provider	555,817,089.60	N/A	kWH					

Data Collection Guidance: Commercial Electricity Consumption (Scope 2) Activity Data							
Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :
- Actual Annual Electricity Consumption (kWh) is based on actual monthly consumption.
- Type of consumers are based on the total appliance load upon application.
- Lower than 20 kW that are not residential are classified under commercial.

District or Barangay	Total Number of Commercial Institutions in District or Barangay (enter "N/A" if no survey data used)	Number of Businesses Surveyed (enter "N/A" if no data)	Representative Sample of Business Surveys	Notes
Davao City				

Commercial Electricity Consumption - Community (kWh)

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Commercial Survey Number or Utility Name and Source Identfier)	Data Type - (e.g. Individual Business Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh)	Estimated Annual Consumption for Emissions Source (enter "N/A" if actual consumption/utility values provided)	Units (e.g. kWh)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	Davao Light and Power Company - Commercial and Industrial	Electricity Utilities Provider	555,817,089.60	N/A	kWH					

Data Collection Guidance: All Other (Scope 2) Activity Data (e.g. MRT, Streetlights, etc.)							
Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*
LGU-Specific Assumptions and Notes on Methodology							
Assumptions : • Actual Annual Electricity Consumption (kWh) is based on actual monthly consumption (in DLPC Streetlights).							

District or Barangay	Other Electricity Consumption Attributable	Notes
Davao City		

All Other Electricity Consumption - Community (kWh)

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Streetlights, MRT line, Utility Name and Source Identfier)	Data Type - (e.g. Individual Business Surveys, National Census Averages, Other) - please select from drop-down	Actual Annual Electricity Consumption (kWh)	Estimated Annual Consumption for Emissions Source (enter "N/A" if actual consumption/utility values provided)	Units (e.g. kWh/household)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	DLPC - Streetlights	Electricity Utilities Provider	13,687,042		kWh					
Davao City	City Engineer's Office	Business Surveys	195,292,658		kWh					

Data Collection Guidance: Agriculture (Crops) Activity Data

Name of Individual(s) Responsible for Data Input:	*Leo Brian D. Leuterio* *Anthony Roy Cariño*	Date of Most Recent Data Entry:	*31/12/2017*	Quality Control (QC) Checker(s):	*Errol John Denosta* *Aldeth E. Manulat*	Corresponding Quality Control (QC) Checklist Filename:	*filename.xls*

Assumptions :
- Rice Straw and others emits 5 MT/hectare
- Assumed that all data provided by the City Agriculturist's Office is correct

District or Barangay	Total Population in District or Barangay	Total Hectares under Crop Production (hectares, ha)	Hectares Represented by Sampling (enter "N/A" if no survey data)	Representative Sample of Hectares Under Agricultural Management	Notes
Davao City	1708972	102114.66	N/A	N/A	

Community-Level Agriculture Crop Emissions Sources

District or Barangay - *please select from drop-down*	Data Source Identifier (e.g. Name of Government Agriculture Agency and Department)	Type of Data (e.g. Agricultural Bureau, Census Averages, Other) - *please select from drop-down*	Application (e.g. crop type and approach) - *please select from drop-down*	Total Hectares Under Production (hectares, ha)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
Davao City	City Agri Office	Data Directly from Government Agricultural Agency	Rice (Wet Season, Irrigated)	923		**City Agriculturist's Office (Planning Division)**	**2019/5/1**	**City Agriculturist's Office (Planning Division)**		
Davao City	City Agri Office	Data Directly from Government Agricultural Agency	Rice (Wet Season, Rainfed)	1039		**City Agriculturist's Office (Planning Division)**	**2019/5/1**	**City Agriculturist's Office (Planning Division)**		
Davao City	City Agri Office	Data Directly from Government Agricultural Agency	Rice (Dry Season, Rainfed)	22		**City Agriculturist's Office (Planning Division)**	**2019/5/1**	**City Agriculturist's Office (Planning Division)**		
Davao City	City Agri Office	Data Directly from Government Agricultural Agency	Crop Residues (tonnes of dry weight)	6845		**City Agriculturist's Office (Planning Division)**	**2019/5/1**	**City Agriculturist's Office (Planning Division)**		

Data Collection Guidance: Agriculture (Livestock) Activity Data

Name of Individual(s) Responsible for Data Input:	*Engr. Ivan C. Cortez* *Loraida Fabro* *Maria Lourdes Misa*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :
- Assumed that all data provided by the City Veterinarian Office is correct

District or Barangay	Total Population in District or Barangay	Total Livestock (headcount)	Headcount Represented in Survey Data (enter "N/A" if survey data not used)	Representative Sample of Livestock	Notes
Davao City	1708972	7256821	n/a	N/A	

Community-Level Agriculture Livestock Emissions Sources

District or Barangay (*please select from drop-down*)	Data Source Identifier (e.g. Name of Government Agriculture Agency and Department)	Type of Data (e.g. Government Agricultural Bureau, National Census Averages, Other) - *please select from drop-down*	Application (e.g. Livestock Type)	Total Heacount	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
Davao City	CVO	Data Directly from Government Agricultural Agency	Buffalo	38642		**City Veterinarian's Office**	**2019/5/1**	**City Veterinarian's Office**		
Davao City	CVO	Data Directly from Government Agricultural Agency	Cattle	36318		**City Veterinarian's Office**	**2019/5/1**	**City Veterinarian's Office**		
Davao City	CVO	Data Directly from Government Agricultural Agency	Swine	229854		**City Veterinarian's Office**	**2019/5/1**	**City Veterinarian's Office**		
Davao City	CVO	Data Directly from Government Agricultural Agency	Goat	46867		**City Veterinarian's Office**	**2019/5/1**	**City Veterinarian's Office**		
Davao City	CVO	Data Directly from Government Agricultural Agency	Poultry	6905140		**City Veterinarian's Office**	**2019/5/1**	**City Veterinarian's Office**		

Data Collection Guidance: Solid Waste Disposal Parameters (IPCC FOD Method, Scope 1)

Name of Individual(s) Responsible for Data Input:		**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names…*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions...

Landfill Solid Waste Disposal Data Entry Parameters (IPCC FOD Method)

	IPCC default value		User-defined	Reference and comments
Starting year	1950			
DOC (Degradable organic carbon)	***Waste by composition***			
(weight fraction, wet basis)	**Range**	**Default**	**User-defined**	
Disposable nappies	0.18-0.32	0.24		
Food waste	0.08-0.20	0.15		
Garden	0.18-0.22	0.2		
Paper	0.36-0.45	0.4		
Sewage sludge	0.04-0.05	0.05		
Textiles	0.20-0.40	0.24		
Wood and straw	0.39-0.46	0.43		
DOCf (fraction of DOC dissimilated)		0.5		
Methane generation rate constant (k)	**Climate Zone: *Moist and wet tropical (range and default rates shown below)***			
(years^{-1})	**Range**	**Default**	**User-defined**	
Disposable nappies	0.15–0.2	0.17		
Food waste	0.17–0.7	0.4		
Garden	0.15–0.2	0.17		
Paper	0.06–0.085	0.07		
Sewage sludge	0.17–0.7	0.4		
Textiles	0.06–0.085	0.07		
Wood and straw	0.03–0.05	0.035		
			0	
Industrial waste	0.15–0.2	0.17		
Delay time (months)		6		
Fraction of methane (F) in developed gas		0.5		
Conversion factor, C to CH_4		1.33		
Oxidation factor (OX)		0		
Parameters for carbon storage				
% paper in industrial waste		0%		
% wood in industrial waste		0%		

Data Collection Guidance: Solid Waste Disposal Methane Correction Factor (MCF) Calculation (IPCC FOD Method)

Name of Individual(s) Responsible for Data Input:	*Names…*	**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names…*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions...

Landfill Solid Waste Disposal Data Entry for MCF Calculation (IPCC FOD Method)

	Unmanaged, shallow	Unmanaged, deep	Managed	Managed, semi-aerobic	Uncategorised	Distribution Check - Total (100%)	References and comments	Calculated Values for MCF - Weighted average MCF for MSW	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
	MCF	MCF	MCF	MCF	MCF								
IPCC default	0.4	0.8	1	0.5	0.6								
User-defined value	0.4	0.8	1	0.5	0.6								
Distribution of Waste by Waste Management Type - Annex A1.1													
User-defined value (Philippines)	0%	0%	0%	0%	0%								
Year	%	%	%	%	%			wt. fraction					
0	0%	0%	0%	0%	0%	0%		0.00					
1	0%	0%	0%	0%	0%	0%		0.00					
2	0%	0%	0%	0%	0%	0%		0.00					
3	0%	0%	0%	0%	0%	0%		0.00					
4	0%	0%	0%	0%	0%	0%		0.00					
5	0%	0%	0%	0%	0%	0%		0.00					
6	0%	0%	0%	0%	0%	0%		0.00					
7	0%	0%	0%	0%	0%	0%		0.00					
8	0%	0%	0%	0%	0%	0%		0.00					
9	0%	0%	0%	0%	0%	0%		0.00					
10	0%	0%	0%	0%	0%	0%		0.00					
11	0%	0%	0%	0%	0%	0%		0.00					
12	0%	0%	0%	0%	0%	0%		0.00					
13	0%	0%	0%	0%	0%	0%		0.00					
14	0%	0%	0%	0%	0%	0%		0.00					
15	0%	0%	0%	0%	0%	0%		0.00					
16	0%	0%	0%	0%	0%	0%		0.00					
17	0%	0%	0%	0%	0%	0%		0.00					
18	0%	0%	0%	0%	0%	0%		0.00					
19	0%	0%	0%	0%	0%	0%		0.00					
20	0%	0%	0%	0%	0%	0%		0.00					
21	0%	0%	0%	0%	0%	0%		0.00					
22	0%	0%	0%	0%	0%	0%		0.00					
23	0%	0%	0%	0%	0%	0%		0.00					
24	0%	0%	0%	0%	0%	0%		0.00					
25	0%	0%	0%	0%	0%	0%		0.00					
26	0%	0%	0%	0%	0%	0%		0.00					
27	0%	0%	0%	0%	0%	0%		0.00					
28	0%	0%	0%	0%	0%	0%		0.00					
29	0%	0%	0%	0%	0%	0%		0.00					
30	0%	0%	0%	0%	0%	0%		0.00					
31	0%	0%	0%	0%	0%	0%		0.00					
32	0%	0%	0%	0%	0%	0%		0.00					
33	0%	0%	0%	0%	0%	0%		0.00					
34	0%	0%	0%	0%	0%	0%		0.00					
35	0%	0%	0%	0%	0%	0%		0.00					
36	0%	0%	0%	0%	0%	0%		0.00					
37	0%	0%	0%	0%	0%	0%		0.00					
38	0%	0%	0%	0%	0%	0%		0.00					
39	0%	0%	0%	0%	0%	0%		0.00					
40	0%	0%	0%	0%	0%	0%		0.00					
41	0%	0%	0%	0%	0%	0%		0.00					
42	0%	0%	0%	0%	0%	0%		0.00					
43	0%	0%	0%	0%	0%	0%		0.00					
44	0%	0%	0%	0%	0%	0%		0.00					
45	0%	0%	0%	0%	0%	0%		0.00					
46	0%	0%	0%	0%	0%	0%		0.00					
47	0%	0%	0%	0%	0%	0%		0.00					
48	0%	0%	0%	0%	0%	0%		0.00					
49	0%	0%	0%	0%	0%	0%		0.00					
50	0%	0%	0%	0%	0%	0%		0.00					
51	0%	0%	0%	0%	0%	0%		0.00					
52	0%	0%	0%	0%	0%	0%		0.00					
53	0%	0%	0%	0%	0%	0%		0.00					
54	0%	0%	0%	0%	0%	0%		0.00					
55	0%	0%	0%	0%	0%	0%		0.00					
56	0%	0%	0%	0%	0%	0%		0.00					
57	0%	0%	0%	0%	0%	0%		0.00					
58	0%	0%	0%	0%	0%	0%		0.00					
59	0%	0%	0%	0%	0%	0%		0.00					
60	0%	0%	0%	0%	0%	0%		0.00					
61	0%	0%	0%	0%	0%	0%		0.00					
62	0%	0%	0%	0%	0%	0%		0.00					
63	0%	0%	0%	0%	0%	0%		0.00					
64	0%	0%	0%	0%	0%	0%		0.00					
65	0%	0%	0%	0%	0%	0%		0.00					
66	0%	0%	0%	0%	0%	0%		0.00					
67	0%	0%	0%	0%	0%	0%		0.00					
68	0%	0%	0%	0%	0%	0%		0.00					
69	0%	0%	0%	0%	0%	0%		0.00					
70	0%	0%	0%	0%	0%	0%		0.00					
71	0%	0%	0%	0%	0%	0%		0.00					
72	0%	0%	0%	0%	0%	0%		0.00					
73	0%	0%	0%	0%	0%	0%		0.00					
74	0%	0%	0%	0%	0%	0%		0.00					
75	0%	0%	0%	0%	0%	0%		0.00					
76	0%	0%	0%	0%	0%	0%		0.00					
77	0%	0%	0%	0%	0%	0%		0.00					
78	0%	0%	0%	0%	0%	0%		0.00					
79	0%	0%	0%	0%	0%	0%		0.00					
80	0%	0%	0%	0%	0%	0%		0.00					
81	0%	0%	0%	0%	0%	0%		0.00					
82	0%	0%	0%	0%	0%	0%		0.00					
83	0%	0%	0%	0%	0%	0%		0.00					
84	0%	0%	0%	0%	0%	0%		0.00					
85	0%	0%	0%	0%	0%	0%		0.00					
86	0%	0%	0%	0%	0%	0%		0.00					
87	0%	0%	0%	0%	0%	0%		0.00					
88	0%	0%	0%	0%	0%	0%		0.00					
89	0%	0%	0%	0%	0%	0%		0.00					
90	0%	0%	0%	0%	0%	0%		0.00					

Data Collection Guidance: MSW Activity Data Input (IPCC FOD Method)

Name of Individual(s) Responsible for Data Input:	*Names...*	**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names...*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

LGU-Specific Assumptions and Notes on Methodology:

DOC (specific to waste type): DOC
DOCf (specific to waste type): DOCf
Half-life time (t1/2, years): h= ln(2)/k
Process start in deposition year (month): M
exp2: exp(-k*((13-M)/12))
Fraction to CH4: F

Landfill MSW Activity Data Input (IPCC FOD Method) - % by Type

Year	Population (LGU)	Waste per capita (tonnes/capita/yr)	Total MSW (tonnes)	Waste Diversion (Destination) Rates (%) and Amounts (tonnes)										Waste Composition (% and tonnes)																Total	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
				% to Solid Waste Disposal Site (SWDS)	Total MSW Deposited to Landfill (tonnes)	% MSW Composted	Total MSW Composted (tonnes)	% MSW Sent to Anaerobic Digestion	Total MSW Sent to Anaerobic Digestion (tonnes)	% MSW Open Burned	Total MSW Open Burned (tonnes)	% Total MSW Other/Unspecified	Total MSW Other/Unspecified (tonnes)	Food (%)	Total Food Waste Deposited to Landfill (tonnes)	Garden (%)	Total Garden Waste Deposited to Landfill (tonnes)	Paper (%)	Total Paper Waste Deposited to Landfill (tonnes)	Wood (%)	Total Wood Waste Deposited to Landfill (tonnes)	Textile (%)	Total Textile Waste Deposited to Landfill (tonnes)	Nappies (%)	Total Nappies Waste Deposited to Landfill (tonnes)	Sludge (%)	Total Sewage/Sludge Waste Deposited to Landfill (tonnes)	Plastics, other inert (%)	Total Plastics and Other Inert Waste Deposited to Landfill (tonnes)						
IPCC Defaults														43.0%		0.0%		12.9%		9.9%		2.7%		0.0%			30.1%		99%					
0		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
1		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
2		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
3		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
4		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
5		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
6		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
7		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
8		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
9		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
10		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
11		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
12		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
13		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
14		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
15		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
16		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
17		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
18		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
19		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
20		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
21		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
22		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
23		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
24		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
25		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
26		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
27		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
28		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
29		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
30		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
31		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
32		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
33		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
34		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
35		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
36		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
37		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
38		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
39		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
40		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
41		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
42		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
43		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
44		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
45		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
46		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
47		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
48		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
49		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
50		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					

Data Collection Guidance: MSW Activity Data Input (IPCC FOD Method)

Name of Individual(s) Responsible for Data Input:	*Names...*	Date of Most Recent Data Entry:		Quality Control (QC) Checker(s):	*Names...*	Corresponding Quality Control (QC) Checklist Filename:	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

LGU-Specific Assumptions and Notes on Methodology:

DOC (specific to waste type): DOC
DOCf (specific to waste type): DOCf
Half-life time (t1/2, years): h= ln(2)/k
Process start in deposition year (month): M
exp2: exp(-k*((13-M)/12))
Fraction to CH4: F

Landfill MSW Activity Data Input (IPCC FOD Method) - % by Type

Year	Population (LGU)	Waste per capita (tonnes/capita/yr)	Total MSW (tonnes)	Waste Diversion (Destination) Rates (%) and Amounts (tonnes)										Waste Composition (% and tonnes)																Total	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
				% to Solid Waste Disposal Site (SWDS)	Total MSW Deposited to Landfill (tonnes)	% MSW Composted	Total MSW Composted (tonnes)	% MSW Sent to Anaerobic Digestion	Total MSW Sent to Anaerobic Digestion (tonnes)	% MSW Open Burned	Total MSW Open Burned (tonnes)	% Total MSW Other/Unspecified	Total MSW Other/Unspecified (tonnes)	Food (%)	Total Food Waste Deposited to Landfill (tonnes)	Garden (%)	Total Garden Waste Deposited to Landfill (tonnes)	Paper (%)	Total Paper Waste Deposited to Landfill (tonnes)	Wood (%)	Total Wood Waste Deposited to Landfill (tonnes)	Textile (%)	Total Textile Waste Deposited to Landfill (tonnes)	Nappies (%)	Total Nappies Waste Deposited to Landfill (tonnes)	Sludge (%)	Total Sewage/Sludge Waste Deposited to Landfill (tonnes)	Plastics, other inert (%)	Total Plastics and Other Inert Waste Deposited to Landfill (tonnes)						
IPCC Defaults														43.0%		0.0%		12.9%		9.9%		2.7%		0.0%			30.1%		99%					
51		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
52		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
53		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
54		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
55		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
56		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
57		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
58		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
59		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
60		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
61		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
62		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
63		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
64		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
65		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
66		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
67		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
68		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
69		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
70		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
71		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
72		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
73		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
74		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
75		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
76		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
77		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
78		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
79		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
80		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
81		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
82		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
83		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
84		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
85		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
86		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
87		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
88		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
89		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					
90		0.000	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	43.0%	0.0	0.0%	0.0	12.9%	0.0	9.9%	0.0	2.7%	0.0	0.0%	0.0	0.0%	0.0	30.1%	0.0	99%					

Data Collection Guidance: Solid Waste Disposal (Landfill)

Name of Individual(s) Responsible for Data Input:	*Engr. Lakandiwa Orcullo* *Engr. Felinee Cabrera*	Date of Most Recent Data Entry:	*31/12/2017*	Quality Control (QC) Checker(s):	*Errol John Denosta* *Aldeth Manulat*	Corresponding Quality Control (QC) Checklist Filename:	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :

- Assumed that all data provided by the City Environment and Natural Resources is correct

General Solid Waste Activity Data

Data Source Identifier	District/Barangay	Total Population of District/Barangay	Waste Per Capita (If Estimating Total Solid Waste)- *default IPCC value (0.19) for the Philippines - user may enter custom factor - enter "N/A" if total waste information does not need to be estimated*	Total Solid Waste for District/Barangay (Estimated)	Total Solid Waste (Actual) for District/Barangay - *enter a value of zero "0" if total waste is estimated*	Fraction of Total Solid Waste Disposed in Solid Waste Disposal Sites - *default value of 62% for Philippines - may be changed to custom value - see row 226 in 'Emission Factor' tab*	Amount Sent to Landfills in District/Barangay	Fraction of Total Waste Sent to Specific Landfill Type - *user may enter "N/A" if realtactual landfill weigh-scale data or otherwise is known*	Specific Landfill Type *please select from drop-down menu*	Location of Landfill Disposal Site (Inside or Outside the Geopolitical Boundaries of the LGU) - *please select from dropdown*	Total Solid Waste Sent to Specific Landfill Type - *enter specific value if an actual value is known*	Total CH_4 Generated from Solid Waste Disposal Site - *user must manually link to the appropriate cell below (e.g. cell D41 for the first landfill data site)* - **tonnes**	Data Uncertainty	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		inhabitants	*tonnes/capita/year*	*tonnes*	*tonnes*	%	*tonnes*	%			*tonnes*						
DAVAO CITY (Collection Area)	Davao City	1,461,480	0.21	306,910.8	-	69%	211768.5	**100%**	**Managed - anaerobic**	**Inside**	**211,768.45**	**0.50**					
DAVAO CITY (Non-collection Area)		246,629	0.21	51,792.1		69%	35736.5	**100%**	**Unmanaged - deep**	**Inside**	**35,736.54**	**0.50**					

Specific Landfill Data Identifier (LGU, District, Barangay)	**DAVAO CITY (Collection Area)**
Type of Landfill	**Managed - anaerobic**
Total Amount of Solid Waste Sent to Above Type of Landfill	**211,768.5**

		Waste Composition % - *default IPCC values for Southeast Asia may be changed to custom values*	**Waste Amount (tonnes)**	**Degradeable Organic Carbon (DOC, %) -** *default IPCC values may be changed to custom DOCs*	**Degradeable Organic Carbon (DOC, tonnes)**
Waste Types	**Paper/Cardboard**	12.9%	27318.1	40.0%	10927.3
	Textiles	2.7%	5717.7	24.0%	1372.3
	Food Waste	43.0%	91060.4	15.0%	13659.1
	Wood	9.9%	20965.1	43.0%	9015.0
	Garden/Park	0.0%	0.0	20.0%	0.0
	Nappies/Diapers	0.0%	0.0	24.0%	0.0
	Sewage/Sludge	0.0%	0.0	5.0%	0.0
	Rubber/Leather	0.9%	1905.9	39.0%	743.3
	All other, Inerts (Plastics, Metals, Glass, Ash, and all inter material with a DOC = 0)	30.1%	63742.3	0.0%	0.0
	Total (DOC, tonnes)				**35716.9**

DOC that Degrades (DOCf)	**% DOC that degrades - default**	60.0%
	% DOC that degrades - used in calculation *(enter "N/A" if using default value)*	
	Type of Landfill Site	Managed - anaerobic
	Impact of waste site - % DOCf formation default value	100.0%
	Impact of waste site - % DOCf used in the calculation *(default value may be used or custom value may be entered)*	100.0%
	DOCf generated (tonnes C)	**21430.12**
Methane Generated	**% DOCf that is Methane - default**	50.0%
	% DOCf that is Methane - used in calculation - *user may enter custom %DOCf that is methane*	50.0%
	C to CH_4 conversion factor	1.33
	CH_4 Generated (tonnes)	**14251.03**

General Data Identifier (LGU, District, Barangay)	DAVAO CITY (Collection Area)
Type of Landfill	Unmanaged - deep
Total Amount of Solid Waste Sent to Above Type of Landfill	35,736.5

		Waste Composition % - *default IPCC values for Southeast Asia may be changed to custom values*	Waste Amount (tonnes)	Degradeable Organic Carbon (DOC, %) - *default IPCC values may be changed to custom DOCs*	Degradeable Organic Carbon (DOC, tonnes)
Waste Types	Paper/Cardboard	12.9%	4610.0	40.0%	1844.0
	Textiles	2.7%	964.9	24.0%	231.6
	Food Waste	43.0%	15366.7	15.0%	2305.0
	Wood	9.9%	3537.9	43.0%	1521.3
	Garden/Park	0.0%	0.0	20.0%	0.0
	Nappies/Diapers	0.0%	0.0	24.0%	0.0
	Sewage/Sludge	0.0%	0.0	5.0%	0.0
	Rubber/Leather	0.9%	321.6	39.0%	125.4
	All other, Inerts (Plastics, Metals, Glass, Ash, and all inter material with a DOC = 0)	30.1%	10756.7	0.0%	0.0
	Total (DOC, tonnes)				6027.3

DOC that Degrades (DOCf)	% DOC that degrades - default	60.0%
	% DOC that degrades - used in calculation *(enter "N/A" if using default value)*	
	Type of Landfill Site	Unmanaged - deep
	Impact of waste site - % DOCf formation default value	80.0%
	Impact of waste site - % DOCf used in the calculation *(default value may be used or custom value may be entered)*	80.0%
	DOCf generated (tonnes C)	2893.12
Methane Generated	% DOCf that is Methane - default	50.0%
	% DOCf that is Methane - used in calculation - *user may enter custom %DOCf that is methane*	50.0%
	C to CH_4 conversion factor	1.33
	CH_4 Generated (tonnes)	1923.92

Data Collection Guidance: Other Solid Waste Disposal (Composting, Anerobic Digestion, Other/Unspecified) - Scope 1

Guidance for Other Solid Waste Disposal Data Collection (ICLEI Method): The GHG inventory team should collect the activity data below from waste collection, processing, and disposal agencies as required or from appropriate government agencies. The data for biological waste (food waste, yard and park waste and sludge) treatment should be provided at the overall LGU level (i.e. it should be aggregated for the entire community). The waste generation rate and population characteristics for the community should be supported by studies and updated annually. For example, if the daytime commuting population into a community's geopolitical boundaries signficantly effects the waste generation rate, this should be reflected in the population/waste generation rate characteristics for the community inventory. It is important that the waste generation data required includes total solid waste produced by the community by type of biological waste disposal (e.g.composting or anaerobic digestion facilities) within the geopolitical boundaries of the community (Scope 1). Furthermore, his tab is to quantify community-level solid waste GHG emissions for solid waste disposed of via open-burning and other/unspecified disposal methods within the LGU's geopolitical boundaries (Scope 1).

In general the LGU will be required to provide the following information:

- The disposal method of waste generated within the community (e.g. semi continuous incineration);
- Quantity of waste disposed;
- Composition of the waste stream;
- Waste dry matter content (%) by waste composition (*optional,* as default data may be used);
- Waste carbon content (% carbon in dry weight) by waste composition (optional, as default data may be used);
- Waste fossil carbon content (% fossil carbon) by waste composition (optional, as default data may be used);
- Type and location of the disposal facilities for all waste originating in the community;
- Operational details of the disposal facilities including total waste disposed, existence and effectiveness of any methane recovery systems and historic use

The inventory team should determine what type of (if any) waste incineration methods are used and what percentage of waste is diverted to each disposal method (e..g. specific type of waste incineration method or open burning). Activity data will have to be sourced for each disposal method (e.g. fluidized bed continuous incineration) by the amount of waste disposed of using that method.

Name of Individual(s) Responsible for Data Input:	*Names...*	**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names...*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*	

LGU-Specific Assumptions and Notes on Methodology

Assumptions...

General Solid Waste Composting (Biological Waste) Activity Data - Aggregated to the LGU (Community) Level

Data Source Identifier	Total Population	Waste Per Capita (If Estimating Total Solid Waste)- *default IPCC value (0.19) for the Philippines - user may enter custom factor - enter "N/A" if total waste information does not need to be estimated*	Total Solid Waste for District/Barangay (Estimated)	Total Solid Waste (Actual) for District/Barangay - *enter a value of zero "0" if total waste is estimated*	Fraction of Total Solid Waste Sent for Composting - *default value of 10% for Philippines - may be changed to custom value*	Fraction of Total Solid Waste Sent for Anaerobic Digestion Facilities - *default value unknown for Philippines - must be changed to custom value*	Fraction of Total Solid Waste Sent for Open Burning - *default value unknown for Philippines - mustbe changed to custom value*	Fraction of Total Solid Waste Other/Unspecified - *default value known for Philippines - may be changed to custom value*	Amount of Total Solid Waste Composted - *user(s) may enter real/actual data if it is not estimated on the fraction of total waste*	Amount of Total Solid Waste Sent to Anaerobic Digestion Facilities - *user(s) may enter real/actual data if it is not estimated on the fraction of total waste*	Amount of Total Solid Waste Sent for Open Burning- *user(s) may enter real/actual data if it is not estimated on the fraction of total waste*	Amount of Total Solid Waste Sent for Other/Unspecified - *user(s) may enter real/actual data if it is not estimated on the fraction of total waste*	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
	inhabitants	*tonnes/capita/year*	*tonnes*	*tonnes*	%	%	%		*tonnes wet weight*	*tonnes wet weight*	*tonnes wet weight*	*tonnes wet weight*					
CENRO	1708972	0.21	358,884.1	358,884.1	10.0%	0.0%	2.0%	3.0%	35,888.4	0.0	7,177.7	10,766.5					

Data Collection Guidance: Solid Waste Disposal (Open Burning) (Solid Waste, Scope 1)											
Name of Individual(s) Responsible for Data Input:	*Names…*	**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names…*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*				
LGU-Specific Assumptions and Notes on Methodology:											
Assumption:											
General Soild Waste Open Burning Activity Data - Aggregated to the LGU (Community) Level											
Data Source Identifier	**Total Population**	**Waste Per Capita (If Estimating Total Solid Waste)-** *default IPCC value (0.19) for the Philippines - user may enter custom factor - enter "N/A" if total waste information does not need to be estimated*	**Total Solid Waste for District/Barangay (Estimated)**	**Total Solid Waste (Actual) for District/Baranga y -** *enter a value of zero "0" if total waste is estimated*	**Fraction of Total Solid Waste Open Burned inside LGU Geopolitical Boundaries -** *default value of 0% for Philippines - may be changed to custom value*	**Amount of Total Solid Waste Open Burned -** *user(s) may enter real/actual data if it is not estaimated on the fraction of total waste*	**Uncertainty of Data (%)**	**Account or File Code Where Data is Stored**	**Ownership and Storage Location of Data (e.g. government agency statistics database)**	**Corresponding Quality Control (QC) Field in Applicable Checklist**	**Basis of the Estimate of Data Uncertainty**
	inhabitants	*tonnes/capita/year*	*tonnes*	*tonnes*	*%*	*tonnes*					
DAVAO CITY	1708972	0.21	0.0	-	2.00%	**7,174.1**					
add rows above as necessary…											

Waste Composition for LGU Waste Open Burned								
DAVAO CITY	Waste Type	Waste Composition - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		%	*tonnes (wet weight)*					
	Paper/cardboard	12.9%	925.5					
	Textiles	2.7%	193.7					
	Food waste	43.5%	3,120.7					
	Wood	9.9%	710.2					
	Garden and Park waste	0.0%	0.0					
	Nappies	0.0%	0.0					
	Rubber and Leather	0.9%	64.6					
	Other, inert waste	30.1%	2,159.4					

	Waste Type	Waste Composition - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		%	*tonnes (wet weight)*					
	Paper/cardboard	12.9%	925.5					
	Textiles	2.7%	193.7					
	Food waste	43.5%	3,120.7					
	Wood	9.9%	710.2					
	Garden and Park waste	0.0%	0.0					
	Nappies	0.0%	0.0					
	Rubber and Leather	0.9%	64.6					
	Other, inert waste	30.1%	2,159.4					

Waste Dry Matter Content (%) LGU Waste Open Burned								
DAVAO CITY	Waste Type	Waste Dry Matter Content - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		dry matter as % of we weight	*tonnes (dry weight)*					
	Paper/cardboard	90.0%	832.9					
	Textiles	80.0%	155.0					
	Food waste	40.0%	1,248.3					
	Wood	85.4%	606.5					
	Garden and Park waste	40.0%	0.0					
	Nappies	40.0%	0.0					
	Rubber and Leather	84.0%	54.2					
	Other, inert waste	90.0%	1,943.5					

	Waste Type	Waste Dry Matter Content - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		dry matter as % of we weight	*tonnes (dry weight)*					
	Paper/cardboard	90.0%	832.9					
	Textiles	80.0%	155.0					
	Food waste	40.0%	1,248.3					
	Wood	85.4%	606.5					
	Garden and Park waste	40.0%	0.0					
	Nappies	40.0%	0.0					
	Rubber and Leather	84.0%	54.2					
	Other, inert waste	90.0%	1,943.5					

Waste Carbon Content (% Carbon in Dry Weight) LGU Waste Open Burned								
DAVAO CITY	Waste Type	Waste Carbon Content - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		% carbon in dry weight	*tonnes carbon*					
	Paper/cardboard	46.0%	383.1					
	Textiles	50.0%	77.5					
	Food waste	38.0%	474.4					
	Wood	50.0%	303.3					
	Garden and Park waste	49.0%	0.0					
	Nappies	70.0%	0.0					
	Rubber and Leather	67.0%	36.3					
	Other, inert waste	3.0%	58.3					

	Waste Type	Waste Carbon Content - *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	Amount Burned (Open Burning)	Uncertainty of Data (%)	Account or File Code Where Data is Stored	Ownership and Storage Location of Data (e.g. government agency statistics database)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
		% carbon in dry weight	*tonnes carbon*					
	Paper/cardboard	46.0%	383.1					
	Textiles	50.0%	77.5					
	Food waste	38.0%	474.4					
	Wood	50.0%	303.3					
	Garden and Park waste	49.0%	0.0					
	Nappies	70.0%	0.0					
	Rubber and Leather	67.0%	36.3					
	Other, inert waste	3.0%	58.3					

Fossil Carbon Content (% Fossil Carbon) in Carbon of LGU Waste Open Burned								
	Waste Type	**Waste Fossil Carbon Content -** *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	**Amount Burned (Open Burning)**	**Uncertainty of Data (%)**	**Account or File Code Where Data is Stored**	**Ownership and Storage Location of Data (e.g. government agency statistics database)**	**Corresponding Quality Control (QC) Field in Applicable Checklist**	**Basis of the Estimate of Data Uncertainty**
DAVAO CITY		*% fossil carbon in carbon*	*tonnes dry weight fossil carbon*					
	Paper/cardboard	1.0%	3.8					
	Textiles	20.0%	15.5					
	Food waste	0.0%	0.0					
	Wood	0.0%	0.0					
	Garden and Park waste	0.0%	0.0					
	Nappies	10.0%	0.0					
	Rubber and Leather	20.0%	7.3					
	Other, inert waste	100.0%	58.3					
	Waste Type	**Waste Fossil Carbon Content -** *IPCC waste composition default values for Southeast Asia - LGU-specific values preferred*	**Amount Burned (Open Burning)**	**Uncertainty of Data (%)**	**Account or File Code Where Data is Stored**	**Ownership and Storage Location of Data (e.g. government agency statistics database)**	**Corresponding Quality Control (QC) Field in Applicable Checklist**	**Basis of the Estimate of Data Uncertainty**
		% fossil carbon in carbon	*tonnes dry weight fossil carbon*					
	Paper/cardboard	1.0%	3.8					
	Textiles	20.0%	15.5					
	Food waste	0.0%	0.0					
	Wood	0.0%	0.0					
	Garden and Park waste	0.0%	0.0					
	Nappies	10.0%	0.0					
	Rubber and Leather	20.0%	7.3					
	Other, inert waste	100.0%	58.3					

Data Collection Guidance: Wastewater (Scope 1)

	Name of Individual(s) Responsible for Data Input:	*Dr. Josephine Villafuerte Dr. Joy*	Date of Most Recent Data Entry:	*31/12/2017*	Quality Control (QC) Checker(s):	*Errol John Denosta Aldeth Manulat*	Corresponding Quality Control (QC) Checklist Filename:	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :
- Assumed that all data provided by the City Health Office is correct.

	LGU	Total Population in LGU	Reference Source(s) for Data *(e.g. treatment system types/distribution by population)*	Notes
	DAVAO CITY	1,708,972		

Overview of Wastewater Management Systems in LGU for Own Waste

					CH_4 Emissions Potential	N_2O Emission Potential	Is the system used in the LGU?	% population using the system	Population using the system	Data Uncertainty	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
					See legend below	*See legend below*	*Yes or No*	*%*	*Number*	*%*					
Uncollecte	Septic tanks						Yes	86.4%	1,476,059		City Health Office- Sanitary Division				
	Open Pits/latrines	dry climate, ground water table lower than latrine, small family (2-5 people)					Yes	10.5%	179,245		City Health Office- Sanitary Division				
		dry climate, ground water table lower than latrine, communal					No		-						
		wet climate/flush water use, ground water table than latrine					No		-						
		regular sediment removal for fertilizer					No		-						
	River Discharge	Stagnant oxigen deficientrivers and lakes					No								
		Rivers, lakes and estuaries					Yes	3.8%	65,600		City Health Office- Sanitary Division				
Collected	Untreated	River Discharge	Stagnant oxigen deficientrivers and				No		-						
			Rivers, lakes and estuaries				No		-						
		Sewers (closed and under ground)					No		-						
		Open Sewers					No								
	Treated	Aerobic	Centralized aeribic well managed				No		-						
			Centralized aeribic not well managed -				No		-						
			Sludge anaerobic treatment in				No		-						
			Aerobic shallow ponds				No		-						
		Anaerobic	Anaerobic lagoons	Shallow (less than 2 m)			No		-						
				Shallow more than 2 m)			No		-						
			Anaerobic reactors				No		-						
Totals								**101%**	**1,720,904**						

Overview of Wastewater Management Systems in LGU for Other Waste Sources (e.g. Waste Received from Other LGUs)

Waste Source (e.g. LGU Name from which Waste Received)	Total Population of Waste Source	Reference Source(s) for Data *(e.g. treatment system types/distribution by population)*	Notes

					CH_4 Emissions Potential	N_2O Emission Potential	Is the system used in the LGU?	% population using the system	Population using the system	Data Uncertainty	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
					See legend below	*See legend below*	*Yes or No*	*%*	*Number*	*%*					
Uncollected	Septic tanks								-						
	Open Pits/latrines	dry climate, ground water table lower than latrine, small family (2-5 people)							-						
		dry climate, ground water table lower than latrine, communal							-						
		wet climate/flush water use, ground water table than latrine							-						
		regular sediment removal for fertilizer							-						
	River Discharge	Stagnant oxigen deficientrivers and lakes							-						
		Rivers, lakes and estuaries							-						
Collected	Untreated	River Discharge	Stagnant oxigen deficientrivers and lakes						-						
			Rivers, lakes and estuaries						-						
		Sewers (closed and under ground)							-						
		Open Sewers							-						
	Treated	Aerobic	Centralized aeribic well managed						-						
			Centralized aeribic not well managed - overloaded						-						
			Sludge anaerobic treatment in aerobic plant						-						
			Aerobic shallow ponds						-						
		Anaerobic	Anaerobic lagoons	Shallow (less than 2 m)					-						
				Shallow more than 2 m)					-						
			Anaerobic reactors						-						
Totals								0%	-						

	Sources of GHG emissions
	Possible source of GHG emissions
	Possible source of GHG emissions when poorly designed
	No source of GHG emissions for this category

Data Collection Guidance: Wastewater (Scope 3)

	Name of Individual(s) Responsible for Data Input:	*Names…*	Date of Most Recent Data Entry:		Quality Control (QC) Checker(s):	*Names…*	Corresponding Quality Control (QC) Checklist Filename:	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions

	LGU	Total Population in LGU	Reference Source(s) for Data *(e.g. treatment system types/distribution by population)*	Notes
	DAVAO CITY	1,708,972		

Overview of Wastewater Management Systems in LGU

					CH_4 Emissions Potential	N_2O Emission Potential	Is the system used in the LGU?	% population using the system	Population using the system	Data Uncertainty	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, Government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of the Estimate of Data Uncertainty
					See legend below	*See legend below*	*Yes or No*	*%*	*Number*	*%*					
Uncollect	Septic tanks								-						
	Open Pits/latrines	dry climate, ground water table lower than latrine, small family (2-5 people)							-						
		dry climate, ground water table lower than latrine, communal							-						
		wet climate/flush water use, ground water table than latrine							-						
		regular sediment removal for fertilizer							-						
	River Discharge	Stagnant oxigen deficientrivers and lakes							-						
		Rivers, lakes and estuaries							-						
Collected	Untreated	River Discharge	Stagnant oxigen deficientrivers and lakes						-						
			Rivers, lakes and estuaries						-						
		Sewers (closed and under ground)							-						
		Open Sewers							-						
	Treated	Aerobic	Centralized aeribic well managed						-						
			Centralized aeribic not well managed - overloaded						-						
			Sludge anaerobic treatment in aerobic plant						-						
			Aerobic shallow ponds						-						
		Anaerobic	Anaerobic lagoons	Shallow (less than 2 m)					-						
				Shallow more than 2 m)					-						
			Anaerobic reactors						-						
Totals								0%	-						

	Sources of GHG emissions
	Possible source of GHG emissions
	Possible source of GHG emissions when poorly designed
	No source of GHG emissions for this category

Data Collection Guidance: Forestry Parameters

Name of Individual(s) Responsible for Data Input:	*Names…*	**Date of Most Recent Data Entry:**		**Quality Control (QC) Checker(s):**	*Names…*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions...

Forestry Data Entry Parameters

	Default values (tons/ha)	User-defined (tons/ha)	Reference and comments
Biomass Density in Remaining Forestlands	262	262	
Carbon Fraction in Biomass		***Equivalent Carbon***	
	Default Values (unitless)	**User-defined (unitless)**	**Reference and comments**
Fuelwood	0.49	0.49	
Charcoal	0.49	0.49	
Construction	0.49	0.49	
Novelties	0.49	0.49	
Used for Agriculture	0.49	0.49	
Used as Grasslands	0.49	0.49	
Left as Barren Areas	0.49	0.49	
Protection Forest/Old Growth/Mossy/Pine/Submar	0.45	0.45	
Secondary Growth	0.44	0.44	
Brushland - for wood	0.45	0.45	
Grassland	0.45	0.45	
Tree Plantation - *S.Macrophylla*	0.43	0.43	
Barren to Forestland	0.49	0.49	
Grassland to Forestland	0.49	0.49	
Wetlands to Forestland	0.49	0.49	
Settlement to Forestland	0.49	0.49	
Cropland to Forestland	0.49	0.49	
Biomass Growth Rate			
	Default (tons/ha/year)	**User-defined (tons/ha/year)**	**Reference and comments**
Used for Agriculture	7.81	7.81	
Used as Grasslands	7.81	7.81	
Left as Barren Areas	7.81	7.81	
Protection Forest/Old Growth/Mossy/Pine/Submar	2.10	2.10	
Secondary Growth	6.50	6.50	
Brushland - for wood	9.40	9.40	
Grassland	2.00	2.00	
Tree Plantation - *S.Macrophylla*	7.50	7.50	
Barren to Forestland	7.81	7.81	
Grassland to Forestland	7.81	7.81	
Wetlands to Forestland	7.81	7.81	

Settlement to Forestland	7.81	7.81	
Cropland to Forestland	7.81	7.81	
	Default Values (unitless)	**User-defined (unitless)**	
Conversion factor, C to CO_2	3.67	3.67	
Wood Density	**Default (tons/cu.m.)**	**User-defined (tons/cu.m.)**	
Fuelwood	0.41	0.41	
Construction	0.61	0.61	

Data Collection Guidance: Forestry Emission Activity Data

Name of Individual(s) Responsible for Data Input:	*Mr. Arnel C. Llido*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumption :

District or Barangay	Total Population in District or Barangay				Notes
Davao City	1708972				

Forestry Emission Sources

District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g. , Others) - *please select from drop-down*	Emission Type	Emission Source (*please select from drop-down)*	*Annual* Total Consumption	Units (*please select from drop-down*)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/ Other Agency	Ownership and Storage Location of Data (e.g. LGU server, government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist	Basis of Data Uncertainty
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Fuelwood	2	cubic meters		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	N/A	
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Charcoal	51	cubic meters		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	N/A	
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Wood and Wood Products Harvesting	Construction	30	cubic meters		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	N/A	
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Changes in the Use of the Forestlands	Used for Agriculture	12,458	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	N/A	
Davao City	Forest Land Use Plan	Census Averages (e.g. National or Provincial Per Registered Business Consumption)	Changes in the Use of the Forestlands	Left as Barren Areas	19	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	N/A	
*z... add rows **above** as necessary*												

Data Collection Guidance: Forestry Removal Activity Data

Name of Individual(s) Responsible for Data Input:	*Mr. Arnel C. Llido*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Manulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumption:

District or Barangay	Total Population in District or Barangay				Notes
Davao City	1708972				

Forestry Removal Sources

District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g. , Others) - *please select from drop-down*	Removal Type (*please select from drop-down*)	Removal Source (*please select from drop-down*)	*Annual* Total Removal	Units (*please select from drop-down*)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Protection Forest/Old Growth/Mossy/Pine/ Submarginal Mangrove	4,920	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Secondary Growth	13,651	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Brushland - for wood	79,188	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Tree Plantation - S. macrophylla	3,225	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	
Davao City	Forest Land Use Plan	Other (e.g. Fuel Supplier Totals)	Remaining Forestland	Grassland	15,636	hectares		City Planning and Development Office (Project Monitoring and Management Division)		City Planning and Development Office (Project Monitoring and Management Division)	
*z... add rows **above** as necessary*											

Data Collection Guidance: Industrial Processes Emission Activity Data

Name of Individual(s) Responsible for Data Input:	*Errol John Denosta*	**Date of Most Recent Data Entry:**	*31/12/2017*	**Quality Control (QC) Checker(s):**	*Errol John Denosta* *Aldeth Mnaulat*	**Corresponding Quality Control (QC) Checklist Filename:**	*filename.xls*

LGU-Specific Assumptions and Notes on Methodology

Assumptions :

District or Barangay	Total Population in District or Barangay	Total Number of Registered Businesses in District or Barangay (enter "N/A" if no survey data used)	Number of Businesses Surveyed (enter "N/A" if no data)	Representative Sample of Businesses Surveyed	Notes
Davao City	1708972				

Industrial Processes Emission Sources

District or Barangay - *please select from drop-down*	Data Source Identifier	Type of Data (e.g. , Others) - *please select from drop-down*	Industry Type (*please select from drop-down*)	Operation (*please select from drop-down*)	*Annual* Total Production	Units (*please select from drop-down*)	Data Uncertainty (see source section in 'Guidance for GHG Inventory Data Collection and Quality Management' document for guidance)	Account or File Code Where Data is Stored	Date Transcribed from Survey or Data Sourced from Government/Other Agency	Ownership and Storage Location of Data (e.g. LGU server, government office, organization)	Corresponding Quality Control (QC) Field in Applicable Checklist
Davao City	Holcim Philippines	Individual Business Surveys	Mineral Industry	Cement Production - Portland	1,430,224	tons		Holcim Philippines		Holcim Philippines	
*z... add rows **above** as necessary*											

PROPOSED CLIMATE CHANGE MITIGATION OPTIONS

Report based on Davao City Local Climate Change Workshop January 30-31, 2020 Malayan College Mindanao (A Mapua School)

Background

As proposed by the stakeholders during the Davao City Local Climate Change Formulation Workshop, January 30 to 31, 2020 at the Malayan Colleges, Mindanao Campus (A Mapua School). The workshop was organised by the Davao City LGU, Institute for Global Environmental Strategies (IGES) and Malayan Colleges, Mindanao (A Mapua School).

The stakeholder's forum was participated by around 100 participants from Davao City LGU, government agencies such as DENR, DPWH, DA, DOE, and NCIP; private businesses such as the Davao Light and Power Company, academes such as Malayan Colleges Mindanao, Ateneo de Davao University; Civil Society Organisations based in Davao such as Interfacing Development Interventions for Sustainability, Sustainable Davao Movement, Minland Foundation, World Peadr Committee, Philippines Eagle Foundation, Tambayan, Guide Inc., and among others.

The stakeholders agreed to conduct a further review of the proposed options for the finalization of the LCCAP Plan by April 2020. Further details on human resource and financial mechanisms to develop the options in a plan will be part of the discussion.

This report compiles the current initiatives and list of Climate Change mitigation and adaptations options of Davao City LGU, government agencies, private businesses, academe based in Davao City and CSOs.

The mitigation options was categorised based on the priority areas identified in the National Climate Change Action Plan. The National Climate Change Action Plan (NCCAP) outlines the long-term program and strategies for climate change adaptation and mitigation in line with national development plans. Adopted in 2012, the NCCAP was developed through a multi-sectoral and multi-stakeholder approach and covered key climate actions in the strategic priorities are defined along thematic outcomes – food security, water sufficiency, ecosystem and environmental stability, human security, climate smart industries and services, sustainable energy, knowledge and capacity development. The NCCAP is also envisioned as foundational document vis-à-vis the development of national commitments and disclosures such as Nationally Determined Contribution and National Adaptation Plan. Davao City's commitment to developing its Local Climate Action Plan by piloting its GHG Inventory for the first time sets a local precedence in achieving the Philippines' Nationally Determined Contribution to global climate change targets by 2030.

The proposed priority areas also corresponds to key sustainable goal target 13, taking urgent action to combat climate change, and its impacts. These follows along key SDG 13 target areas:

13.1 Strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries;
13.2 Integrate climate change measures into national policies, strategies, and planning;
13.3 Improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning;
13.a Implement the commitment undertaken by developed country Parties to the UNFCCC to a goal of mobilizing jointly USD100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation

actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible; and

13.b Promote mechanisms for raising capacities for effective climate change-related planning and management, in LDCs, including focusing on women, youth, local and marginalized communities.

Sustainable Development Goals

Source: UNFCC

A. CURRENT INITIATIVES

Current Initiatives of the local government units, government agencies and civil society organization to ensure food security in Davao City, addressing climate change impacts and as well as achieve sustainable development goals for the city.

FOOD SECURITY

1. Davao City Agriculturist Office and Department of Agriculture

- Introduction and research of climate resilient, drought and flood resistant crops
- Development Irrigation System
- Rainwater Catchment System
- AMIA (Adaptation Mitigation Initiatives in Agriculture)
- Soil management and conservation practices such as SALT (Sloping Agricultural Land Technology)
- Sustainable Rural Development projects – by DENR, DA, and DILG
- Climate Resilient Village in partnership with a private business, developer/company (DCCI)
- Pest and disease surveillance
- Utilization of waste for fertilizer and fuel
- Rice-Fish culture (Palaymanan)
- Organic Agriculture training and support
- Risk transfer schemes
- Credit support services to eligible farmers and entities

2. Flagship Projects

- Maligaya Flatbed Dryer. Used farm by-products like rice hull, corn cobs, or coffee hulls as fuel for heating drying air; allows drying during unfavorable weather conditions, i.e. at night and during typhoons; and allows income generation from custom drying operations.
- Rice Husk Gasifier Engine. Utilizes rice hull biomass as source of energy; sustainable and environment-friendly; can be used for stationary shaft power application including water pumping, power generation, rice milling.
- Maligaya Rice Hull Stove. Inexpensive and easy to fabricate; environment-friendly; practically smokeless; and efficient and economical.
- Floating garden project. Growing vegetables in the perpetually flooded areas.
- Rice Hull Carbonizer. Lightweight, portable, and easy to fabricate; aasy to operate and requires less attention; and efficient, environment-friendly, economical and practically smokeless.

3. Department of Education is implementing vegetable gardening in the schools and organic farming.
4. CSO projects on urban containerise gardening.
5. The City Veterinarian's Office steers the development of organic pasture area for livestocks and development of ethno-medicinal garden.

ECOLOGICAL ENVIRONMENTAL STABILITY

1. Green Building Code - LED/Energy saving lamps, ventilation and insulation
2. Rainwater harvesting Ordinance by Davao City LGU
3. Biogas from Livestock Production project by the Department of Agriculture
4. Carbon Sink Forest (Adop-a-site project of DCWD) by the Watershed Management Council, Davao City Water District, DENR-EMB
5. Deployment of Pollution Control Officers (PCOs and Industry) by DENR-EMB
6. Development of Bamboo Industry as alternative to wood by the Department of Trade and Industry
7. Organic Agriculture Economy (Passaged of Ordinance in Davao City) by City Agriculturist Office
8. Recycling and Composting Facilities by the City Environment and Natural Resources Office

CLIMATE SMART INDUSTRIES AND SERVICES

1. Internal policies on climate change
2. Policy advocacy and lobbying on Environmental issues at the local level
3. Conduct of environmental researches contributing to address climate change
4. Conduct of environmental activities such as community-based water management, tree growing and adopt-a-riverbank program
5. Litigation and consultation on environmental issues on watershed, mining and aerial spray

SUSTAINABLE ENERGY

Mainly initiated by the Department of Energy, Davao Light and Power Company, City Government of Davao and Institute for Environmental Strategies (IGES)

1. Consultations/meetings on vulnerability adaptation assessment, CLUP Climate disaster risk assessment mainstreaming; GHG inventory, and formulation of LCCAP.
2. Mix use of energy resources e.g 68% on renewable energy; annual tree planting activities; and public awareness on radio about electrical safety and energy conservation.
3. Rural household electrification
4. Rural renewable energy
5. Introduction of solar panels
6. Implementation of LED lights and solar panels in building and project design

7. Sister City collaboration with Kitakyushu City Japan and Davao City supporting GHGI and LCCAP formulation, coordinated by IGES

WATER SUFFICIENCY

1. Sewerage & Septage Treatment Plant (50% to 60% Fund)
2. Water Supply Facility (level 1 and 2) [Tourism Water Supply Infrastructure Program]
3. Rainwater Harvester for all Department of Education Schools (e.g. 4 cu. m/tank)
4. Installation of Rainwater collection system for all DPWH offices
5. Tree Transplanting 1:200 (for every tree cut; replant 200 trees) by DPWH.

Government Agencies. Department order no. 187 series of 2015 (policy guidelines on water conservation measures)

– Section 2: Water pump shall be turned on at 7:00 am and turned off at 5:30 Pm during weekdays.
– Section 3: All officials and employees shall turn off the faucets in their respective offices and comfort room when not in use. Everyone shall use containers/glasses when brushing their teeth, washing their hands, cleaning room and other related activities.
– Section 4: Plants shall be watered early in the morning before 10:00 am or late in the afternoon at 4:00 pm onwards to minimize evaporation, consequently giving the plants enough water supply for at least 3 days.
– Section 5: Shuttle buses and other service vehicles shall be washed not more that once week, unless there is a pressing need to wash them (e.g vehicle is covered with mud from previous trip). Pails and “tabo” shall be used for cleaning said vehicles instead of hoses, unless the hose used is a high pressure, low volume type.

HUMAN SECURITY

1. Developed a DRRM Plan for Davao City under the coordination of the DRRM Office
2. Final draft of the updated Comprehensive Land Use Plan for Davao City
3. Ongoing barangay profiling and inclusion of GHG related data collection at the community level by CPDO and Barangay Development Council
4. GHG Inventory by CPDO, TWG members and IGES
5. Various health programs by the City Health Office

MITIGATION OPTIONS AND PRIORITY AREAS

There are already a number of initiatives that has been pushed forward to address and mitigate the impacts of climate change. The stakeholders of the Davao City LCCAP Formulation Workshop are proposing for the following priority areas as added GHG mitigation options, adaptation measures, and as overall inputs to the LCCAP planning process.

FOOD SECURITY

What must be done?	What do we need to fulfill/achieve it?	Who will do it?	Mitigation/SDG Targets
Land Conversion Regulation	- Protect prime agriculture areas from conversion to other uses - Lobby for limit in allowed conversion to 15%	Davao City Agriculture; Fisheries Development Plan	GHG emissions reduction SDG 13
Soil management of areas prone to Landslide/Soil Erosion	- Introduction of Sloping Agriculture Land Technology - Practice of zero/minimum tillage farming		Mitigation - reduction of GHG releases from soil and biomass; low carbon SDG 13, 15
	Multi-cropping system		Reduction of synthetic fertilisers and pesticides; low carbon emissions SDG 2, 12, 13, 15
	Regulate mechanised farming		Minimum tillage - reduction of GHG releases from soil, low carbon SDG 13, 15
Go for renewal energy sources	Explore windmill, solar powered pump and irrigation system		Reduction of fossil fuel use; GHG emission reduction; low carbon SDG 13, 7, 11
Water Conservation	Rainwater harvesting and utilisation of small farm reservoir		Conservation/adaptation measure; ensue water sufficiency during disasters ad calamities (adaptation and resilience) SDG 6, 13, 15

Bio energy	Process livestock/poultry waste into organic fertiliser; Biogas technology		GHG emissions reduction, 2, 7, 11, 15
Ensure Food sufficiency	Community gardening establishment (household and community)		Resilience building: Reduction of poverty and hunger; food sufficiency, health safety SDG 1, 2, 3, 13
Revisit Convergence Area Development			
Partnership with schools and universities	Research/technology on resilient agricultural technology		SDG13
Adaptive Mitigation Initiatives in Agriculture	Duplicate successful projects		SDG13

ECOLOGICAL ENVIRONMENTAL STABILITY

What must be done?	What do we need to fulfill/achieve it?	Who will do it?	Mitigation/SDG Targets
Greening	Incorporate TREES as infrastructure plan		GHG emissions reduction SDG 13
	Coordinate Tree cutting with LGU (DPWH)	CPDO	Mitigation - reduction of GHG releases from soil and biomass; low carbon SDG 13, 15
	Proper planning for mangrove trees		Reduction of synthetic fertilisers and pesticides; low carbon emissions SDG 2, 12, 13, 15
	Monitoring of parks and open spaces (CENRO, academe, NGO)		Minimum tillage - reduction of GHG releases from soil, low carbon SDG 13, 15
	Cultivate nurseries for endemic trees	Local community, academe, CENRO	Reduction of fossil fuel use; GHG emission reduction; low carbon SDG 13, 7, 11
	Adapt local indigenous knowledge and practices in CCA/DRR		Conservation/adaptation measure; ensue water sufficiency during disasters ad calamities (adaptation and resilience) SDG 6, 13, 15
	Include trees in building designs, especially those along busy streets		GHG emissions reduction, 2, 7, 11, 15
	Identify more urban green spaces		Resilience building: Reduction of poverty and hunger; food sufficiency, health safety SDG 1, 2, 3, 13

Hazard Zones/ Reclaim as buffer zones	Transfer communities in hazard zones		SDGs 13
	Strictly implement the zoning ordinance		GHG emissions reduction SDG 13
Improve solid waste management system (RA 9003)	Expand the collection of residuals	CENRO	Mitigation - reduction of GHG releases from soil and biomass; low carbon SDG 13, 15
	Implement RA 9003 at institutional levels e.g. academe		Reduction of synthetic fertilisers and pesticides; low carbon emissions SDG 2, 12, 13, 15
	Fastrack the septage management	DCWD, CEO, CHO	Minimum tillage - reduction of GHG releases from soil, low carbon SDG 13, 15
	Implement a Davao Gulf Management Plan	Network	Reduction of fossil fuel use; GHG emission reduction; low carbon SDG 13, 7, 11
Promote Sustainable Transport (mass transport)	Regulate private vehicle use (including motorcycles)		Conservation/adaptation measure; ensue water sufficiency during disasters ad calamities (adaptation and resilience) SDG 6, 13, 15
	Reserve pedestrian only areas (e.g. City Hall)		GHG emissions reduction, 2, 7, 11, 15
	Policy lobbying	NGOs	Resilience building: Reduction of poverty and hunger; food sufficiency, health safety SDG 1, 2, 3, 13
	Identify and declare Marine Protectd Areas		SDG

CLIMATE-SMART INDUSTRIES AND SERVICES

What must be done?	What do we need to fulfill/achieve it?	Who will do it?	Mitigation/SDG Targets
Amend Green Building Code	Require permeable pavement		Water conservation/water sufficiency (resilience building) SDG 11
	Rainwater Conservation		SDG6
	Rooftop garden		GHG removal by carbon sink SDG 2, 11, 13
	Build Green Houses		Low carbon SDG 2, 11, 13
Mandatory Materials Recycling Facility for all Barangay Local Government Units	Commercial establishments, institutions/schools, subdivisions	LGU, BLGU, Developers, Homeowners Association, Academe	Low carbon SDG 11
Improve Carbon Sink/Forest	Public land conservation areas scheme	DENR, LGU, Industries	GHG removal SDG 15, 13
	Designate/build urban parts that is accessible to all		GHG removal SDG 15, 11, 13
	Deploy Forest Guards (e.g. Bantay Bukid) for monitoring		Protection and community participation in mitigating/combating climate change impacts SDG 15, 17
Promotion/Incentives for Green Jobs	Enterprise and comapanies	DTI, DOLE, LGU	Low carbon SDG 1, 8

Review and update emission and effluent standards	More parameters, especially for GHG strict monitoring	FPA, EMB, DA, CS	GHG national level standards SDG 13
	Mandatory GHG monitoring for small to medium scale industries and recycling plants	EMB, LGU	Enabling, LGU action to combat climate change; GHG inventory reporting SDG 11, 9
	Strictly enforce RA 9003; SLF as final disposal method for solid waste	EMB, City ENRO	Low carbon SDG 11
EPR	Zero waste; plastic free packaging	DTI	SDG 11
Establish/require production data reporting		EMB, DTI, LGU, MMT, SMR	SDG17

CLIMATE-SMART INDUSTRIES AND SERVICES

What must be done?	What do we need to fulfill/achieve it?	Who will do it?	Mitigation/SDG Targets
Housing Development	High density/vertical tenement/row house/clustered planning	LGU, DHSUD, Developer, Private Sector, NHA	Low Carbon SDG 11
Quarrying Industry	Amendment/review mining ordinance	LGU, CENRO, CMRB, DENR, CEO, Operators	SDG 13, 15
	Capacity threshold study		
	Enforcement of low impact operation		

KNOWLEDGE AND CAPACITY DEVELOPMENT

What must be done?	Who will do it?	Mitigation/SDG Targets
Intensify research and data availability	Academic Institutions (USEP, AdDU, Malayan, UM, etc.), DOST, DENR, CPDO, IDIS	
Intensify capacity building and knowledge sharing among the Barangays in Davao City	DILG, LGU, ABC, CSOs	Understanding climate risks and mitigating measure among constituencies SDG 13
Intensify climate change discourse through fora, symposia, and other avenues for dialogues	NGAs, LGAs, and CSOs	Understanding climate risks and mitigating measure among constituencies SDG 13, 17
Engage youth in climate change issues	DepEd, LGU, CSOs, SK, Youth Organizations	Understanding climate risks and mitigating measure among constituencies SDG 13, 17
Develop IEC materials that are reader-friendly	LGU (CIO) and CSOs	Understanding climate risks and mitigating measure among constituencies SDG 13
Engage and utilize multi-media in campaigning to address climate change issues	LGU and CSOs	Understanding climate risks and mitigating measure among constituencies SDG 13

SUSTAINABLE ENERGY

What must be done?	What do we need to fulfil it?	Who will do it?	Mitigation/SDG Targets
Mini Hydropower supply for off-grid and forested areas	Conduct studies in collaboration with agencies	Collaboration of related government agencies, NGOs and Its	Investments for GHG emissions reduction, low carbon SDG 13, 11, 7
Vehicle conversion: use of alternative fuels	Conduct studies with government agencies	Collaboration with relevant government agencies	Investments and technology innovation for GHG emissions reduction SDG 11, 13, 7
Upgrade to biodiesel fuels	Conduct Feasibility Studies	Department of Energy	Investments for GHG emissions reduction, low carbon SDG 7, 13
Promote Euro IV Fuels	Information Education Communication Campaigns on Liquid fuels conservation	Department of Environment and Natural Resources	Investments and technology to reduce GHG emissions SDG 7, 13

WATER SUFFICIENCY

What Needs to be done	What do we need to fulfil it?	Mitigation/SDG Targets
a. **Integrated Water Resource Management**	Integrated Watershed mgt program	**Mainly GHG removal, by carbon sink forest protection, adaptation and resilience building**
	Watershed rehabilitation project	SDG 17, 15
	Forest & Biodiversity protection project (forest guardians & foot patrolling)	SDG 15
	Riverbank rehabilitation conservation projects	SDG 15
	Environmental monitoring (rivers)	SDG 15
	Sustainable upland farming & backyard gardening	SDG 2, 15
	Capacity buildings & IECs	
	Adopt-A-Site Project (Tree planting and parenting w/ partner PO's/Agencies)	SDG 15, 13
2. **Water safety plan (from source to customer)**		SDG 6
3. **Water sanitation & hygiene**		SDG 6
4. **PUSH UP (Public Utility Sanitation & Health Upgraded Program)**		
5. **Tubig(water) Ambassadors**		SDG 17
6. **Water Statistics Monitoring**		SDG 7
7. **Septage Management Program**		SDG 13, 11
8. **Rain water Harvesting Campaign**		SDG 15, 13, 11
9. **Ground Water Study**		SDG 7

10. **Tanugan Surface Water Development Plan**		SDG 17
11. **Water & Sanitation (Level 1 & 2) Committee**	Inventory of levels 1 & 2	SDG 3, 6
	Proposed water system for funding	SDG 7
12. **Strengthen Bawasa**	Brgy. Water & sanitation	SDG 7
13. **Adopt-A-Tree**	Yearly tree planting activity in ancestral domain areas of Davao City (Watershed Areas)	SDG 15
14. **Tamugan riverbank (malibago) planting and growing**		SDG 15
15. **River water quality monitoring**		SDG 15
16. **Biodiversity monitoring (PTW)**		SDG 15
17. **Illegal logging activities and cleaning tamugan river & tributaries monitoring**		SDG 15
18. **Monitoring natural calamities and tree planting % IDIS**	Massive tree planting in PTW	SDG15
	Declare Panigan-Tamugan as organic zone	SDG15
	Identify and monitor the main water run-off for the hills of PTW	SDG15
	Develop eco-friendly livelihood for upland charcoal makers (to prevent charcoal making)	SDG15
	DPWH should coordinate w/ LGU's & other agencies before doing tree cutting & slope benching along riverbanks and steep slope	SDG 15, 17
19. **Politicians should also consider the environmental impacts of the infrastructure projects to propose.**	City Council should immediately act in the Draft MOA and septage management (naay ID and potential septage site and DCWD)	SDG 11SDG 6

	Protect the natural surface water sources for the future water needs in Davao City. (ie for Apo Agua Facilities)	SDG 6, 15, 13
	No chemical based “parties” or activities that contaminated rivers/watershed should not be allowed	SDG 6, 15, 14
	No swimming pool resorts in the watershed	SDG 6,15
	Massive tree planting in all Davao City water shed espcially in PTW.	SDG 6, 15,16
	Individual efforts to change to eco-friendly lifestyle.	SDG 13

HUMAN SECURITY

What Needs to be done	What do we need to fulfil it?	Mitigation	SDG Targets
Barangay Profiling	Monitoring and enforcement	Improvement of GHG inventory and reporting	SDG13
Life Cycle Approach			SDG9
Raising Awareness and education on climate change			SDG13
Urban Forestry Landscape Programs		GHG removal	SDG15
Retrofitting of public buildings (Green Building Code)		Low carbon	SDG11

Annex A

List of organisations, Davao City LGU, and government agencies who participated in the 2 day workshop, January 30-31, 2020 at the Malayan Colleges Mindanao, Davao City

Government

1. Davao City- City Planning and Development Office
2. Davao City Council, Davao LGU
3. Davao City Water District
4. Sanggunian Kabataan (Youth Council)
5. City Disasater Risk Reduction and Management Office (CDRRMO)
6. Environment and Natural Resources Office (CENRO)
7. Department of Environment and Natural Resources - Environment Management Bureau (DENR-EMB)
8. City Councillor of 1st District - City Council
9. Department of Energy (DOE Mindanao)
10. Department of Agriculture (DA) Region X1
11. City Transportation and Traffic Management Office (CTTMO)
12. City Agriculturist Office, Davao City
13. Department of education Region XI (DepED)
14. National Commission on Idigenous Peoples (NCIP Region XI)
15. Department of Public Works and Highways (DPWH)
16. City Veterinarians Office

Civil Society GroupCity s

17. Interface Development Interventions for Sustainability
18. Guide Inc.
19. FSD
20. Mindanao Land Foundation
21. San Lorenzo Foundation
22. World Peace Committee
23. SALIGAN (Alternative Law Group)

Academe

24. Malayan Colleges Mindanao
25. Ateneo de Davao University

26. Ecoteneo - Ateneo de Davao University
27. Philippine eagle Foundation
28. SEA - Ateneo de Davao University
29. Tambayan (Child and Youth)
30. Masipag (CSP Organic Agriculture Practitioners and Advocates)
31. University of the Philippines School of Law (Usep - SoL)

Private Businesses/Companies

32. Davao Light and Power Company (DLPC)

Community groups/volunteers

33. Bantay Bukid (Forest Watch) - Community

International Partners/Guests

34. Institute for Global Environmental Strategies
35. APLA

LUMINAIRE REQUIREMENTS		60W	80W	110W	210W
Correlated Color Temperature (CCT)	3000K (Warm White)				
Color Rendering Index (CRI)	Luminaires shall have a minimum CRI of 70.				
Minimum Luminaire Efficacy	Minimum 105 lm/W for Warm White				
Operating Environment	Luminaire shall be able to operate normally in temperatures from -20° C and 50° C.				
Cooling System	Shall consist of a heat sink with no fans, pumps, or liquids, and shall be resistant to debris buildup that does not degrade heat dissipation performance.				
Housing	Shall be primarily constructed of die cast aluminum, A380. Finish shall be gray in color, powder coated and rust resistant. Driver must be mounted internally and be replaceable. Driver must be accessible without tools. All screws shall be stainless steel. Captive screws are needed on any components that require maintenance after installation. No parts shall be constructed of polycarbonate unless it is UV stabilized (lens discoloration shall be considered a failure under warranty).				
Ingress Protection	Shall be rated at a minimum of IP65 (both optical and gear compartment)				
Wind Velocity Resistance	At least 180kph				
Luminaire Classification	**Full Cutoff.** A luminaire light distribution where zero candela intensity occurs at or above an angle of 90° above nadir.				
PE Cell Receptacle	NA				
Luminaire Protector	Hinged Tempered Glass or Transparent weather resistant grade polycarbonate optics				
Mounting Arm	Luminaires shall mount on 1” 1/2” O.D. pipe with no more than four bolts and two piece clamp.				
Tilting feature	Can be tilted up to 15 degrees				
Vibration Protection	Meets 3G vibration per ANSI C136.31				
Impact Protection	IK08				
Luminaire and LED Module Lifetime	The luminaire shall have a minimum rated lifetime of at least L80B10 = 100,000 hours The supplier shall provide the technical specifications of the luminaire (which are based on state-of-the-art measurement methods including, where available, harmonized European standards				
Equipment Identification	Serialized/Barcoded. Shows wattage and current ratings.				
Dimension	Supplier to provide				
Weight	Supplier to provide				

POWER SUPPLY/DRIVER REQUIREMENTS					
Power Input	120-277 Volts AC, 60Hz				
Power Factor	Power factor at full load≥ 0.90				
Electrical Protection	Shall have Class II electrical Protection				
Surge Protection	Up to 10KV				
Operating Temperature	Power Supply shall operate between -20° C and 50° C.				
Lifetime of Driver	The failure rate of the driver shall be lower than 0.1 % per 1,000 hours. Failure after 100,000 hours shall be lower than 10 %. The supplier shall provide the technical specifications of the control gear (based on recognized state-of-the-art measurement methods including, where available, harmonized European standards)				
Frequency	Output operating frequency must be≥ 120 Hz (to avoid visible flicker) and input operating frequency of 60 Hz.				

WARRANTY					
Warranty period	A warranty must be provided for the full replacement of the luminaire due to any failure within a minimum of five (5) years.				
Luminaire lumen output	The luminaire shall maintain 80% of its initial lumen output within the warranty period. Full replacement of the lumenaire if the lumen instrument reading is below 80%.				
Driver maintenance	The warranty shall provide for the repair or replacement of defective electrical parts (including light source and power supplies/drivers) for a minimum of five (5) years from the date of installation.				
Spare parts availability	The availability of spare parts shall be guaranteed for a period of (10) ten years. Concerning repairability, the light source (lamp or LED module) and auxiliaries must be easily accessible and replaceable on site (i.e. at luminaire mounting height). Repair shall be accomplishable with standard, widely accessible tools.				
Replacement of defective batch	Complete replacement of batches of luminaires in case more than 10 % of the units in the batch are defective after 1000 hours of utilization or 83 days				

照明器具の要件		60W	80W	110W	210W
相関色温度 (CCT)	3000K (温白色)				
演色評価数 (CRI)	最低CRI値は70であること				
照明器具の最低エネルギー効率	温白色で最低105 lm/W				
使用環境	-20℃～50℃で正常に使用できること				
冷却システム	放熱板で構成されていて、ファン、ポンプ、液体を含まないもの、かつ、塵等の堆積に強く、熱放散性能を劣化させないもの				
ハウジング	主としてアルミダイキャストA380製であること。仕上がり色はグレー、粉体塗装仕上げ、防錆処理済み。駆動部は内部に取り付けてあり、交換可能であること。駆動部には工具なしでアクセスできること。ネジ類は全てステンレス製。設置後のメンテナンスが必要となる部品には全て拘束ネジを使用すること。部品の材質については、紫外線安定化処理が施されていないポリカーボネイトは、一切使わないこと（レンズの変色は保証内）。				
防塵防水性能	最低でもIP65クラスであること（光学部品、ギア部品とも）				
風速抵抗	最低180kph				
照明器具分類	フルカットオフタイプ。天底角が90℃以上で、光度が0キャンデラの地点において配光あ				
PEセルレセプタクル	なし				
照明器具保護器具	蝶番付きの強化ガラス、または透明の耐候性クラスのポリカーボネイトレンズ				
設置アーム	外径1インチ半のパイプに4個以下のボルトと2個のクランプで設置する。				
傾斜仕様	15度まで傾斜可				
振動保護	ANSI規格C136.31で3Gの振動に耐える				
衝撃保護	IK08				
照明器具およびLEDモジュールの寿命	最低でもL80B10クラス、すなわち10万時間の寿命であること。 照明器具の技術仕様書（最新の計測方式に基いており、必要があればヨーロッパの基準に適合しているもの）がメーカーから提供されていること				
機器の識別	シリアルナンバー/バーコード付き。定格電力値、定格電流値が表示されている。				
寸法	メーカーが提供				
重量	メーカーが提供				

電源/駆動部の要件					
入力電源	交流120-277 V, 60Hz				
力率	全負荷での力率　0.90以上				
電気的保護	クラス2の電気的保護レベル				
サージ保護	10KVまで				
使用温度	電源は -20℃～50℃の範囲で使用可能				
駆動部の寿命	駆動部の故障率は1000時間あたり0.1%未満、10万時間を超えた後の故障率は10%未満とする。 コントロールギアの技術仕様書（承認済みの最新計測方式に基いており、必要があればヨーロッパの基準に適合しているもの）がメーカーから提供されていること。				
周波数	出力動作周波数は120 Hz以上（視認性のちらつきを避けるため）、入力動作周波数は60 Hz				

保証					
保証期間	最低5年以内に起こった故障については、照明器具の一括交換を保証する。				
照明器具ルーメン出力	初期ルーメン出力の80%を保証期間内において維持すること。ルーメン計測値が80%を下回る場合は照明器具の一括交換を行う。				
駆動部のメンテナンス	電気部品不良（光源、電源/駆動部を含む）については、設置日から最低5年間、その修繕および交換は保証範囲内とする。				
スペア部品の調達	スペア部品の調達は10年間保証されること。修繕の可否については、光源（電球またはLEDモジュール）および付属部品は現地調達可能で、照明器具を設置した状態で（つまり設置高さのままで）交換できること。標準的で入手しやすい工具で修繕が可能であること。				
不良バッチ製品の交換	同一バッチの照明器具について、1000時間または83日間使用した後の故障率が10%を超える場合、当該バッチの製品はすべて交換すること。				

		DHOWA NIINUMA EVALUATION					
		160W	80W	60W	45W	REMARKS	Recommendation
Model	NEW					PASSED	
Wattage	DLPC	210W	110W	80W	60W	ACCEPTABLE	
	Sample	160W	80W	60W	45W		
Lumen Package	DLPC	22050	11550	8400	6300	LESSER BUT ACCEPTABLE	
	Sample	21920	10960	8220	6165		
LED Chip Brand	No established standard yet					PASSED	
	Sample	Lumileds					
LED Nodes (qty)	DLPC	>50 nodes	>30 nodes	>20 nodes	>15 nodes	PASSED	
	Sample	120	54	36	36		
Efficacy (Lumens/Watt)	DLPC Min Required: 105 lumes/watt					PASSED (Better)	
	Sample	137	137	137	137		
Actual Wattage Consumption (Watts)	Should not exceed 5Watts of rated wattage (165W,85W,65W,50W)					PASSED	
	Sample	157.9W	83W	57.8W	41.5W		
Surge Protection	Should have 10kV SPD					PASSED Except 80W	All wattage shall comply.
	Sample	20kV	None	20kV	20kV		
Temperature °C	Should not exceed 85 Degrees C					PASSED	
	Sample	-	38 deg	-	-		
Ingress Protection	Should be IP66 rated					PASSED	
	Sample	IP66	IP66	IP66	IP66		
Body Alloy	DLPC	A380				PASSED (Better)	
	Sample	ADC12					
Average Illuminance (Lux)	No average illuminance standard					PASSED (Better)	
	Sample	36.74	15.51	14.09	11.36		
Uniformity	No uniformity standard					PASSED	
	Sample	0.14	0.13	0.21	0.26		
Mounting Bracket Diameter	Should be 42mm inside diameter					Spigot is too big to fit for our existing bracket.	Ask Supplier to change the spigot to fit to 1 1/2"" bracket diameter. Preferred diameter is 42mm
	Sample						
		67mm	67mm	54mm	54mm		
Mounting Bracket Bolts	At least 2 bolts (1 inch length) with lock nut					2 bolts without lock nut	Require lock nut
							
	Sample	1in	1in	1in	1in		

Conclusion Models passed but with some minor revisions.

JCM Model Project for LED Light Project in Davao City

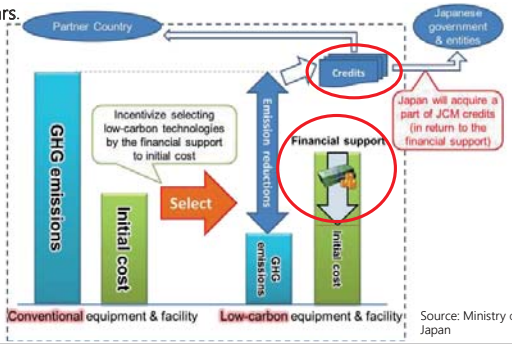
January 31st, 2020

Shiko Hayashi
Programme Director, Kitakyushu Urban Centre

IGES
Institute for Global Environmental Strategies

Financing Programme for JCM Model Project

- Scope of the financing:
  Facilities, equipment, vehicles, etc. which **reduce CO_2 from fossil fuel combustion** as well as construction cost for installing those facilities, etc.
- Eligible projects:
  Starting installation after the adoption of the project and finishing installation **within three years.**



Source: Ministry of the Environment, Japan

Project to realize low carbon society in Davao City through a support for a development of Local Climate Change Action Plan

City of Kitakyushu — Davao City

Green Sister City Agreement
(November, 28th, 2017)
Expanding the cooperation area to
a development of low carbon society

Agreement on cooperation

Focal point

Institute for Global Environmental Strategies (IGES) — Ateneo De Davao University

Agreement on cooperation

Support for a development of **Local Climate Change Action Plan** of Davao City
- A development of GHG inventory（supported by IGES）
- A development of mitigation measures（supported by Kitakyushu City and IGES）
- A development of adaptation measures (supported by Ateneo De Davao Uni.)

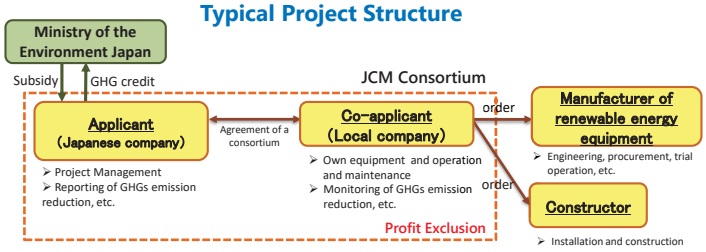
An implementation of concrete mitigation measures

Study on a feasibility of low-carbon project (for JCM Model Project)
- Feasibility study on other low-carbon projects (renewable energy and energy saving projects)
- Coordination with related-stakeholders for an implementation, technical study, evaluation of the amount of CO2 reduction, etc.
- Supporting for a preparation of applying JCM Model Project

Study on possible application of JCM Model Project

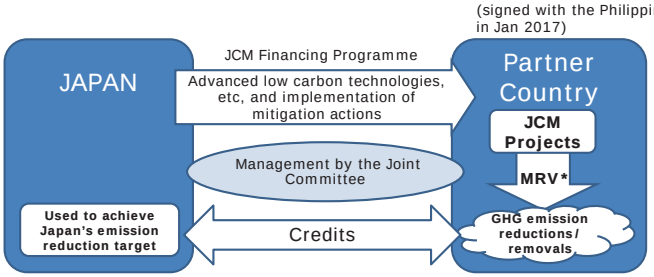
Components will be checked for a feasibility study on low-carbon projects:
- Forming an **international consortium** including both a owner and user of the equipment, etc.
- Coordination on a **timing and condition** of a procurement of a low-carbon project in Davao City with related organizations, etc.
- Coordination with **manufacturers** of renewable energy equipment as well as **constructors**
- **Selection of equipment**, calculate the amount CO2 reduction, support for a preparation to apply for JCM Model Project

Typical Project Structure



Basic Concept of Joint Crediting Mechanism (JCM)

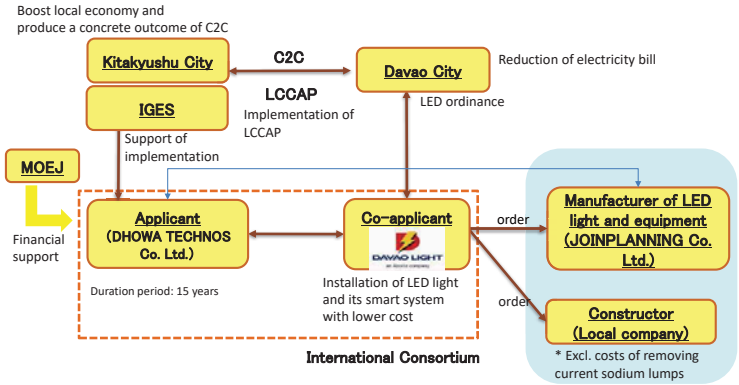
- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions of partner countries.
- Evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner by MRV.
- Contributing to achieve Japan's emission reduction target of the UNFCCC by facilitating global actions for GHG emission reductions.



*measurement, reporting and verification

Source: Ministry of the Environment, Japan

Possible Project Structure



Benefits and Responsibilities of Co-applicant under JCM Model Project

Benefits:

- Local partner can buy leading low-carbon technologies with a price reflecting the JCM subsidy
  - expecting to reduce the LED price by XXX

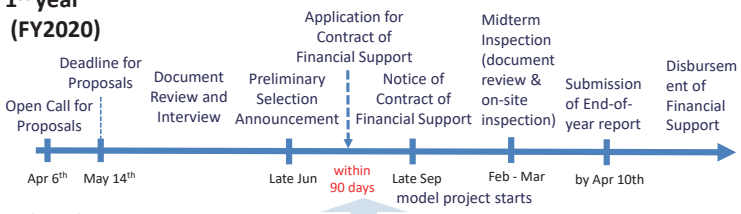
Burdens/responsibilities:

- A limited tendering contract is a requirement
  - A contract for 3 years is preferred.
  - Limited tendering is required in order to justify the condition of JCM Model Project which is the project cannot be implemented without the JCM subsidy.
- Submit the following documents for application
  - A document explaining a payback period or return of investment (with and without the JCM subsidy)
  - Financial report for the latest 3 years (Balance Sheet (BS), Income Statement (PL), Cash Flow Statement)
- Monitoring GHG emission reduction over the legal durable years as stipulated by the Japanese law (LED products: 10 years)
- Accept an inspection by JCM Model project secretariat (randomly selected by GEC)

Schedule for Applying JCM Model Project

* The schedule is followed to Japanese fiscal year (April - March)
* The open call process will be through a year (Apr ~ Nov).

1st year (FY2020)



2nd ~3rd year (FY2021,FY2022)

- Contracts signed with Japanese application, manufacturers, local constructor, etc.

Documents to be submitted for JCM Model Project

(a) Form No.1 Application Form
(b) Form No.2 Declaration by Representative Participant
(c) Form No.3a Project Implementation Plan
* Supporting documents must be included according to the Checklist (Form No. 6).
(d) Form No.3b Project Idea Note for the JCM Model Project
* Without prior notice to a representative participant, this document may be shared with government officials of a partner country where a project will be implemented. Also, we may forward questions from the government officials and request for the answers.
(e) Form No.4 Budget (including supporting documents, such as quotations, of the budget)
(f) Company information (such as company brochure) and certificate of incorporation of both representative participant and partner participant(s)
(g) Financial statement of both representative participant and partner participant(s) (audited, recent 3 consecutive years)
(h) International consortium agreement
Draft International consortium agreement and status toward signing the agreement. Signed agreement must be submitted to apply for Contract of Finance.
(i) Form No.5 Agreement on the Allocation of JCM Credits
* Signed agreement must be submitted.
(j) Form No.6 Checklist for Submission of Proposal
(k) Other supporting documents

Some conditions for JCM Model Project

- Finance rate will be determined based on the number of already selected JCM Model Projects using a similar technology in each country.
- Regardless of the finance rate, selected entities in JCM Model Project are expected to deliver at least half of JCM credits issued to Government of Japan.

Number of already selected project(s) using a similar technology in each partner country	Percentage of financial support
None (0)	Up to 50%
Up to 3 (1 – 3)	Up to 40%
More than 3 (>3)	Up to 30%

Cost effectiveness (JPY/t-CO_2e)

- Dividing "the amount of proposed subsidy" by "the accumulated emission reduction" achieved during "the legal durable years" (under Japanese tax law).
- **Below 4,000 JPY/t-CO_2e**

Payback period (year) $\frac{\text{(Total initial cost) – (Amount of subsidy)}}{\text{(Reduction for annual operation cost)}}$

- Payback (or Return of Investment) period of should be more than 3 years with the financial support.

Source: Ministry of the Environment, Japan

Calculation of GHG emission reduction

$$ER_p = RE_p - PE_p$$

ER_p	Emissions reduction during the period p (tCO_2/p)
RE_p	Reference emissions during the period p (tCO_2/p)
PE_p	Project emissions during the period p (tCO_2/p)

Criterion 1	The project installs LED street lighting system utilizing wireless network control, which is connected to an electricity grid system.
Criterion 2	All lighting equipment in one lighting system has the same specifications.
Criterion 3	Wireless network technology enables controlling of the volume of lighting.

$$RE_p = \sum_i P_i \times \left(\eta_{PJ,i} \div \eta_{RE}\right) \times PO_{i,p} \times EF_{grid} \times 10^{-6}$$

RE_p	Reference emissions during the period p (tCO_2/p)	
P_i	Rated power consumption of a lighting equipment used in the project lighting system i (W)	
$\eta_{PJ,i}$	Luminaire efficiency of a lighting equipment used in the project lighting system i (lm/W)	140
η_{RE}	Luminaire efficiency of the reference lighting system (lm/W)	62 (default)
$PO_{i,p}$	Total operating hours of project lighting system i during the period p (hrs/p)	4380 hrs/year
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)	0.286
i	Identification number of the lighting system	

$$PE_p = \sum_i PEC_{i,p} \times EF_{grid} \times 10^{-6}$$

GHG emission reduction : **2,193.26 t-CO2/year**
Total GHG emission reduction (10 years): **21,932.6 t-CO2**

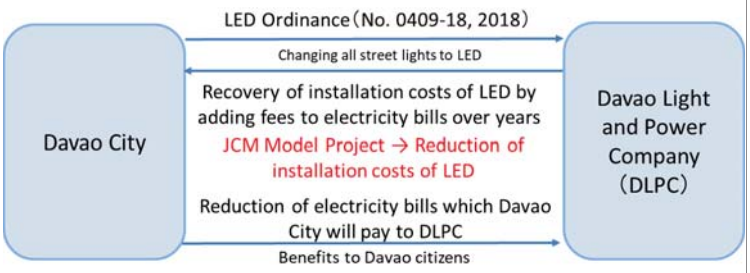
PE_p	Project emissions during the period p (tCO_2/p)	
$PEC_{i,p}$	Total amount of electricity consumed in the project lighting system i during the period p (Wh/p)	
EF_{grid}	Grid emission factor of Mindanao grid (tCO_2/MWh)	0.286
i	Identification number of the lighting system	

Source: https://www.jcm.go.jp/kh-jp/methodologies/34

Requirements of Co-applicant of JCM Model Project

(b) All members of the international consortium are responsible for the followings:
i. To cooperate with JCM methodology developers by providing information required to develop a methodology applicable to the project for GHG emission reductions;
ii. To cooperate with TPEs by providing materials and information required to efficiently conduct validation of the abovementioned project and verification of GHG emission reductions at the project site;
iii. To reduce, monitor and calculate GHG emissions utilizing the facilities/equipment with leading low carbon technology;
iv. To estimate the GHG emission reductions by the project, and to report it to MOEJ annually until the end of the legal durable years of the facilities/equipment as stipulated by the Japanese law, which is unique to each project;
v. To request the Joint Committee to issue credits and take necessary actions such as application for the project registration by the Joint Committee set up or to be set up by the Governments of Japan and JCM partner country;
vi. To deliver to the account of Japanese government at least fifty percent of the JCM credits of GHG issued corresponding to emission reductions achieved by the project for the abovementioned legal durable years;
vii. To manage the facilities/equipment with due care of a prudent manager for their legal durable years as stipulated by the Japanese law in order to realize their efficient operation in accordance with the purpose of the financial support even after the completion of the model project.
viii. To report to GEC in case that a constituent member is changed and to continue the above obligations from i. to vii.

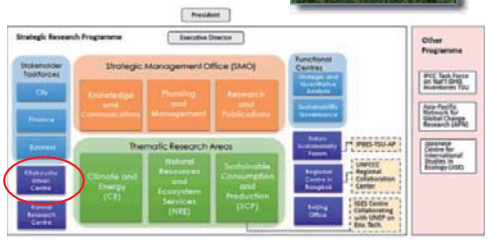
Feasibility Study of LED Project



Picture: LED lighting for street lights (JOIN PLANNING Co., Ltd.)

What is IGES?

- Institute for Global Environmental Strategies
- Established in 1998.
  Head office: Hayama Town, Kanagawa Prefecture
- Research areas and bases



Research system of the Integrative Strategic Research Programme for the Seventh Phase

Ranked among the top 10 think tanks in the world for climate change

- According to a study by the International Center for Climate Governance (ICCG), IGES ranked **7th in the world in 2017** in the world's Climate Think Tank Rankings and **1st in regions other than Europe and the US** (announced in June of this year). In 2016, IGES ranked 37th.
- According to the Global Go To Think Tank Index survey (University of Pennsylvania), IGES ranked 38th in the Environmental Policy Think Tanks group (6,500 organisations worldwide) (announced in January).

令和元年度 JCM 応募相談･参画促進に関するヒアリングシート

管理 No.	
ご回答日（面談日）	2020 年　2 月　22 日
ご回答方法	メール　／（面談）（於　　）
ご回答事業者名	（公財）地球環境戦略研究機関
ご担当者ご所属	北九州アーバンセンター
ご担当者氏名 （又はご回答者）	林　志浩
メールアドレス	hayashi@iges.or.jp
電話連絡先	093-681-1563
GEC 担当者	坂内修様
応募予定	（令和二年度）／ 検討中（提案時期：4 月上旬　頃　）
対象国	フィリピン
代表事業者名	株式会社ドーワテクノス
共同事業者名 （現地企業または SPC）	ダバオライト社（Davao Light Power Company, Inc.） （Aboitiz Power Corp.傘下の電力会社）
事業名および概要	全角 100 文字以内 「街灯の LED 化事業」 ダバオ市は条例（No.0409-18 号, 2018）により、市の管轄域内の全ての街路灯を高圧ナトリウム（HPS）灯から LED 照明に変換することを定めている。既に、市中心部の 1,000 本を対象に昨年 LED 化を実施。今後、順次 LED 化を実施する予定。LED 化に伴っては、ダバオライト社（DLPC）が LED 化に伴う設備費を一次的に負担し、今後ダバオ市から支払われる電気料金（LED 化の費用が上乗せ）で回収する予定。ダバオ市幹部、DLPC 副社長との数回の協議で、日本の LED 照明に大変興味を示しており、JCM 設備補助事業を活用し、都市まるごと低炭素（街灯の LED）化を目指している。 また、現在北九州市との都市間連携事業で支援をしている「ダバオ市気候変動行動計画（LCCAP）」に同 LED 化事業の実施を位置づけることで、実施可能性を高めるとともに、低炭素化事業の実施による GHG 削減効果を評価・公表することが期待できる。
総事業費（千円）	500,000 千円
補助対象経費 （補助金申請額） （千円）	合計　500,000　千円　（ 70,000 千円） （内訳）令和 2 年度：500,000 千円　（ 70,000 千円） 令和 3 年度：　千円　（　千円） 令和 4 年度：　千円　（　千円）
補助率（見込）	14%　（費用対効果を 4,000 円/t-CO2 に合わせて場合）

事業期間	（1年）／ 2年 ／ 3年
対象サイト	ダバオ市域内の街灯（約 22,800 本）
主な導入設備	高発光効率の LED ライト
法定耐用年数 とその根拠	8 年（根拠※：270 電球、電子管又は放電灯製造設備） ※『減価償却資産の耐用年数等に関する省令』耐用年数表を参照して記載
想定 CO2 排出削減量 （※GHG と CO2 が異なる場合は併記）	2,193.26 tCO2／年（平均）
補助金費用対効果	法定耐用年数：8 年 14,248 円／tCO2 （補助率 50%の場合） 3,989 円／tCO2 （補助率 14%の場合） 法定耐用年数：10 年 11,399 円／tCO2 （補助率 50%の場合） 4,103 円／tCO2 （補助率 18%の場合）
事業性	投資回収年数：未定 年（補助金なし）、未定 年（補助金あり） IRR： 未定 %（補助金なし）、未定 %（補助金あり）
代表（共同）事業者の意思決定状況	・DLPC の実質経営トップである Rodger Velasco 氏（副社長兼 COO）、Mark Valencia 氏（技術部門副社長）及びダバオ市と数回の協議を重ねており、日本側の提案内容に高い関心を示している。 ・DLPC 側が技術仕様に基づく提案製品の技術評価を行い、日本側の提案製品の技術評価を終えている。
必要な許認可等 （取得予定年月）	特になし
資金調達方法および協議状況	DLPC が資金調達を行う（ダバオ市が支払う電気代に費用を上乗せして回収予定）。 当該プロジェクト予算はフィリピン国電力規制委員会の方で承認済 DLPC との提案製品に関する技術協議は終了（先方の技術仕様は全て満たしている）
本事業に関連する政府調査・補助事業実績	廃棄物管理分野における北九州市及び関連機関によるダバオ市への支援実績 · 「ダバオ市における気候変動行動計画策定支援等による低炭素社会推進事業」環境省 低炭素社会実現のための都市間連携事業（2018 年度、令和元年度）
事業実施に関する問題点や課題など	· JCM 設備補助事業への申請手続きと代表事業者の責務など
その他ご質問やご要望など	JCM 設備補助事業の申請 · JCM 設備補助事業に申請する際の補助申請率について、費用対効果（4,000 円/t-CO2）を基準に申請するという考え方で良いか？ · 提出書類「共同事業者の経理状況説明書」について、どのような資料が妥当

	か？ · 提出書類「投資回収年数及び内部収益率の計算過程・根拠の説明資料（補助あり、補助なしの２通り）」については、共同事業者（ダバオライト社）に提出を求めることになると思うが、具体的なフォーマットなど決まっているのか？また、根拠資料の添付なども求められるのか？ · 来年度も 4 月上旬からの公募開始を予定しているのか？ 代表事業者の責務 · GHG 排出量を算出するために必要なモニタリングの実施について、具体的にどの様な文書の提出が求められるのか？テンプレートがあれば、共有頂けないか？ · 公募要領に「JCM 合同委員会に対し、当該プロジェクトによるクレジットの発行申請を行い、発行された JCM クレジットのうち 1/2 以上を、日本国政府の口座に納入すること。」とあるが、発行申請を行う具体的な手続きとはどのようなものか？ 国際コンソーシアムの組成 · 設備補助事業の申請者（代表事業者）が商社の場合、利益排除（自社製品の調達を行う場合）は該当せず、申請者として利益を上げても良いという理解か？ その他 · 補助金の動きについて、国際コンソーシアムの図を基に確認したい。（補助金は環境省から代表事業者に支払われ、実際は補助金分を差し引いた金額で LED を DLPC 社（共同事業者）納品することになるのか？）

以上

Cooperation on 3Rs and Waste Management between DENR and MOEJ

Shiko Hayashi, Programme Director
Kitakyushu Urban Centre,
Institute for Global Environmental Strategies
2nd August 2019

Outputs from the Bilateral Cooperation

WtE Guidelines

WACS Guidelines (draft)

PPP Guidelines on solid waste management project (on-going)

Environmental Dialogue on Waste Management


(October 27th, 2015)

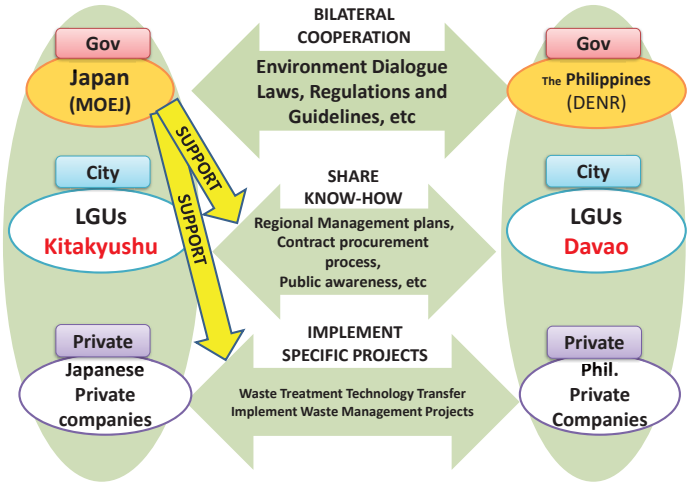

(November 7th, 2016)


(November 21th, 2017)


(February 6th, 2019)

Comprehensive cooperation by **Quezon, Davao and Cebu cities** selected as model cities for WtE in the Philippines, with their respective collaborative cities in Japan, namely **Osaka, Kitakyushu and Yokohama cities**

Cooperation Framework for Supporting Waste Management



Activities of the Bilateral Cooperation

Workshops for Waste to Energy

- Local Workshop in Quezon City and Davao City on Waste Management between the Philippines and Japan (24, 25 Jan. 2017)
- Joint Workshop on WtE Technology (Sep 15, 2017)
- Workshop on PPP Projects in the Area of Waste Management (1st Feb. 2018)
- Workshop on Waste-to-Energy Technology in Davao City (19 Feb. 2018)

Waste to Energy Study Tour

- Since 2015, we organized the study tour to Japan on WtE every years.

Emission Standards in Japan and EU

REGULATIONS AND STANDARDS FOR EMISSIONS IN JAPAN

1. Flue gas → EMISSIONS STANDARDS (DRY GAS, 12% OXYGEN)
2. Ash
3. Sewage
4. Noise
5. Vibration
6. Foul odors

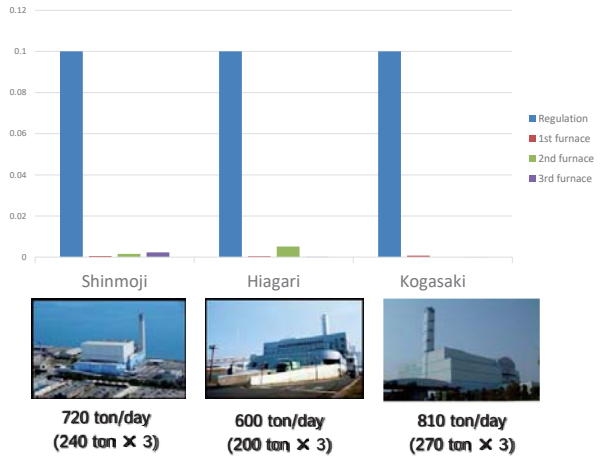
Substance	Unit	Regulation	Stricter standards set by LGUs
Dust/ Particulates	mg/Nm³	40 or less	10 or less
HCL	mg/Nm³	430 (ppm)	10~50 (ppm)
SOx	K value	3 – 17.5	20~30 ppm
NOx	ppm	250 (ppm)	30~100 (ppm)
Dioxins	ng-TEQ/Nm³	0.1	0.1
Mercury	mg/Nm³	0.05 or less	There are no laws for emissions standards for other substances. However, there are substances for which standards have been set through municipal ordinances and environmental conservation conventions.
Cadmium	mg/Nm³	1 or less	
Lead	mg/Nm³	10 or less	
Fluorine	mg/Nm³	9 or less	

Same as EU standard

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) Text with EEA relevance
(Annex6, Part3, 1.4: Average emission limit value (ng/Nm³) for dioxins and furans over a sampling period of a minimum of 6 hours and a maximum of 8 hours.)

Emission Standards: Dioxins

Monitored values of dioxins in Kitakyushu City

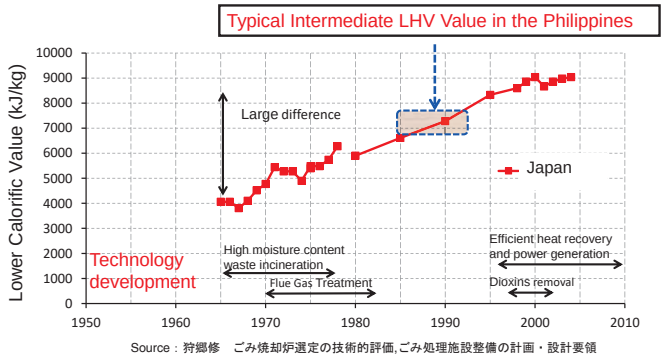


720 ton/day
(240 ton × 3)

600 ton/day
(200 ton × 3)

810 ton/day
(270 ton × 3)

History of WtE in Japan



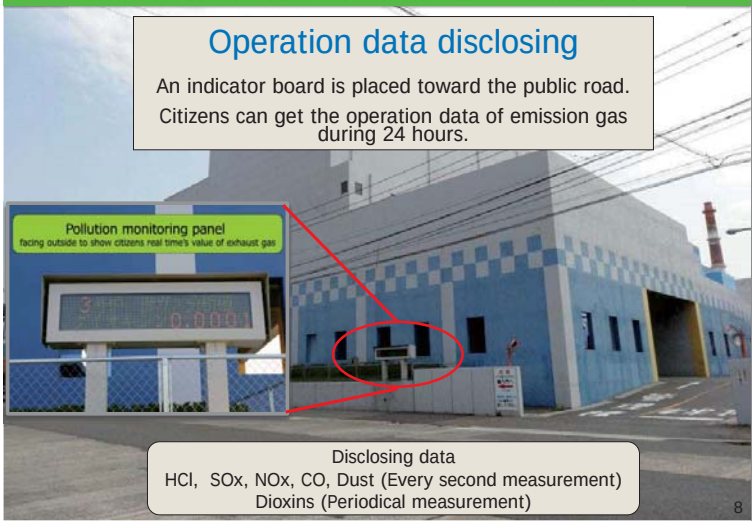
Source：狩郷修　ごみ焼却炉選定の技術的評価,ごみ処理施設整備の計画・設計要領

- 1st WtE Plant in Japan -

1965	Osaka City (closed in 1999)	
	Throughput	200t/d, 2lines
	LHV	1,200kcal/kg (5MJ/kg)
	Steam condition	2.3MPa, 350˚C
	Electricity	2,700kW, 2lines(23.2%)

Source: JEFMA (Japan Environmental Facilities Manufacturers Association)

Information Disclosure of Emission Values



Waste-to-Energy Facilities in Japan

1,103 incineration facilities in Japan (FY2017)

Dioxins Intake per person･day in Japan

- About 98% of dioxins are taken from food.
- Ministry of Health, Labour and Welfare and Ministry of the Environment recommend to eat various kinds of food in well-balance

unit: pg-TEQ/kg/day (in 2009)

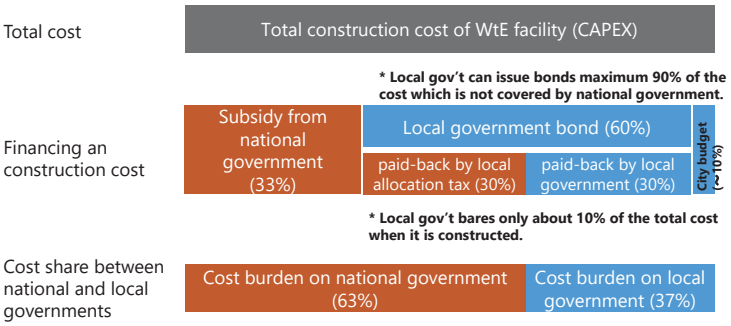
Air	0. 0090	0. 013	
Soil	0. 0042		Environment
Fish	0. 78	0. 84	Food
Meat, egg	0. 040		
Milk, dairy	0. 013		
Vegetable	0. 00040		
Wheat, potato	0. 0010		
Other	0. 0038		

TDI in Japan: 4pg-TEQ/kg/day

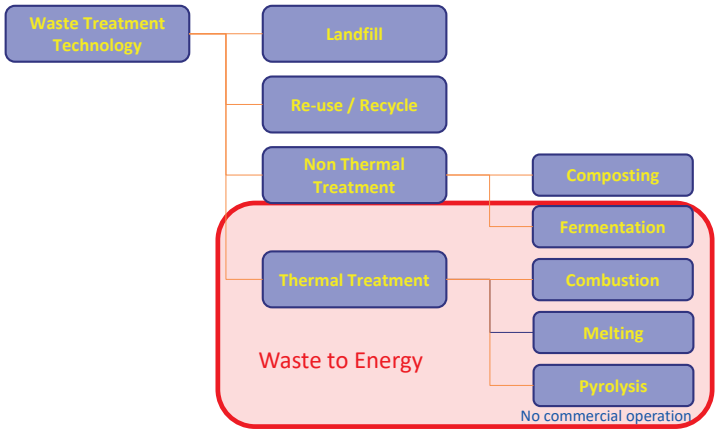
Actual intake in Japan: about 0.85pg-TEQ/kg/day

Source: Ministry of the Environment, Japan
https://www.env.go.jp/chemi/dioxin/pamph/2012.pdf

Cost burdens on National and Local Governments for WtE Project in Japan (an example)



Types of Waste Treatment Technologies



Source: JEFMA - Japan Environmental Facilities Manufacturers Association

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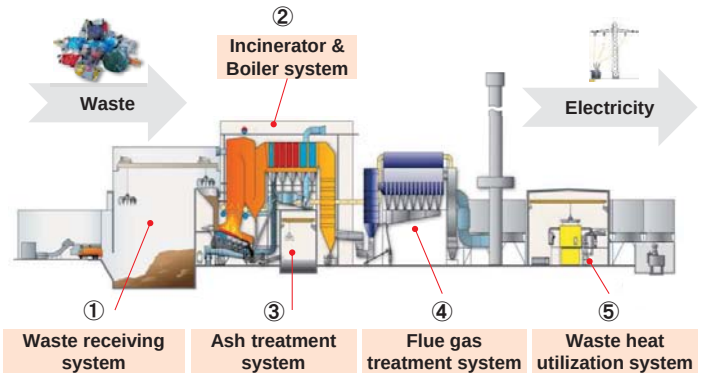
Typical Flow of Waste-to-Energy Facility



Source: JEFMA - Japan Environmental Facilities Manufacturers Association

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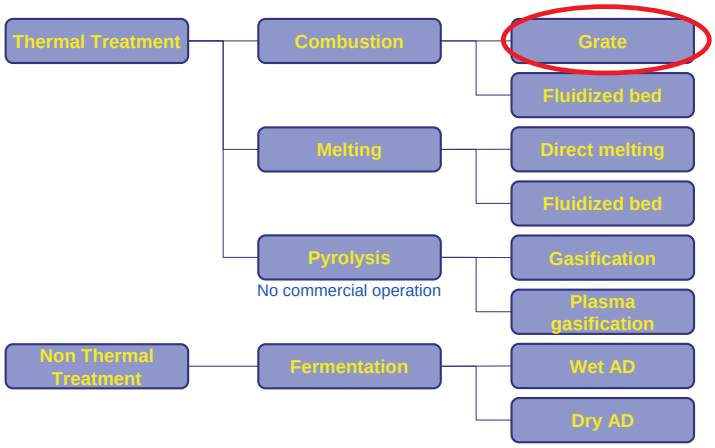
Types of Waste Treatment Technologies



Source: JEFMA - Japan Environmental Facilities Manufacturers Association

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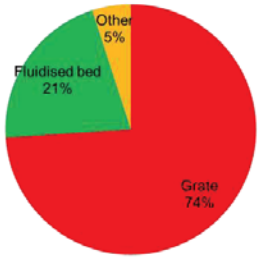
Types of Waste Treatment Technologies

Combustion : Grate

Worldwide Capacity by Type of Technology



Analysis of 692 units, commissioned between 2006 – 2015
Source : ecoprog

Outline

- Waste is burned by autogenous combustion while moving on the grate.
- Air is provided under the grate.
- Waste is burned slowly on the grate for 1 to 2 hours.

Characteristic

- This is the **most proven technology**, and it is possible to achieve **stable operation.**
- It is possible to **treat a large amount of waste in short time**.
- It is easy to **meet fluctuation of waste quality** flexibly.
- It is **not necessary to pre-treat** waste.

Source: JEFMA - Japan Environmental Facilities Manufacturers Association

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Republic of the Philippines
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Tel. Nos. (632) 929-66-26 to 29 • (632) 929-62-52
Website: www.denr.gov.ph / E-mail: web@denrgov.ph

NOV 2 6 2019

DENR ADMINISTRATIVE ORDER
NO. 2019 - 21

SUBJECT: GUIDELINES GOVERNING WASTE-TO-ENERGY (WtE) FACILITIES FOR THE INTEGRATED MANAGEMENT OF MUNICIPAL SOLID WASTES

Pursuant to Section 8 (f) of Republic Act (RA) 9003, otherwise known as the Ecological Solid Waste Management Act of 2000, NSWMC Resolution No.669, Series of 2016, Adopting the Guidelines Governing the Establishment and Operation of Waste to Energy Technologies for Municipal Solid Wastes (MSW), Executive Order 192 (Providing the Reorganization of the Department of Environment, Energy and Natural Resources; Renaming it as the Department of Environment and Natural Resources) dated 10 June 1987, the Department of Environment and Natural Resources (DENR) hereby adopts and promulgates these guidelines on the establishment and operation of Waste-to-Energy (WtE) facilities for municipal solid wastes.

These guidelines also adhere to the policy of the government to promote compliance with Presidential Decree (PD) 1586 (Establishing an Environmental Impact Statement System), RA 6969 (Toxic Substances and Hazardous and Nuclear Wastes Act of 1990), RA 8749 (Philippine Clean Air Act of 1999); and RA 9275 (Philippine Clean Water Act of 2004).

SECTION 1. DECLARATION OF POLICY

It is hereby declared the policy of the State to adopt a systematic, comprehensive and ecological solid waste management program which shall ensure the protection of public health and environment and set guidelines and targets for solid waste avoidance and volume reduction through source reduction and waste minimization measures, including composting, recycling, re-use, recovery, green charcoal process, and other schemes, before collection, treatment and disposal in appropriate and environmentally-sound solid waste management facilities in accordance with ecologically sustainable development practices.

SECTION 2. OBJECTIVE

This Order is issued to provide guidelines on the evaluation, establishment, operation and de-commissioning of waste-to-energy (WtE) facilities for the integrated management of municipal solid wastes.

SECTION 3. SCOPE AND COVERAGE

These guidelines cover the requirements, and procedures on the establishment and operation of WtE facilities utilizing municipal solid wastes.

SECTION 4. DEFINITION OF TERMS

a) **Biodegradable Waste** shall refer to solid wastes that can be decomposed by microorganism into humus-like product.

b) **Bottom Ash** shall refer to the agglomerate ash formed that are too large to be carried in the flue gases and fall through open grates to an ash hopper at the bottom of the furnace.

c) **Bureau** shall refer to the Environmental Management Bureau.

d) **Clustering** is a strategy of pooling available resources of neighboring cities, municipalities or barangays for the establishment of a common solid waste management facility or service.

e) **Continuous Emissions Monitoring System** (CEMS) shall refer to the total equipment used to sample, analyze and provide a permanent record of emissions or process parameters.

f) **Decommissioning** is a process in which the WtE facility is placed in a safe and environmentally acceptable condition prior to cessation of operation.

g) **Department** shall refer to the Department of Environment and Natural Resources.

h) **Environmental Permits and Clearances** shall refer to the Environmental Compliance Certificate (ECC), Permit to Operate (PTO) and other legal requirements that must be secured prior to construction, set-up and operation of a WtE facility.

i) **Dioxins and Furans** shall refer to the polychlorinated organic compounds namely polychlorinated dibenzo p-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) that are generated unintentionally from waste incinerators and other industrial processes, and 17 of which are toxic in nature. The 17 toxic congeners include seven (7) 2,3,7,8 - substituted PCDDs and ten (10) 2,3,7,8- substituted PCDFs.

j) **Effluent Standard** shall refer to any legal restriction on quantities, rates, and/or concentrations or any combination thereof, of physical, chemical or biological parameters of effluent which a person or point source is allowed to discharge into a body of water or land.

k) **Emission** shall refer to any air contaminant, pollutant, gas stream or unwanted sound from a known source which is passed into the atmosphere.

l) **Fly Ash** shall refer to the ash formed that are too small and light and are carried in the flue gases.

m) **Feedstock** refers to the segregated biodegradable or residual waste materials supplied to the WtE facility to generate heat or electricity.

n) **Hazardous wastes** shall refer to by-products, side-products, process residues, spent reaction media, contaminated plant or equipment or other substances from manufacturing operations and as consumer discards of

manufactured products which present unreasonable risk and/or injury to health and safety and to the environment.

o) **Host LGU** shall refer to the LGU (province, city, municipality or barangay) where the waste to energy facility is located.

p) **Materials Recovery Facility (MRF)** shall include solid waste transfer station or sorting station, drop off center, a composting facility and a recycling facility (DAO 2001-34).

q) **Municipal Solid Waste (MSW) or Municipal Wastes** shall refer to wastes produced from activities within local government units which include a combination of domestic wastes from residential, commercial, institutional and industrial wastes and street litters (DAO 2001-34).

r) **Recyclable Materials** shall refer to any waste material retrieved from the waste stream and free from contamination that can still be converted into suitable beneficial use or for other purposes

s) **Residual Waste** shall refer to any material generated after the implementation of 3Rs (Reduce, Reuse, Recycle) with fuel value.

t) **Residuals Containment Area (RCA)** shall refer to the temporary storage for segregated residual wastes.

u) **Sanitary Landfill** shall refer to a waste disposal site designed, constructed, operated and maintained in a manner that exerts engineering control over significant potential environmental impacts arising from the development and operation of the facility.

v) **Segregation** shall refer to a solid waste management practice of separating different materials found in solid waste in order to promote recycling and re-use of resources and to reduce the volume of waste for collection and disposal.

w) **Source Segregated Waste** shall refer to solid waste segregated at the point of origin/generation.

x) **Toxic Equivalents (TEQ)** shall refer to the overall toxicity of a sample as if it was comprised completely of 2,3,7,8 - tetrachlorodibenzo-p-dioxin. This is obtained by multiplying the individual congener concentrations by their respective TEF value and summing the results.

y) **Toxic Equivalency Factors (TEFs)** shall refer to the relative degree of toxicity of PCDD/PCDF congeners in relation to the most toxic dioxin congener 2,3,7,8 - tetrachlorodibenzo-p-dioxin which is assigned a nominal value of 1.

z) **Waste-to-Energy** (WtE) shall refer to the process of converting wastes with various technologies, usually the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes.

aa) **WtE Facility** shall refer to the structure/appurtenant facility where the waste-to-energy operations are housed.

SECTION 5. REQUIREMENTS

The following conditions must be met prior to the establishment of a WtE facility:

a) All WtE facilities shall undergo Environmental Impact Statement System and secure all applicable environmental permits, clearances and other legal requirements from concerned agencies prior to construction, set-up and operation of a WtE facility.

b) Documentation for compliance with the requirements of PD 1586 shall include an environmental and health risk assessment.

c) The host LGU including the LGUs where the source of the feedstock will originate from shall ensure that the plan to establish and/or utilize WtE facility is integrated in their approved 10-year solid waste management plan consistent with the provisions of RA 9003.

d) The host LGU are allowed to implement clustering and/or form partnerships with the private sector in the establishment, construction and operation of WtE facility.

e) The proponent shall submit an Environmental Technology Verification (ETV) Statement and Report following the DOST ETV Protocol as per DENR-DOST Joint Administrative Order 2006-001.

f) The WtE facility owner shall:

   i. Develop a manual of operation and quality assurance and control to be submitted to EMB for monitoring purposes.

   ii. Maintain, at the highest possible standards, a quality control/assurance system to demonstrate its ability to consistently provide products and services that meet applicable statutory and regulatory requirements.

   iii. Implement and communicate a detailed emergency response plan to ensure effective and rapid containment and clean-up in the event of an emergency incident. The facility must be equipped with adequate fire-fighting devices certified by the Bureau of Fire Protection.

   iv. Provide appropriate personal protective equipment and medical care in compliance with existing laws, rules and regulations to all personnel of the facility directly handling or exposed to waste materials, in-process materials and finished products.

   v. Ensure implementation of resource efficient and cleaner production program that follows the waste management hierarchy of source reduction, recycling, treatment and safe disposal.

   vi. Provide appropriate, recent and state of the art pollution control and abatement facilities to ensure that all emissions and effluents comply with relevant environmental standards.

vii. Avail services of EMB registered transporters and treatment, storage and disposal facilities for any hazardous waste resulting from the operations of the WtE facility.

SECTION 6. OPERATIONAL GUIDELINES FOR WTE FACILITY

6.1 Waste Delivery Control

Acceptable Municipal Solid Waste for WtE Facility

The facility shall only accept source segregated biodegradables or residual wastes collected from households, MRFs, Residual Containment Areas (RCAs), Sanitary Landfills and other disposal facilities.

For unsegregated wastes resulting from calamities, flooding and clean up, the waste must undergo pre-processing to achieve the quality and suitability as feedstock.

The WtE facility shall document and maintain records indicating the quantity in weight, source and type of source-segregated wastes to be processed including the date and time received. *(Annex A)*

6.2 Storage Facility

Appropriate storage facilities should be provided for source segregated wastes, in-process materials and any by-product from the WtE facility operation. Such storage shall institute measures to address the risks of potential explosion, combustion, corrosion, contamination, infection and odor emission that could pose potential hazard to human health and the environment.

6.3 Environmental Monitoring

a) The WtE facility operator shall submit to EMB Regional Offices quarterly Self-Monitoring Report and semi-annual Compliance Monitoring Report in accordance with DAO 2003-27 and/or new relevant issuances thereof.

b) The WtE facility operator shall install CEMS, linked with the EMB, measuring PM, NO_2, CO, HCl, Temperature and other parameters as determined by Bureau.

c) In coordination with EMB, WtE facilities utilizing thermal process (whether burn or non-burn) must conduct sampling and analysis for dioxins and furans based on EMB Memorandum Circular No. 2007-003 *(Policy on Compliance and Permitting for Industrial Facilities Relating to Air Quality)* following the prescribed methodology; all average values of dioxins and furans measured over the sampling period of a minimum of six (6) hours and a maximum of eight (8) hours **must not exceed the limit value of 0.1 nanogram toxic equivalents per normal cubic meter (ng-TEQ/NCM).** (For this guideline, TEF values to be used for calculation of Toxic Equivalents (TEQs) of a particular sample is based on the 1989 update of the United States Environmental Protection Agency (US

EPA) adopting the 1989 International NATO/CCMS TEF values, otherwise represented as I-TEF).

d) Effluents from WTE facilities must conform with DENR Administrative Order No. 2016-08 (Water Quality Guidelines and General Effluent Standards) and/or the latest relevant issuance thereof.

6.4 Documentation and Data Management

All aspects of WtE facility operations must be well documented. As such, documents and records as listed below shall be maintained at least five (5) years and be made available for inspection:

a) Delivery record of each waste material received in the facility
b) Daily processing operation log sheet showing or attaching the following information:
    i. Quantity of waste materials processed
    ii. CEMS data online submission to EMB
c) Laboratory analysis of effluent, source emission, fly ash and bottom ash.

6.5 Social Accountability

The facility owner shall endeavor to establish partnership with stakeholders through education and training, infrastructure improvements, disaster risk reduction and management and such other social development activities.

The WtE facility shall maintain a Light-Emitting Diode (LED) or similar system/device display board, in front of its site and within view of the general public, containing updated information on its air emissions and effluent.

6.6 Interim Cease and Desist Order by the Secretary

Whenever there is an exceedance of the emission standards set by the Department or if there is imminent threat to life, public health, safety or general welfare, or to plant or animal life, an interim order for the closure, suspension, or cessation of operations of the WtE facility may be immediately issued by the DENR Secretary or his authorized representative, without the need for a prior public hearing (Sec 45, RA 8749).

The interim cease and desist order shall be immediately executory and shall remain in force and effect until the WtE operator has reduced the limit value of the dioxin and furans to 0.1 nanogram toxic equivalent per normal cubic meter (ng-TEQ/NCM), or until a temporary lifting order is issued by the Pollution Adjudication Board (PAB) or an injunctive writ is issued by a Court of Law. (Sec 1, Rule X, of PAB Resolution No. 1, Series of 2010)

SECTION 7. DECOMMISSIONING OR ABANDONMENT

A detailed Decommissioning/Abandonment Plan shall be submitted to the Bureau for approval at least one (1) year prior to the decommissioning or abandonment of the facility. The Plan shall include rehabilitation measures, clean-up activities, remediation of areas affected by the WtE facility and proposed alternative post land use of the area.

SECTION 8. FINES AND PENALTIES

Fines and penalties for violating these guidelines shall be governed by pertinent provisions in Presidential Decree 1586 (Establishing an Environmental Impact Statement System), RA 6969 (Toxic Substances and Hazardous and Nuclear Wastes Act of 1990, RA 8749 (Philippine Clean Air Act of 1999), RA 9003 (Ecological Solid Waste Management Act of 2000), and RA 9275 (Philippine Clean Water Act of 2004).

Violation of any provision of these guidelines by WtE facility may result to the suspension or cancellation of relevant permits and clearances and/or the filing of appropriate charges, pursuant to relevant environmental laws and policies as determined by the Department.

SECTION 9. TRANSITORY CLAUSE

Any establishment operating a WtE facility using MSW as feedstock prior to the effectivity of this DAO shall be given one (1) year to comply with all permitting requirements set forth provided, that such facility does not cause or pose imminent threat to property, public health and environment as determined by DENR-EMB or other government agencies concerned.

SECTION 10. EFFECTIVITY

This guideline shall take effect fifteen (15) days after its publication in two (2) newspapers of general circulation and upon submission of a copy thereof to the Office of the National Administrative Registry (ONAR) at the University of the Philippines Law Center.

ROY A. CIMATU
Secretary

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
SENR057759

Republic of the Philippines
City of Davao
OFFICE OF THE VICE MAYOR

January 14, 2020

MR. KAZUHIKO TAKEUCHI
President
Institute for Global Environmental Strategies
2108-11 Kamiyamaguchi, Hayama, Miura District,
Kanagawa 240-0115, Japan

Dear President Takeuchi:

Greetings!

Last January 12, 2020, the Philippine Institute of Volcanology and Seismology (PHIVOLCS) raised the alert level of the Taal Volcano eruption to four, prompting warnings of a possible explosive eruption. Hence, flights in the Davao City airport were canceled, including mine and the rest of the Davao City delegates. There is no advisory as to when the operations of the airport will return to normal; therefore, I could not rebook my flight at the soonest possible time.

On behalf of the Davao City delegation, please accept my sincerest regrets for being unable to attend the **Seminar on City-to-City Collaboration for Creating Low-carbon Society** as well as the site visits in the cities of Tokyo and Kitakyushu.

I would also like to extend my gratitude to the organizers of this event for the opportunity and invitation. As much as I would like to visit your beautiful city, my security team have already made precautions regarding the risk of our flight and decided to cancel the trip officially. I earnestly apologize for any inconvenience this may have caused you.

Rest assured, Davao City will remain committed to strengthen our partnership with your government and hope to offer our participation in the future. I am hoping that we will still be working with each other soon. Please do not hesitate to contact my office if you need anything.

Davao City will always be open if you decide to come and visit us.

Thank you for your consideration and understanding.

Best regards,

SEBASTIAN Z. DUTERTE
City Vice Mayor

City-to-City Collaboration Progamme between Davao City and City of Kitakyushu：Supporting Davao to become Low-carbon City

January 14th, 2020

Shiko Hayashi
Programme Director, Kitakyushu Urban Centre

IGES
Institute for Global Environmental Strategies

What is IGES?

- Institute for Global Environmental Strategies
- Established in 1998.
  Head office: Hayama Town, Kanagawa Prefecture
- Research areas and bases

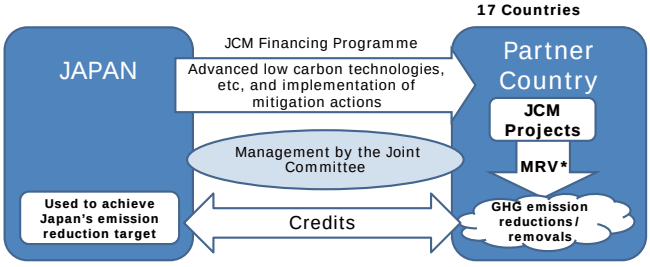
Research system of the Integrative Strategic Research Programme for the Seventh Phase

Ranked among the top 10 think tanks in the world for climate change

- According to a study by the International Center for Climate Governance (ICCG), IGES ranked **7th in the world in 2017** in the world's Climate Think Tank Rankings and **1st in regions other than Europe and the US** (announced in June of this year). In 2016, IGES ranked 37th.
- According to the Global Go To Think Tank Index survey (University of Pennsylvania), IGES ranked 38th in the Environmental Policy Think Tanks group (6,500 organisations worldwide) (announced in January).

Basic Concept of Joint Crediting Mechanism (JCM)

- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions of partner countries.
- Evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner by MRV.
- Contributing to achieve Japan's emission reduction target of the UNFCCC by facilitating global actions for GHG emission reductions.

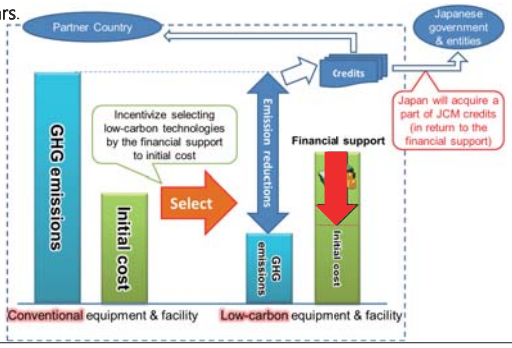


*measurement, reporting and verification

Source: MOE Japan

Financing Programme for JCM Model Project

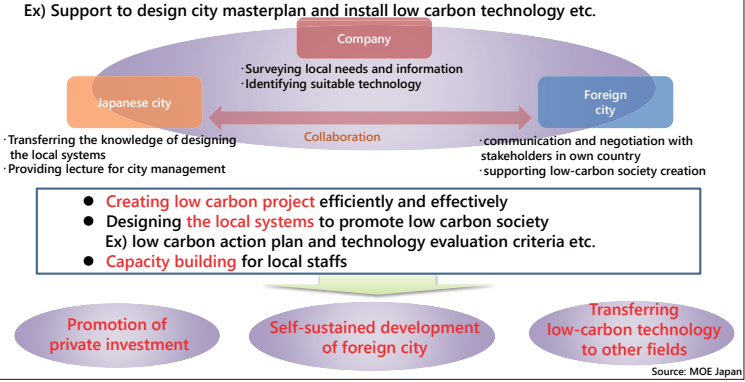
- Scope of the financing:
  Facilities, equipment, vehicles, etc. which **reduce CO_2 from fossil fuel combustion** as well as construction cost for installing those facilities, etc.
- Eligible projects:
  Starting installation after the adoption of the project and finishing installation **within three years**.



Source: MOE Japan

Outline of City-to-City Collaboration Programme

- Basic concept is transferring the knowledge and experience of Japanese cities for creating low carbon society to foreign cities which have the mutual relationship.
- Private companies formulate the consortiums with Japanese cities and support foreign cities to create low carbon cities.
  Ex) Support to design city masterplan and install low carbon technology etc.



- Creating low carbon project efficiently and effectively
- Designing the local systems to promote low carbon society
  Ex) low carbon action plan and technology evaluation criteria etc.
- Capacity building for local staffs

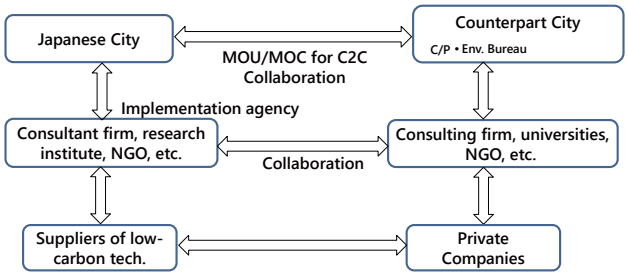
Promotion of private investment

Self-sustained development of foreign city

Transferring low-carbon technology to other fields

Source: MOE Japan

Framework of City-to-City Collaboration Programme



Supporting to develop a plan/policy, etc. as well as capacity building

- Support for a development of Local Climate Change Action Plan or etc.
  incl. GHG Inventory, technical evaluation of a project proposal, appropriate selection process, etc.

Feasibility study of an introduction of low-carbon technologies

- Coordination with related agencies & private companies to study a feasibility of low-carbon project, evaluation of potential amount of CO2 reduction, etc.
- Preparing for an application for JCM Model Project

Asia:10 countries, 31 cities / Japan: 14 cities

Lao PDR

Foreign city	Japanese city
Vieng chan	Kyoto

Myanmar

Foreign city	Japanese city
Yangon	Kawasaki
Ayeyarwady	Fukushima
Sagaing	Fukushima
Mandalay	Kitakyushu
Yangon	Kitakyushu

Thailand

Foreign city	Japanese city
Bangkok	Yokohama
Rayong	Kitakyushu
Chiang mai	Kitakyushu
EEC	Osaka

India

Foreign city	Japanese city
Bangalore	Yokohama

Cambodia

Foreign city	Japanese city
Phnom penh	Kitakyushu
Siem reap	Kanagawa pref.

Mongolia

Foreign city	Japanese city
Ulaanbaatar	Sapporo Hokkaido pref.

Malaysia

Foreign city	Japanese city
Iskandar	Kitakyushu
Penang	Kawasaki
Kuala Lumpur	Tokyo

Vietnam

Foreign city	Japanese city
Hai phong	Kitakyushu
Da nang	Yokohama
Ho chi minh	Osaka
Kiên Giang	Kobe
Can Tho	Hiroshima

Philippines

Foreign city	Japanese city
Quezon	Osaka
Davao	Kitakyushu

Indonesia

Foreign city	Japanese city
Denpasar	Tokyo union
Surabaya	Kitakyushu
Batam	Yokohama
Smarang	Toyama
Bandung	Kawasaki
Jakarta	Kawasaki
Bali	Toyama
Riau	Kawasaki

※New entry cities from FY2019 Source: MOE Japan

Project to realize low carbon society in Davao City through a support for a development of Local Climate Change Action Plan

City of Kitakyushu — Green Sister City Agreement (November, 28th, 2017) Expanding the cooperation area to a development of low carbon society — Davao City

Focal point

Institute for Global Environmental Strategies (IGES) — Agreement on cooperation — Ateneo De Davao University

Agreement on cooperation

Support for a development of **Local Climate Change Action Plan** of Davao City

- A development of GHG inventory（supported by IGES）
- A development of mitigation measures（supported by Kitakyushu City and IGES）
- A development of adaptation measures (supported by Ateneo De Davao Uni.)

An implementation of concrete mitigation measures

Study on a feasibility of low-carbon project (for JCM Model Project)

- Feasibility study on other low-carbon projects (renewable energy and energy saving projects)
- Coordination with related-stakeholders for an implementation, technical study, evaluation of the amount of CO2 reduction, etc.
- Supporting for a preparation of applying JCM Model Project

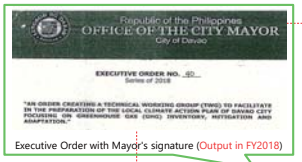
Capacity building opportunities
(training program, study tour to Japanese cities, attending seminar etc.)

Davao – Kitakyushu

The training workshop aims to:

- learn Kitakyushu's practice on the LCCAP development;
- learn how to estimate GHG emissions & emission reduction potential (MRV);
- learn overview of JCM scheme;
- visit the sites where Kitakyushu's mitigation measures are implemented; and
- promote city-to-city collaboration for low-carbon, resilient and sustainable cities.

Supporting to develop the LCCAP of Davao City



Executive Order with Mayor's signature (Output in FY2018)

Activities under the C2C collaboration

Expected output for FY2019:
(1) GHGI report
(2) Longlist of mitigation options tied with SDGs

- Vulnerability assessment & Adaptation option longlist — LCCAP draft
- May 2018: C2C collaboration started
- Dec. 2018: TWG establishment — EO No. 40 December 28, 2018
- April 2019: GHGI development — CCC's Technical WS April 30-May 2, 2019
- Nov. 2019 – Feb. 2020: Mitigation option longlist & Mainstreaming
  - ✓ Potential low-carbon projects are to be included in the LCCAP
  - ✓ Tie with SDGs
- Mar. 2020-: Integrate LCCAP & Launch, implement & monitor LCCAP progress

Input from Team Kitakyushu (2018):
- Basic information on GHGI & LCCAP
- Sharing of a list of data to be collected
- Hands-on training in Japan
- Liaison with Climate Change Commission

Input from Team Kitakyushu (2019):
- Mainstreaming low-carbon city concept by aligning other administrative plans;
- Sharing examples of mitigation options being implemented in Kitakyushu;
- Suggesting potential JCM projects as concrete mitigation options.

Foundation for a sustainable city development has been created.

UNHABITAT (2013) — Green Sister City Agreement (December 28, 2017) — Davao City / IGES & City of Kitakyushu (2018-) — Actor / Supporters

Supporting to develop the LCCAP of Davao City

Adaptation options
(Updates from UNHABITAT study)

Mitigation options
(need to identify climate change mitigation)

Technical Working Group

GHG emissions from sources

GHG removals from sinks

Net GHG emission from Davao in 2017

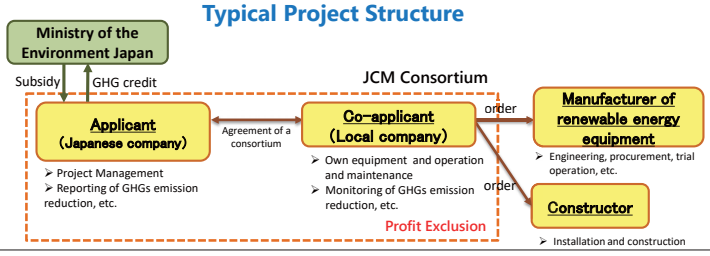
GHG inventory
(need to document all the information for future use)

Study on possible application of JCM Model Project

Components will be checked for a feasibility study on low-carbon projects:

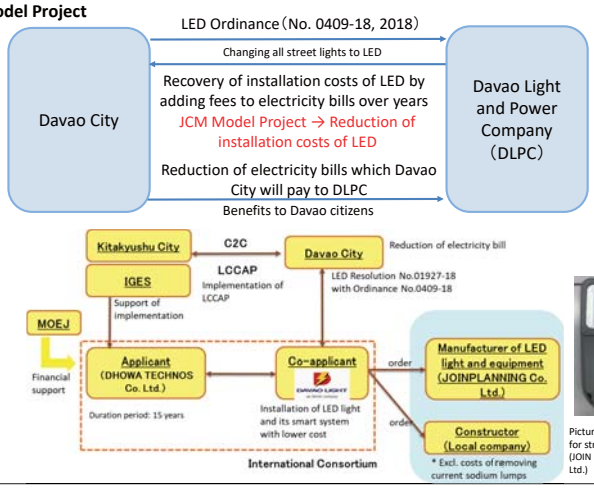
- Forming an **international consortium** including both a owner and user of the equipment, etc.
- Coordination on a **timing and condition** of a procurement of a low-carbon project in Davao City with related organizations, etc.
- Coordination with **manufacturers** of renewable energy equipment as well as **constructors**
- **Selection of equipment**, calculate the amount CO2 reduction, support for a preparation to apply for JCM Model Project

Typical Project Structure



Feasibility Study of LED Project

JCM Model Project

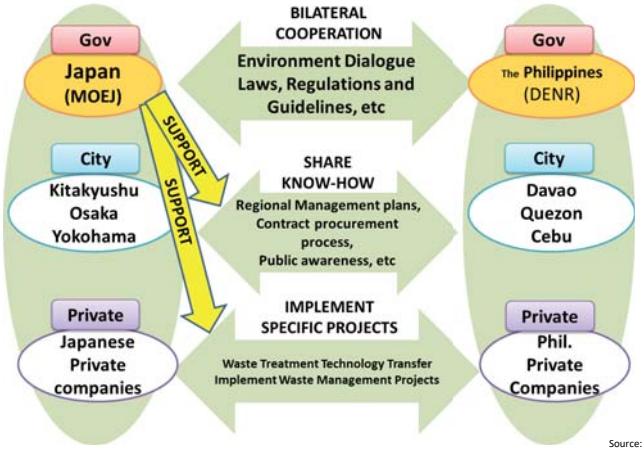


Picture: LED lighting for street lights (JOIN PLANNING Co., Ltd.)

Thank you.

For any further questions, please contact hayashi@iges.or.jp

Cooperation between the Philippines and Japan on Waste Management



Source: MOEJ

Environment Dialogues between DENR and MOEJ

Quezon City (with Osaka City), Davao City (with Kitakyushu City), and Cebu City (with Yokohama City) as Model Cities for WtE

✓ Organized **"Joint workshop on waste management between Japan and the Philippines"** to deepen understanding of current situation of waste management practices in Japan and the Philippines
✓ Cooperated to formulate **a draft WtE guideline (NSWMC resolution)**
✓ Organized **a study tour to Japan to learn about WtE management in Japan**

FY 2019 City-to-City Collaboration for Low-Carbon Society
(Project to Create a Low-Carbon Society in Davao City
through Support for the Development of a Local Climate Change Action Plan)
Report

February 2020

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