MOEJ

Final Report

City to City
Collaboration for
Zero-carbon Society in FY2021

Zero Carbon Development in Quezon City
for the Implementation of
Climate Change Mitigation Actions

March 2022

Oriental Consultants Co., Ltd.
Osaka City

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List of Abbreviations

Abbreviation	Meaning
C40	C40 Cities Climate Leadership Group
CFC	Chlorofluorocarbon
COP	Coefficient of Performance
DENR	Department of Environment and Natural Resources
EPWMD	Quezon City Government - Environmental Protection & Waste Management Department
GHG	Greenhouse Gas
GIZ	GesellschaftfürInternationale Zusammenarbeit GmbH
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
NCCAP	National Climate Change Action Plan
NFSCC	National Framework Strategy on Climate Change
ODP	Ozone Depletion Potential
POD	Philippine Ozone Desk
UNEP	United Nations Environment Programme

Chapter 1 Project Overview

1.1 Project Objective

The Paris Agreement came into force in November 2016 and the year 2020 represents its implementation stage. This agreement cites that central governments as well as local governments, cities and non-governmental organizations should accelerate measures against climate change. At the "Online Platform Ministerial Meeting on Recovery from the New Coronavirus and Climate Change/Environmental Measures" held in September 2020, it was confirmed that decarbonization policies are necessary for local governments that engage in activities directly related to communities and that local community-led development approaches are important. In Japan, it has been declared that the country aims to achieve a decarbonized society with zero greenhouse gas (GHG) emissions as a whole by 2050 and the number of municipalities declaring virtually zero carbon dioxide (CO2) emissions has rapidly increased to over 300.

As described above, the role of cities and local governments is becoming more important in considering and implementing specific regional climate change countermeasures and projects. In order to realize a global decarbonized society, it is necessary to accelerate the movement toward building a sustainable decarbonized society, especially in Asia, where economic growth is remarkable, and it is a place for activities that support socio-economic development. The movement to support the efforts of cities is being strengthened internationally toward the decarbonization and low carbonization of cities.

In addition, in the current situation of the spread of the new coronavirus infection, cities are under pressure to address issues related to the spread of infection and at the same time readjust and consider new measures to achieve sustainable development. It is extremely important to build a new method and a new city through cooperation between cities.

In this project, Japanese research institutes, private companies, universities, etc., together with Japanese cities that have experience and know-how regarding the development of zero/low-carbon societies, will conduct a research project to support the efforts of overseas local governments to form a zero/low-carbon society and the introduction of facilities that contributes to the formation of a zero/low-carbon society.

1.2 Project Overview

Entrusted Project Name:	City to City Collaboration for Zero-carbon Society in FY2021 Zero Carbon Development in Quezon City for the Implementation of Climate Change Mitigation Actions
Implementation Period:	September 1, 2021 to March 10, 2022
Ordering Party:	International Cooperation / Environmental Infrastructure Strategy Section, Global Environment Bureau, Ministry of the Environment
Consignee:	Oriental Consultants Co., Ltd.

1.3 Entrusted Project Content

1.3.1 Project Flow

This project was implemented in accordance with the following workflow:

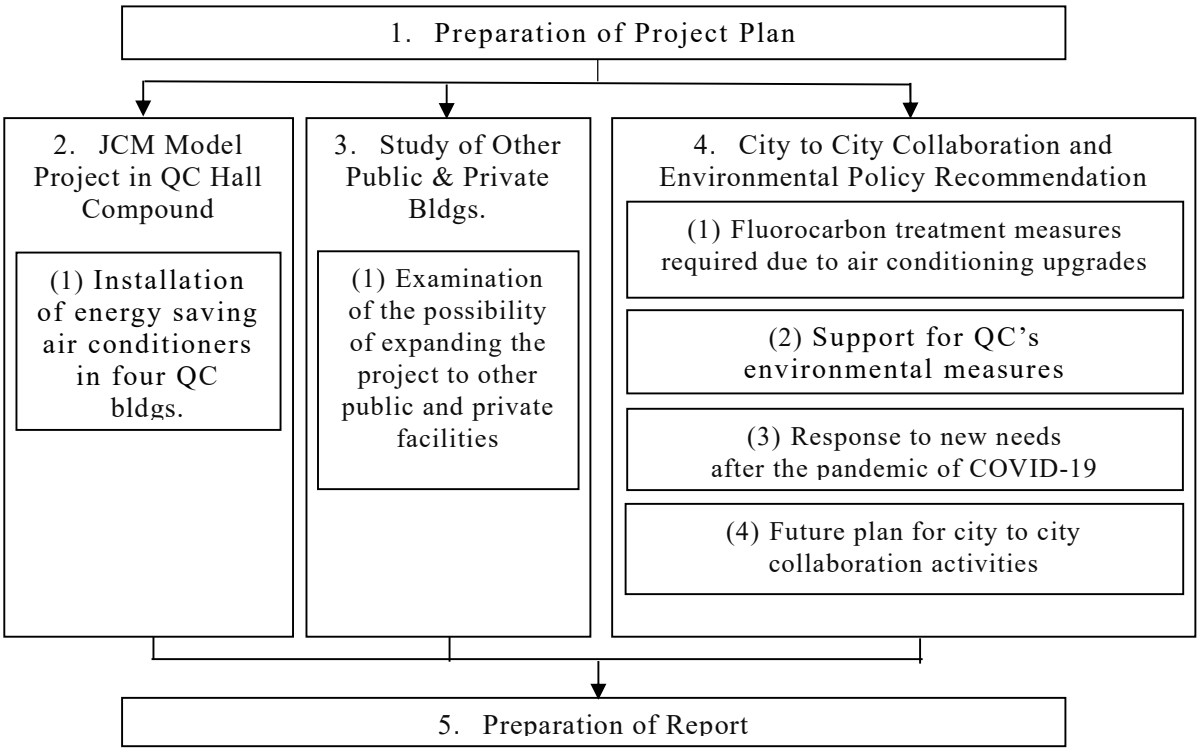


Figure 1-1 Project Workflow

1.3.2 Project Implementation Process

This project was implemented in accordance with the process described in this section.

Table 1-1　Project Implementation Process

Project Items	FY2021											
	4	5	6	7	8	9	10	11	12	1	2	3
Meetings						Kick-off			Mid term report		Final report	
JCM Model Project in QC Hall Compound －Application/adoption of JCM Model Project －Procurement/renewal of air conditioners (Acs) －Leasing/monitoring	Preparation			Application					Adoption			
Detailed study for installing ACs in other public &private bldgs. －Analysis of the results of the second year study －Detailed survey of public and private facilities －Examination of the possibility to apply for JCM Model Project												
Continuation of city-to-city collaboration and future project plan －Support for Quezon City's environmental policies －Study for responses in the pandemic of Covid 19 －Formulation of future project plan －Support for proper treatment of fluorocarbons －Workshops and information sharing												
Seminar organized by MOE and policy dialogue										MOE seminar and policy dialogue		
Monthly report												
Final report												

Implementation Period: Sep. 1, 2021 - Mar. 10, 2022

1.3.3 Project Implementation Structure

Oriental Consultants Co., Ltd. became the main proposer for this project and the project proceeded in cooperation with Osaka City as the joint proposer, in cooperation with the Quezon City Government - Environmental Protection & Waste Management Department (EPWMD)[1], the counterpart.

The implementation structure of this project and roles are described below.

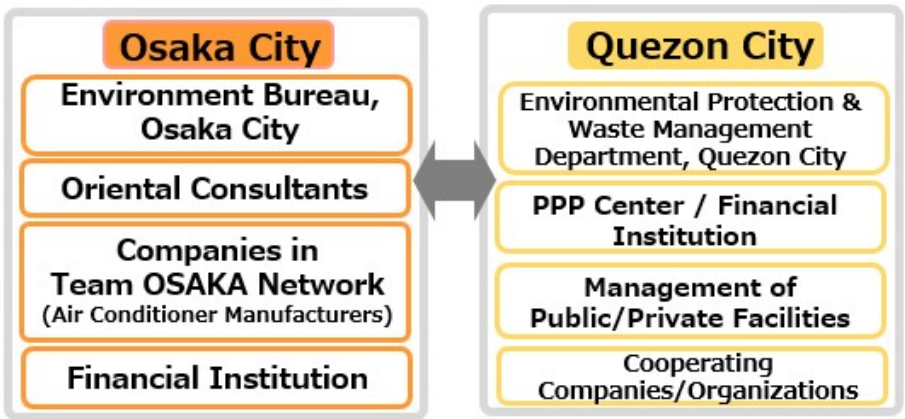


Figure 1-2　Implementation Structure

[1] As of March 2022, the department name is Climate Change and Environmental Sustainability Department.

Table 1-2 Roles of Project Participants

Role	Participant	Work Content
Representative Company	Oriental Consultants Co., Ltd. (hereinafter OC)	In charge of coordination with domestic and Philippine side parties, creation of business model for project formulation, compiling of study results, other such issues.
Air Conditioning System/ Fluorocarbon Measures, etc.	Team OSAKA Network[2] (Daikin Industries, Ltd. etc.)	Reviews cooperation with air conditioning manufacturers in Team OSAKA Network. Provides technical advice on the introduction of fluorocarbon measures/air conditioning systems.
Advice Related to Financing	Tokyo Century Corporation	Company participating in Team OSAKA Network. Joint applicant in last fiscal year. Has experience in JCM facility assistance project funding in the Philippines. Operates leasing business in the Philippines jointly with Philippine bank.

1.3.4 Meetings and Workshops

In cooperation with local partners, we collected local information and conducted meetings and workshops online.

[2] Team OSAKA Network was established by Osaka City as a platform for collaboration among companies in Osaka and the Kansai region with environmental technologies, Osaka City, the Global Environment Centre Foundation (GEC), and universities to create and form projects to build a low-carbon society in Asia and other cities.
Through its activities, the network aims to help companies expand their business overseas and revitalize the economies of Osaka and the Kansai region, as well as contribute to Japan's role in the international environmental field.

Table 1-3 Project Meetings

No.	Date	Venue	Overview
1	2021/9/7	WEB	・Meeting with Osaka City (preparation for the first workshop)
2	2021/9/16	WEB	・First workshop on between Quezon City and Osaka City
3	2021/9/29	WEB	・Kick-off meeting with Ministry of the Environment
4	2021/10/5	WEB	・Meeting with Osaka City(progress report)
5	2021/10/5	WEB	・Meeting with Quezon City and DENR (JCM model project)
6	2021/10/6	WEB	・Meeting with Quezon City (JCM model project)
7	2021/10/13	WEB	・Meeting with Daikin Airconditioning Philippines, Inc.
8	2021/10/18	WEB	・Meeting with Quezon City and Osaka City (JCM model project)
9	2021/11/12	WEB	・Meeting with Osaka City and ENDO Lighting Corporation
10	2021/11/19	WEB	・Meeting with Quezon City (JCM model project)
11	2021/11/26	WEB	・Second workshop with Quezon City and Osaka City
12	2021/12/8	WEB	・Meeting with Osaka City
13	2021/12/10	Osaka City	・Meeting with Osaka City
14	2021/12/17	WEB	・Meeting with GIZ (Solar Power Generation)
15	2021/12/21	WEB	・Meeting with Quezon City (site survey)
16	2021/12/27	WEB	・Meeting with Quezon City
17	2021/12/28	WEB	・Mid-term report to Ministry of the Environment
18	2022/1/18	WEB	・Meeting with ENDO Lighting Corporation
19	2022/1/18	WEB	・Meeting with local construction company for installing air conditioners
20	2022/1/20	WEB	・Meeting with Osaka City
21	2022/1/28	WEB	・Meeting with Tokyo Century Corporation
22	2022/2/3	WEB	・Third workshop with Quezon City and Osaka City
23	2022/2/9	WEB	・Meeting with Ministry of the Environment and Osaka City
24	2022/2/25	WEB	・Final report to Ministry of the Environment
25	2022/3/1	WEB	・Fourth workshop with Quezon City and Osaka City

1.4 Study Content

This project will support the introduction of policies and facilities for the development of zero carbon society in Quezon City in the Philippines, which is experiencing remarkable economic growth, based on the experience and know-how of Osaka City, which has declared net zero CO2 emissions by 2050.

Quezon City is an environmentally advanced city and is the only city in the Philippines that has joined C40 (C40 Cities Climate Leadership Group). Based on the “Memorandum of Understanding (MOU) between Quezon City and Osaka City for Cooperation in the Development of a Low/Zero Carbon City in Quezon City (hereinafter referred to as the “Quezon City-Osaka City MOU”),” which was renewed in August 2021, energy-saving measures will be promoted by introducing energy-saving air conditioning system in Quezon City government buildings, hospitals and shopping malls to realize climate change

mitigation actions in Quezon City. The outline of this year's study, the third year of the project, is shown in Table 1-4.

Table 1-4 Overview of Study

Project item	Activities
JCM Model Project in QC Hall Compound	Apply for and implement a JCM model project installing the targeted 531 energy-saving air conditioners in four QC buildings ⇒Establishing an international consortium and a PPP project and preparing a financing plan
Study of Other Public and Private Buildings	Analyze the study result conducted in the second year on the City Hall Compound, other public and private facilities, and identify their issues Conduct a detailed study on public and private facilities Consider a JCM model project by exploring potential applicability to the City Hall Compound and other public and private facilities, based on consideration of model projects in which reducing CO2 emissions and economic effects were confirmed, as well as examining the second year study result
City to City Collaboration and Environmental Policy Recommendation	Proper management of fluorocarbons required due to air conditioning upgrades Support for Quezon City's environmental measures (introducing electric vehicles (EVs) in the city bus system and technology for reducing plastic waste, improving water quality and the environment in San Juan River, etc.) Response to new needs arising from the COVID-19 pandemic (proper treatment of medical waste, a high-performance energy-efficient ventilation system, etc.) Future plan for city to city collaboration activities Workshops and seminars

1.4.1 Climate Change Measures in the Philippines

The Philippines is vulnerable to climate change and faces complex disaster risks, including typhoons, floods, droughts and landslides. In 2010, the Philippines government established the National Framework Strategy on Climate Change 2010-2022 and has since proactively striven to strengthen its adaptability, prevent global warming and promote sustainable development. This strategy prioritizes renewable energy, energy efficiency, sustainable infrastructure and waste management as pillars for climate change mitigation measures while setting out 1) capacity development, 2) knowledge management and information, education and communication and 3) research and development (R&D) and technology transfer as its three cross-cutting strategies. Moreover, in 2011, the National Climate Change Action Plan (NCCAP) was formulated to crystallize action programs based on the national strategy and advocating the need to strengthen sustainable energy development.

The following table shows the Nationally Determined Contribution (NDC) submitted by the Philippines to the UNFCCC in 2015. The NDC does not mention unconditional GHG reduction targets and presents its target of a "reduction of about 70% by 2030 relative to

its BAU scenario" contingent on cooperation from developed and other countries being made available to the Philippines.

Table 1-5 Outline of the Philippines' NDC

Implementation Period	Not specified.
GHG Reduction Targets	By domestic efforts (unconditional contribution): (not specified) With international support (conditional contribution: reduction of about 70% by 2030 relative to its BAU scenario)
Mitigation Measures	Contribution by mitigation is contingent on the extent of technological development and transfer and capacity development that will be domestically available.
Adaptation Measures	Mainstreaming disaster risk reduction which is integrated into the national plan. Disaster reduction focused sectors: agriculture, water and health CO2 emission reduction sectors: energy, transportation, waste, forestry and industrial sectors.
Certain Technological Needs	Technological transfer and innovation is needed to support adaptation and minimize loss and damage as well as enhance the capacity for mitigation. Technical inputs and assistance are critical for certain sectors such as grid efficiency improvement, standard development for energy and water efficiency and alternative or high-efficiency technology for conventional power generation.

Source: NDC of the Philippines[3]

1.4.2 Efforts in Quezon City and Request for Support

Metro Manila consists of 16 cities and 1 town, including Manila and the former capital, Quezon. It is the political, economic, cultural, transportation and information center of the Philippines and forms one of the largest metropolitan areas in the world with a metropolitan population of 12.88 million (Philippine National Census, 2015).

Quezon City has the largest area in Metropolitan Manila and various issues which include waste, energy, transportation, and urban greening have become more serious with the increase in population. Quezon City, which participates in C40, will participate in the Quezon City-Osaka City Bureau Director-level Policy Dialogue and Intercity Collaboration Workshop held in February 2021 in order to realize climate change mitigation actions as a representative environmentally advanced city in the Philippines. It shows the policy of efforts in the fields of 1) energy, 2) buildings, 3) transportation and 4) waste. After that, in the discussion on the activity policy of this year conducted with Quezon City, it is possible that the air conditioning replacement project of the City Hall, for which a plan and implementation system plan has already been formulated, will be feasible as a JCM project based on the results of the efforts up to the previous year. I have confirmed that it is

[3]https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Philippines%20First/Philippines%20-%20NDC.pdf

expensive. The air conditioning replacement project enables early recovery of investment costs and is expected to be “Decarbonization Domino” by being expanded horizontally to public and private facilities. Furthermore, by supporting the recovery and destruction of CFCs with a high global warming coefficient that occur when air conditioning equipment is renewed, it is possible to enhance the GHG emission reduction effect in cooperation with the Fluorocarbon Initiative advocated by Japan.

1.4.3 Climate Change Measures in Quezon City

In March 2021, Quezon City formulated the Enhanced Quezon City Local Climate Change Action Plan 2021-2050 (Enhanced QC-LCCAP) with the cooperation of C40. According to the Plan, GHG emissions in 2016 amounted to approximately 8 million tCO2. Regarding the proportion of major emission sources, the stationary energy use in buildings (housing, commercial and industrial facilities, etc.) and the manufacturing and construction sectors comprised 60%, followed by land transportation for 21% and waste (landfill disposal sites, open dumping, biological treatment, wastewater, etc.) for 19%. According to the BAU scenario starting from 2016, GHG emissions in Quezon City will increase to 19% in 2020, 85% in 2030 and around double in 2040.

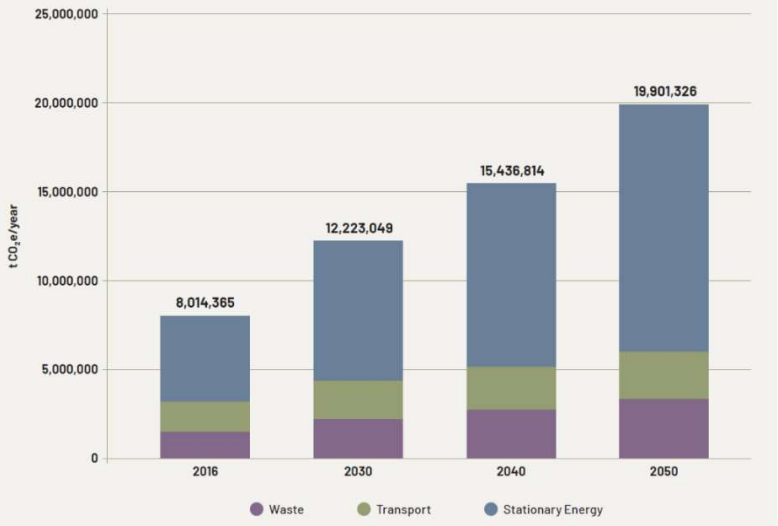


Figure 1-3 GHG Emissions Prediction in the Major Three Sectors in Quezon City by 2050

Source: Enhanced QC-LCCAP

Quezon City paves the way toward a carbon-neutral future with its ambitious action scenario targeting a 30% reduction in CO2 emissions against BAU by 2030 and the achievement of the carbon-neutral goal by 2050. As shown in the green line on Figure 1-4, this scenario targets peak-out of emissions in 2030 and zero emissions by 2050.

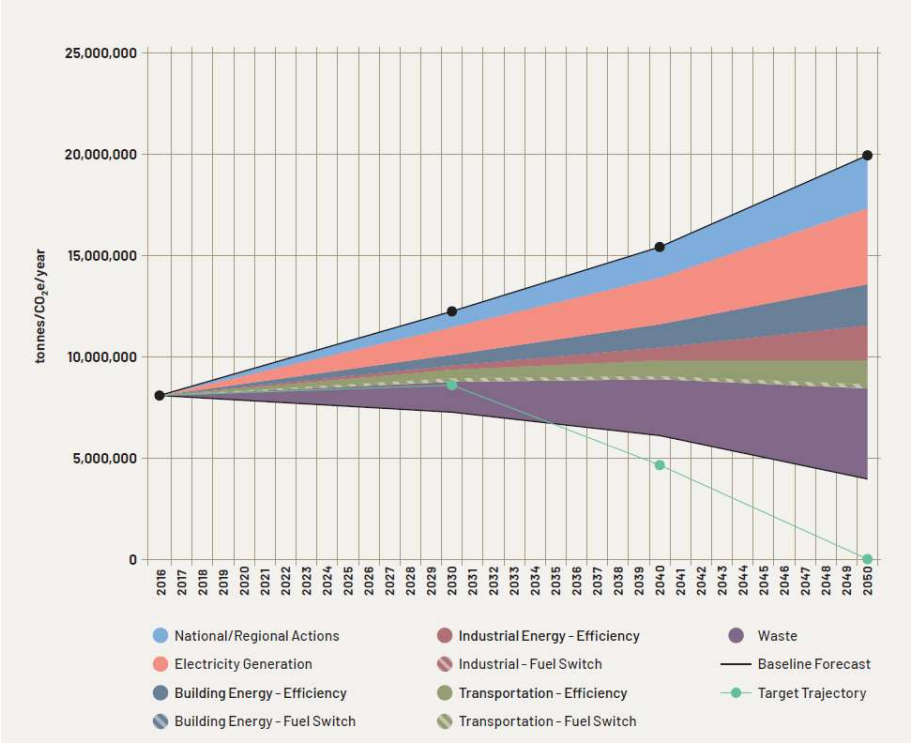


Figure 1-4 Emissions Reduction Targets of Quezon City by 2030 and 2050

Source: Enhanced QC-LCCAP

As specific actions, Quezon City has committed to innovative initiatives in the energy and construction, transportation and waste sectors. As part of moves to expand the scope of introducing renewable energy, the predicted contributions to emissions reduction in each sector based on their target are as follows: up to 63% by 2050 in energy and construction sectors; 31.8% by 2030 and 27.9% by 2050 in the waste sector. The transportation sector is expected to reduce emissions by 11 and 9% by 2030 and 2050, respectively.

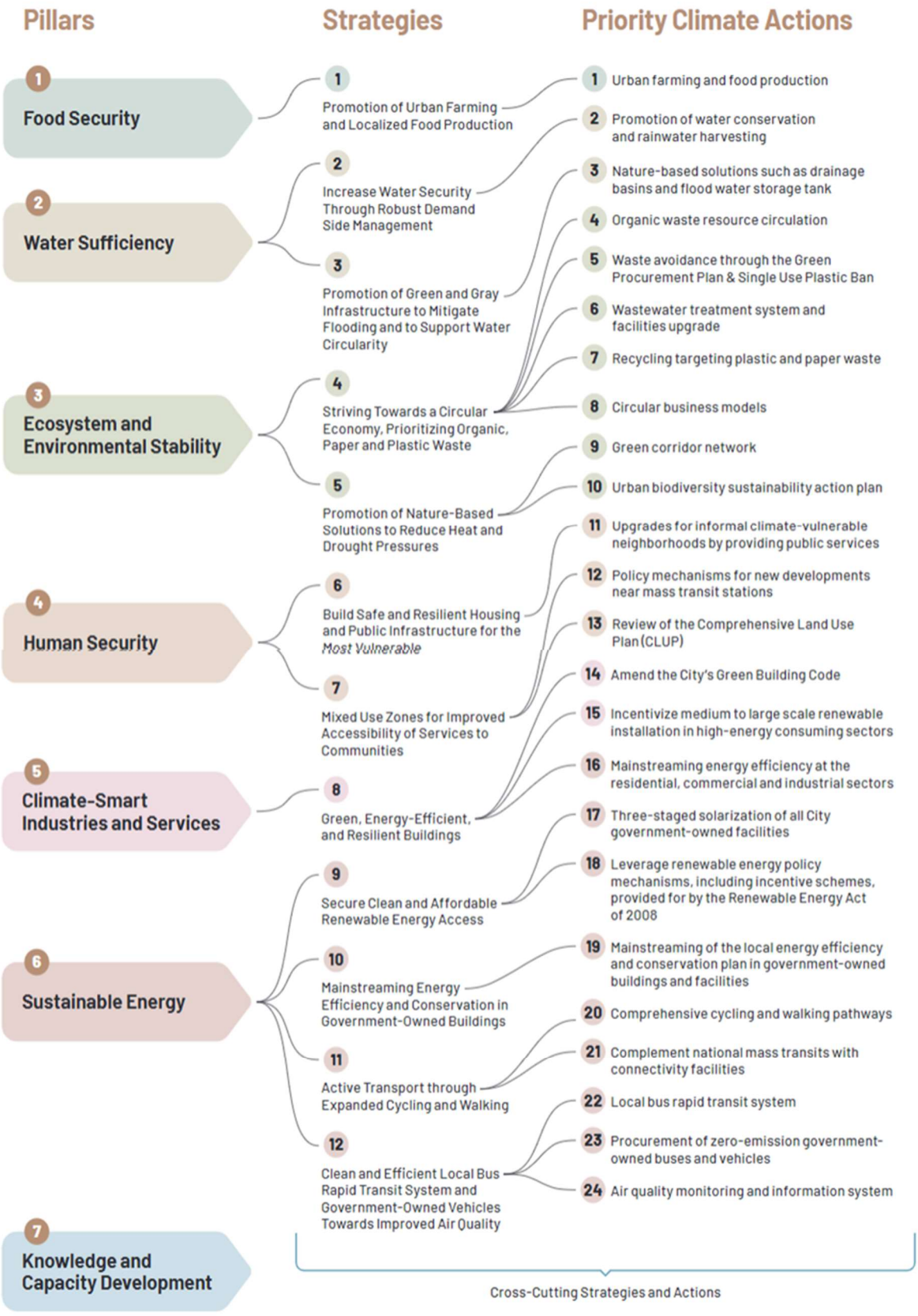
Table 1-6 Transformative Actions in Key Sectors

Sector	Transformative Actions
Energy and Building	• Meet national Renewable Energy targets (contingent on the achievement of national targets) • Scale-up solarization in government-owned, commercial, and residential buildings (national and local) • Develop and implement the enhanced Local Green Building Code
Transportation	• Mode shift to walking and biking • Mode shift to mass public transport • Modernization of public utility vehicles (PUVs) and private cars
Waste	• Enhanced comprehensive solid waste management program • Managing and processing of organic waste • Enhanced wastewater management

Source: Enhanced QC-LCCAP

To achieve the above vision, Enhanced QC-LCCAP has developed 7 pillars, 12 strategies and 24 priority climate actions based on the Philippines' National Climate Change Action Plan (NCCAP).

Table 1-7 Enhanced Quezon City Local Climate Change Action Plan 2021-2050



Source : Enhanced QC-LCCAP

Compared to the Quezon City Local Climate Change Action Plan 2017-2027, more specific measures including (14) Amend the city's green building code, (17) Solarization of all city government-owned facilities, (23) Procurement of zero-emission government-owned buses and vehicles are described.

Table 1-8 Overview of Quezon City Local Climate Change Action Plan

Measure for Climate Change	Objective/Purpose
1. Food Security	• Campaigns to promote food storage for emergencies and develop knowledge on food security to adapt to climate change • Increase usage, stable supply and accessibility of safe and healthy food
2. Stable Supply of Water	• Sustainable, secure and adequate supply of water • Assessment of water management • Improve hygiene infrastructure
3. Ecological and Environmental Stability	• Build capacity of local governments and communities to adapt • Improve capacity of organizations and individuals to adapt and help build healthy city lifestyles
4. Human Security	• Protect people from health hazards and dangers to social security caused by climate change • Promote establishment of housing and services adapted to climate change • Build capacity of local governments and communities to adapt
5. Climate-Smart Industries and Services that Contribute to Climate Issues	• Promote development of infrastructure in Quezon City that is highly resistant to climate change • Implement environmentally friendly solid waste management to mitigate and adapt to climate change • Set scope of greenhouse gas emissions
6. Sustainable Energy	• Utilize sustainable renewable energy and energy saving technology (a major constituent element of sustainable development) • Promote use/repair/improvement of energy systems and infrastructure that are impacted by climate change
7. Knowledge and Capacity Development	• Further develop scientific knowledge on climate change • Improve capacity related to adaptation, mitigation and reducing disaster risk of climate change at regional and community level • Establish management system for climate change and gender to educate people of Quezon City • Build climate change measure network that shares good practices and other resources

Source: QC-LCCAP

1.4.4 Previous Study Results

（1） Air Conditioning Demand in the Philippines

With economic growth and other development, air conditioning demand has increased annually in the Philippines. The stock quantity of air conditioning systems is predicted to

increase to approximately 15 million in 2050, tripling the five million or so in 2010 (and approximately 2.5 times larger than FY 2018).

According to the World Air Conditioner Demand Forecast published by the Japan Refrigeration and Air Conditioning Industry Association, demand for commercial air conditioners in the Philippines in 2018 equated to approximately 82,000 units. Based on the economic scale and population ratio, equivalent figures for such demand in Metro Manila and Quezon City for the year were estimated at approximately 30,000[4] and 7,000[5], respectively. When the growth rate throughout the Philippines is applied to both cities, demand for commercial air conditioners in 2050 will increase around 2.5 fold: approximately 75,000 units in Metro Manila and 17,500 in Quezon City respectively.

Assuming an air conditioner service life of around a decade, demand to upgrade air conditioners will also keep increasing. The project implemented last year also confirmed that air conditioning systems in public buildings would be upgraded sequentially in Quezon City.

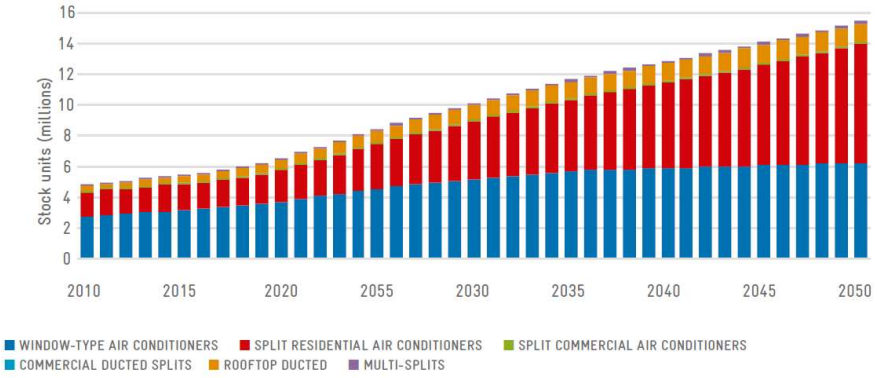


Figure 1-5　Forecast of Air Conditioner Stock Quantity in the Philippines

Source: GIZ 2019

（2） Possibility of Disseminating High-efficiency Air Conditioners

Considering the recent growing demand for air conditioning across the Philippines, including Metro Manila where Quezon City is located, as well as the obvious aging of air conditioners in public buildings, there is considerable potential to expand the scope of the project and introduce high-efficiency air conditioners from Quezon City to Metro Manila across the Philippines. Demand for air conditioning within general housing and housing complexes is expected to steadily grow across the Philippines as the national population increases.

The JCM model project for upgrading air conditioners in four targeted buildings involves establishing model projects expected to achieve economic efficiency with lower initial

[4] Metro Manila comprises 36% of GDP of the Philippines as a whole. Accordingly, the estimation is: 82,000 × 36% = approx. 30,000

[5] Quezon City comprises 23% of the population in Metro Manila. Accordingly, the estimation is: 30,000 × 23% = approx. 7,000

investment risk. These can then be leveraged to gain insights into effective promotion and targeted when rolling out the project nationwide in future. Given the assumed market potential of this project to upgrade highly energy-efficient air conditioning systems and the economic effect, a regional decarbonization domino effect is expected, to be triggered intensively and symbolically; centering on Quezon City and Metro Manila, with Japan supporting efforts to expand the model project.

（3） Energy Saving Air Conditioners

The energy-saving effects and introduction costs were calculated when assessing the introduction of (inverter-type) energy-saving air conditioners in the four buildings of the Quezon City Hall, scheduled for replacement by 2022. A total of 531 air conditioners were introduced in the four buildings (Breakdown: Window-type: 32 units, Floor-mounted type: 68 units, Wall-mounted type: 98 units, Ceiling cassette type: 333 units). The study confirmed that the expected GHG emissions reduction from energy-saving air conditioners would be 933 tCO2/year while the expected emissions reduction from fluorocarbon destruction would be 2,204 tCO2. The study team consented with Quezon City to apply for the FY 2021 JCM model project to upgrade air conditioners in the four buildings utilizing the PPP scheme of Quezon City. Each year, upgrading the air conditioner system will save 34,026,595 JPY in electricity charges, allowing a total investment of 76,300,000 JPY in electricity charges to be recouped in approximately 2.3 years.

The energy-saving effects and introduction costs were also calculated for upgrading air conditioners in City Hall Compound other than the four buildings, public facilities, such as hospitals, schools (universities) and sporting facilities and private facilities including shopping malls and hotels. Since the Ministry of the Environment of Japan and the GEC discussed and concluded that GHG emissions reduced as a result of recovering and destroying fluorocarbons were outside the scope of the JCM model project, the expected GHG emissions reduction by energy-saving air conditioners was calculated by excluding the amount of fluorocarbons destroyed, which confirmed that reductions of 793, 2,722 and 139,544 tCO2 annually in City Hall Compound other than the four buildings, public and private facilities, respectively, were predictable. However, the number and details of air conditioners installed in private facilities remained unknown since details of air conditioning systems in shopping malls and hotels were unavailable due to the COVID-19, although a remote survey was conducted in cooperation with local stakeholders. Accordingly, the calculation results represent reference values obtained by manufacturer interviews and assuming standard conditions. Considering differences in air conditioners actually installed and their installation conditions, a detailed survey was conducted in the third year to confirm the conditions and specifications of air conditioners installed at each facility.

Figure 1-6　Air Conditioners in Quezon City Hall

（4） Fluorocarbons Recovery and Destruction

During the first year, a basic survey was conducted on the legal framework and structure concerning how fluorocarbons were distributed and managed in the Philippines by interviewing related organizations and companies. The study clarified that while regulations govern the import and export of fluorocarbons (CFCs, HCFCs), no applicable regulations govern alternative fluorocarbons (HFC), nor are there any regulations concerning how fluorocarbons are collected, recovered and destroyed.

In the second year, the E-waste management status was surveyed to consider the collection and proper processing of old and new fluorocarbons from E-waste, the lack of national regulations on comprehensive E-waste management was confirmed and Quezon City did not take administrative responsibility for E-waste processing. The country was attempting to promote the sorting of E-waste by establishing recycling facilities (MRF) in areas managed by local governments to facilitate E-waste management by local governments. Although multiple MRFs have been established in Quezon City, it was confirmed that existing MRFs for collecting and sorting E-waste were unsuitable.

（5） Capacity Development Support

To date, capacity development support has been provided to Quezon City, including intercity collaboration seminars and workshops to share knowledge of Osaka City and confirm progress. In 2020, the Philippines announced its participation in the Fluorocarbon Initiative after approaching the POD via the project and other efforts. Sharing views and information on waste management and introducing solar power generation has been continued since past intercity projects. The final-year study provided support for introducing organic waste treatment devices at public markets and implementing solar power generation project for public school

Chapter 2 Model Project for Installing Energy Saving Air Conditioning System in Quezon City Hall Compound

2.1 Review of Existing Air Conditioners for Applying JCM Model Project

2.1.1 Overview of Survey Target Facilities

In the second year study, the Quezon City Hall Compound was selected from the standpoint of having the city become a regional model, and the four buildings (ANNEX, LEGISLATIVE, CIVIC-A, CIVIC-B) for which Quezon City has scheduled replacement of the old air conditioners were designated as the survey target.

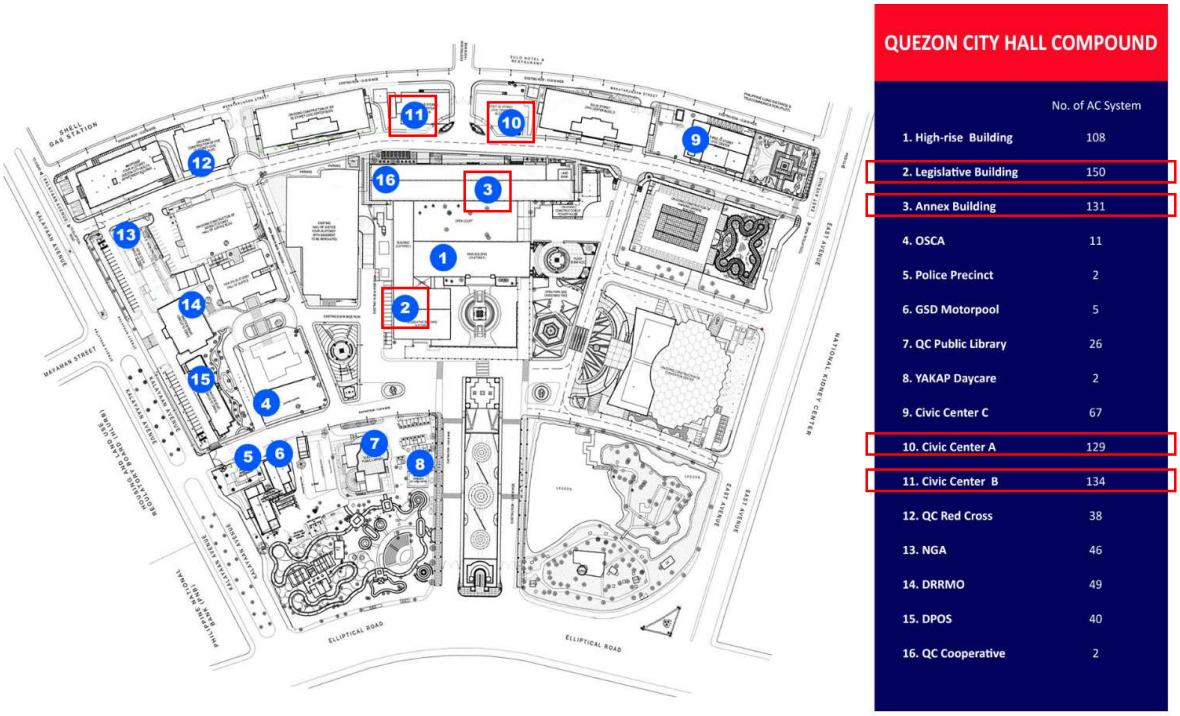


Figure 2-1 Location of Four Target Facilities in Quezon City Hall Compound

An overview of the air conditioning units in the four buildings is described below. Interviews from Quezon City indicated that the operating time of air conditioners is 2,349h/year (operated 8:00 –17:00 excluding Saturday and Sunday).

Table 2-1 Overview of Air Conditioners in Four Buildings

Building Name	Number of Units and Main Type	Main Manufacturer	Main Refrigerant
ANNEX	Indoor Unit: 118 units Outdoor Unit: 80 units Type: Mainly ceiling cassette	Mitsubishi Electric Koppel Carrier	R-410A (HFC-410A) R-22 (HCFC-22)
LEGISLATIVE	Indoor Unit: 150 units Outdoor Unit: 150 units Type: Mainly wall mounted	Kolin Carrier LG, etc.	-
CIVIC A	Indoor Unit: 129 units Outdoor Unit: 129 units Type: Mainly ceiling cassette	Mitsubishi Electric Koppel	R-22 (HCFC-22)
CIVIC B	Indoor Unit: 134 units Outdoor Unit: 140 units Type: Mainly ceiling cassette	Mitsubishi Electric Koppel	R-22 (HCFC-22)

The results of the study in the second year for the amount of reduction in Greenhouse gas (GHG) by introducing energy saving air conditioners and proper management of fluorocarbons are described below.

Table 2-2 GHG Emissions Reduction (study results in the previous fiscal year)

Item	Energy Saving Air Conditioning (1 year)	Proper Management of Fluorocarbons
Reference Emissions	2,324 tCO2	3,275 tCO2
Project Emissions	1,391 tCO2	1,071 tCO2
Expected Emissions Reduction	933 tCO2	2,204 tCO2

2.1.2 Review of Air Conditioning Units

（1） Selection Conditions of Air Conditioning Units

Based on the study result in the second year, an interview was conducted with an air conditioner manufacturer to enhance planning accuracy and carefully examine the reference equipment and project equipment, given specific project formulation and application for the JCM model project. The changes from the second year is shown in the table below.

Table 2-3 Changes from Second Year Study

Item	Reason for Change
i) Update the list of air conditioning equipment in the target facilities	The number of equipment and specifications of the surveyed facilities were updated based on the list of equipment for each facility compiled by Quezon City in the third year study.
ii) Updating the specifications of air conditioning equipment	Based on the results of i) above, the updated equipment specifications (inverter air conditioning equipment (individual, multi), cooling capacity, COP, etc.) were discussed with the air conditioning equipment manufacturer.
iii) Review of the concept of setting up reference devices	In the referenced methodology, the reference air conditioning system was assumed to be an existing system and the COP of the reference and project air conditioning systems was calculated based on the ratio of their COPs. In the JCM scheme, the cooling capacity and COP of the equipment were updated to be those generally adopted for equipment replacement at the target site.
iv) Review of the calculation method for GHG reduction benefits	For the JCM scheme, the average cooling load per hour needs to be calculated after setting, so it was updated.

The specifications of the air conditioning system/equipment and the monitoring equipment suitable for the planned JCM model project were conditioned on meeting the eligibility requirements of the approved methodology “VN_AM006 Introduction of air

conditioning system equipped with inverters (2016).” The eligibility requirements for this methodology include the installation of inverter air conditioning and COP standards for the equipment to be installed, as well as a plan for not releasing refrigerant from the existing chillers into the atmosphere, details of which are shown in Table 2-4. For equipment that did not meet the criteria, the study considered consolidating the equipment with multi-type air conditioners or converting to energy-efficient models.

Table 2-4 Eligibility Criteria of Methodology “VN_AM006 Introduction of Air Conditioning System Equipped with Inverters (2016)”

<table>
<tr><th>Applicable Criteria</th><th>Installation Conditions</th></tr>
<tr><td>i) An air conditioning system with an inverter is newly installed or installed to replace an existing non-inverter air conditioning system.</td><td>The project air conditioning system was installed to replace an existing non-inverter air conditioning system and as such, meets the criteria.</td></tr>
<tr><td>ii) The cooling capacity of the project air conditioning system exceeds or is equal to 14kW.</td><td>Although some of the equipment to be installed has a capacity under 14 kW (379 units/442 units), equipment with a capacity under 14 kW has been selected at the same level as COP2.97 of 14≤x<28 in the applicable criteria (iii) and a sufficient reduction effect has been secured by replacing the equipment.</td></tr>
<tr><td>iii) The COP of the project air conditioning system has a value exceeding that of the value indicated in the table below.
<table>
<tr><th>Cooling capacity [kW]</th><th>COP</th></tr>
<tr><td>14≤x<28</td><td>2.97</td></tr>
<tr><td>28≤x<42</td><td>2.94</td></tr>
<tr><td>42≤x<56</td><td>2.91</td></tr>
<tr><td>56 ≤ X</td><td>2.56</td></tr>
</table>
</td><td>Of the 14 kW units, 34 (FVA140AMVM: 2.45, FHA140BVMA: 2.59) are below the standard shown on the left. However, the COP of these units improves and exceeds the standard under partial load, meaning the applicable standard can be met by taking appropriate operational measures.
<table>
<tr><th>Model</th><th>Unit</th><th>100%</th><th>80%</th><th>60%</th><th>40%</th></tr>
<tr><td rowspan="2">FVA140AMVM /RZF140CVM</td><td>Cooling capacity</td><td>14</td><td>11.2</td><td>8.4</td><td>5.6</td></tr>
<tr><td>COP</td><td>2.45</td><td>2.33</td><td>2.54</td><td>4.91</td></tr>
<tr><td rowspan="2">FHA140BVMA /RZF140CVM</td><td>Cooling capacity</td><td>14</td><td>11.2</td><td>8.4</td><td>5.6</td></tr>
<tr><td>COP</td><td>2.59</td><td>2.47</td><td>2.68</td><td>5.19</td></tr>
</table>
</td></tr>
<tr><td>iv) The Ozone Depletion Potential (ODP) of the refrigerant used for the project air conditioning system is zero.</td><td>All the equipment to be installed in this project was selected to be free of ozone depletion potential (ODP).</td></tr>
<tr><td>v) Plans to prevent the release of refrigerants into the atmosphere at the time of removing the air conditioning system are prepared for both the project air conditioning system and the existing air conditioning system replaced by the project. When replacing the existing air conditioning system for a project air conditioning system, the execution of the prevention plan is checked at the time of verification, e.g., re-use of refrigerant, to confirm that the refrigerant used for the existing air conditioning system removed as part of the project is not released into the air.</td><td>Appropriate refrigerant treatment plans will be developed, and both the newly installed equipment and existing equipment will be treated and handled appropriately.</td></tr>
</table>

（2） Qualified Air Conditioners for Methodology

For the procurement of the air conditioning system, considering the funding status of Quezon City, a procurement contract between a leasing company in the Philippines and an air conditioner manufacturer capable of installing and testing the systems as well as properly processing fluorocarbon refrigerants from old air conditioners when replacing them is expected to be concluded. The contractor also maintains the system after installation.

Two systems will be introduced which are high energy efficiency inverter-type air conditioning system using refrigerants with low global warming potential (VRV and ceiling cassette type). Specifically, the systems are the product of Daikin Industries, Ltd. which precisely control the compressor motor, the central part of air conditioner and equip an inverter specifically for air conditioning that allows to reduce power consumption more than non-inverter type air conditioners, which should meet the eligibility requirements as shown in Table 2-4. As a result of consideration, specifications and the number of units will be introduced as shown in Table 2-5.

Table 2-5 Specifications of Air Conditioners to be Installed

No.	Air Conditioner	Model	Cooling Capacity (kW)	COP	Quantity (units)
#1-1	Consolidated Inverter-type Air Conditioner (outdoor unit)	RXUQ10AYM	28.0	4.45	3
#1-2		RXUQ12AYM	33.5	4.29	4
#1-3		RXUQ14AYM	40.0	4.23	10
#1-4		RXUQ16AYM	44.8	4.65	2
#1-5		RXUQ18AYM	50.0	3.91	2
#1-6	Consolidated Inverter-type Air Conditioner (indoor unit)	FXFQ63AVM	-	-	75
#1-7		FXFQ140AVM	-	-	75
#1-8	Indoor and Outdoor Units Individual Inverter-type Air Conditioner	FVA71AMVM / RZF71CVM	7.1	2.83	232
#1-9		FVA100AMVM / RZF100CVM	10.0	2.87	34
#1-10		FVA140AMVM / RZF140CVM	14.0	2.45	19
#1-11		FCF71CVM / RZF71CVM	7.1	3.68	102
#1-12		FBA100BVMA / RZF100CVM	10.0	3.32	2
#1-13		FHA100BVMA / RZF100CVM	10.0	3.09	7
#1-14		FHA140BVMA / RZF140CVM	14.0	2.59	15
#1-15		FTKM35TVM / RKM35TVM	3.5	3.89	2
#1-16		FVGR8PVL / RCN80HTL9	23.5	3.00	8

（3） Layout of the Air Conditioning System

The layouts of the systems to be installed as shown in the previous section were planned per building, based on a survey result for system installation, is shown in Figure 2-2. The numbers (#) shown in Figure correspond to No. (#) Table 2-5.

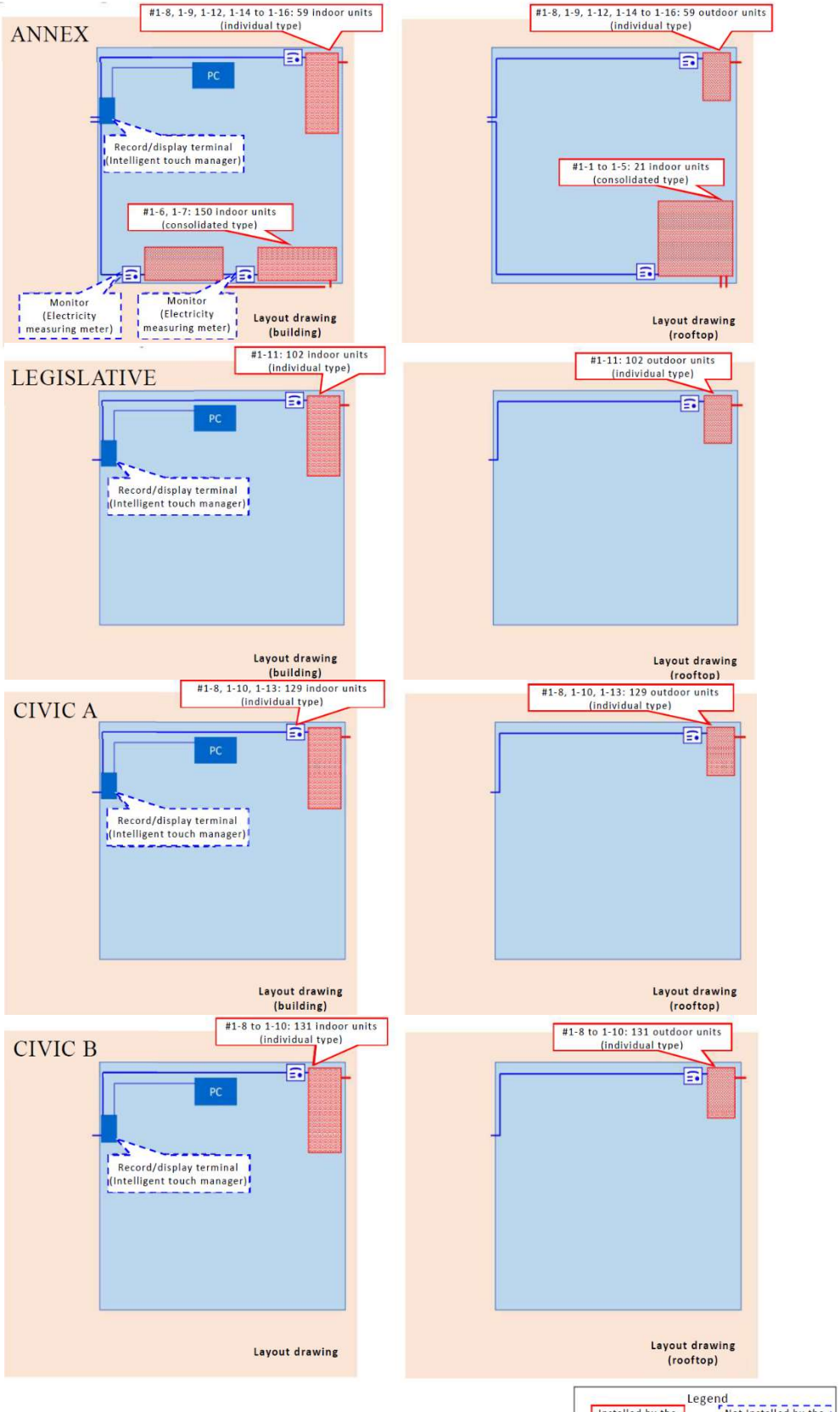


Figure 2-2 Layout

（4） Air Conditioning System Configuration

As well as normal commercial air conditioners, this project also introduces “multi-type air conditioner” allowing multiple air conditioners to be operated with a single outdoor unit. This project plans five methods, the piping and wiring drawings of which are shown as follows:

Table 2-6 Piping and Wiring for Multi-type Air Conditioners (1/2)

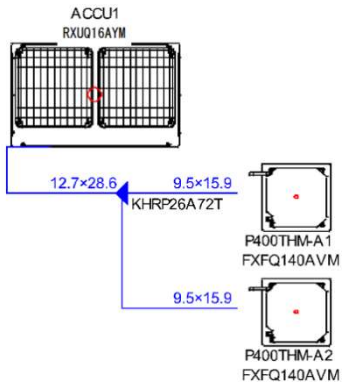
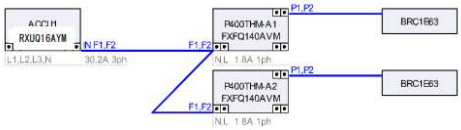
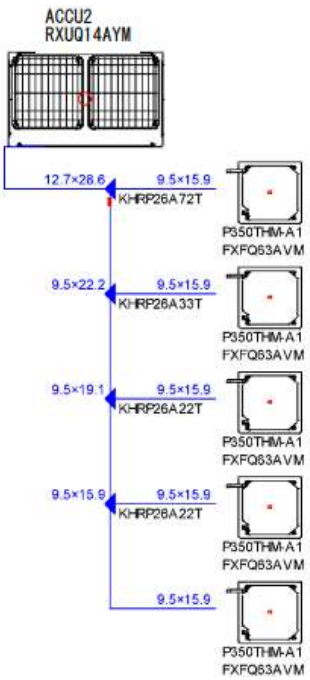
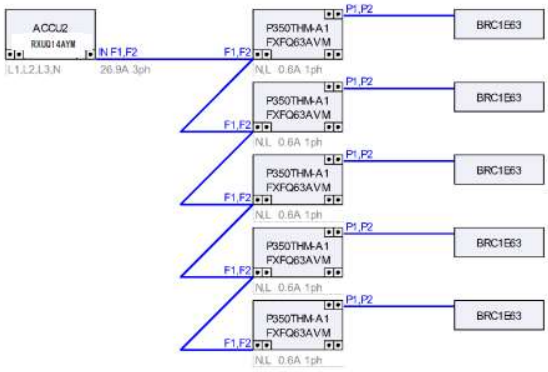
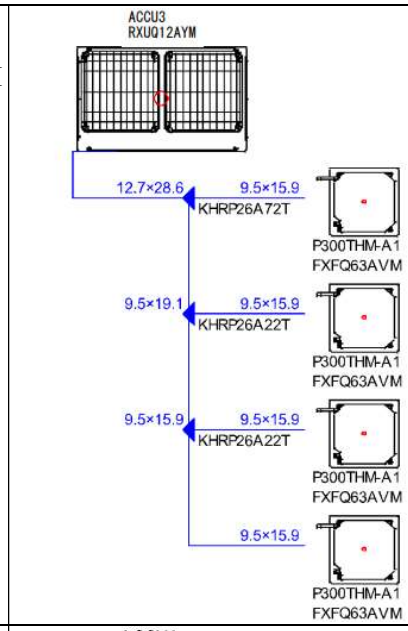
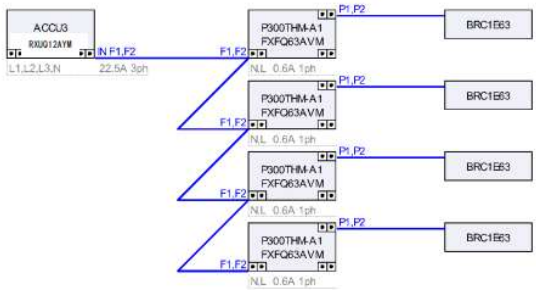
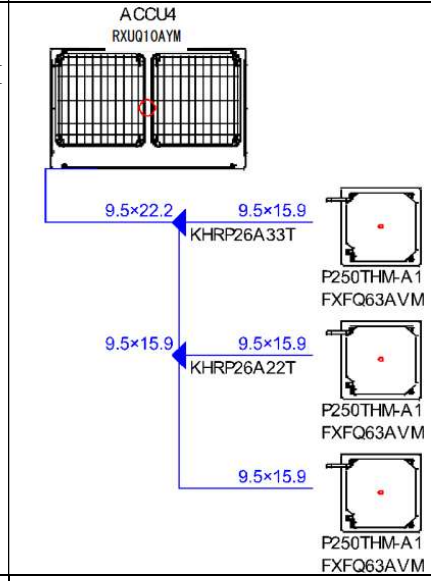
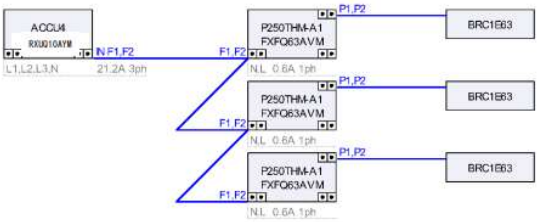
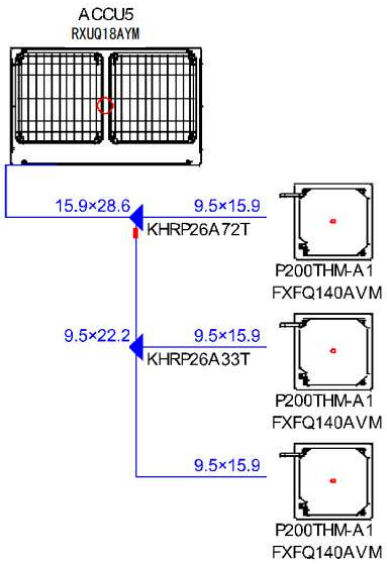
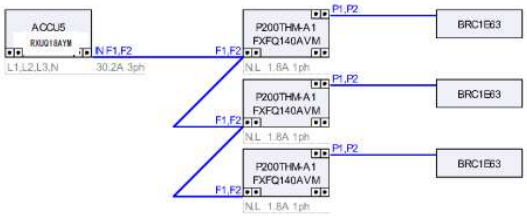
Method	Piping	Wiring
ACCU1 RXUQ16AYM		
ACCU2 RXUQ14AYM		

Table 2-6 Piping and Wiring for Multi-type Air Conditioners (2/2)

ACCU3 RXUQ12AYM		
ACCU4 RXUQ10AYM		
ACCU5 RXUQ18AYM		

2.1.3 Review of GHG Emissions Reduction

GHG emissions reduction confirmed by careful examination is shown below.

By reviewing the second year study results of the GHG emissions reduction calculation method needed to apply for a JCM model project, the GHG emissions reduction was shown to decline by 153 tCO2 after an energy-saving air conditioner was introduced. The GHG emissions reduction from destruction of fluorocarbons was 0 tCO2 since the above-mentioned GHG emissions reduction was only appropriated.

Table 2-7 GHG Emissions Reduction

Item	Energy Saving Air Conditioning (1 year)	Destruction of Fluorocarbons
Reference Emissions	6,588 tCO2	0 tCO2
Project Emissions	5,807 tCO2	0 tCO2
Expected Emissions Reduction	780 tCO2	0 tCO2

Table 2-8 Comparison of GHG Reductions with Results of Second Year Study

Item	i) Second Year Study (442 units)	ii) Third Year Study (442 units)	Difference (②-①)
Reference Emissions	2,324 tCO2	6,588 tCO2	4,264 tCO2
Project Emissions	1,391 tCO2	5,807 tCO2	4,416 tCO2
Expected Emissions Reduction (Total)	933 tCO2	780 tCO2	-153 tCO2
Expected Emissions Reduction (per unit)	2.11 tCO2	1.76 tCO2	-0.35 tCO2

2.2 Application for JCM Model Project

2.2.1 Applicable Subsidy Projects

It is expected that the JCM model project scheme can be utilized for the replacement of air conditioners, consisting of either a normal JCM model project or a JCM Eco-lease Project. The differences between these two types of projects are outlined below. Since the methodology has not been established for which application of established methodology is a requirement for JCM Eco-lease, efforts will be made to use a normal JCM model project for this case.

Table 2-9 Difference between JCM Model Project and JCM Eco-lease Project

Item	JCM Model Project	JCM Eco-lease Project
Subsidy Rate	Based on number of JCM projects using similar technology that have been adopted in the past. 0 project: 50% upper limit 1-3 projects: 40% upper limit 4 or more projects: 30% upper limit	Flat 10%
Requirement	–	• Monitoring period shall be lease period (5 years or more). Therefore, period can be shortened compared to JCM facility assistance • Applicable of established methodology is a requirement, making it necessary to first implement a JCM facility assistance project when not established

2.2.2 Examination of Cost Effectiveness of JCM Model Project

The cost effectiveness of utilizing a JCM model project was considered.

The study in the previous fiscal year indicated the cost for replacement is 106,837,607 PHP (251,068,376 JPY) (1 PHP=2.35 JPY). The maximum subsidy rate that has been adopted in the past for JCM projects utilizing similar technology is 50% according to the number of uses, but an amount of 1,834 PHP (4,000 JPY)/tCO2 is the standard for the cost effectiveness (Subsidy target amount ÷ (GHG reduction amount x life expectancy)) for JCM model projects, meaning that the cost effectiveness will be at the practical upper limit which is below the standard.

When air conditioners are replaced, the fluorocarbons from the recovered old air conditioners need to be processed in a proper manner. When considering the cost effectiveness of a JCM model project, the GHG reduction for the 6 years of legal durable years is 4,680 tCO2 (780 tCO2 x 6 years) when the reduction in GHG by destruction of fluorocarbons is not taken into consideration.

The subsidized amount for GHG reduction of under 1,834 PHP (4,000 JPY)/tCO2, which is the cost efficiency criterion, is 7,872,765 PHP (18,501,000 JPY), equating to approximately 11.53% of the cost for upgrading.

Above all, the subsidy rate for this project is given as 11.53% while the cost-effectiveness is 1,683 PHP (3,954 JPY) /tCO2.

<Formula for Calculation of Cost Effectiveness>

Cost effectiveness

= Subsidy rate of 11.53% (7,872,765 PHP (18,501,000 JPY)) ÷ [Expected emissions reduction by energy saving air conditioners (780 tCO2) x Legal durable years (6 years)]

=1,683 PHP (3,954 JPY)/tCO2

2.2.3 Energy Saving Effect of JCM Model Project

The saving energy effect by updating to inverter type air conditioning in Quezon City Hall Compound is described in this section.

Updating to inverter type air conditioning saves 1,306,000 kWh per year (power consumption before updating of 11,018,000 kWh – power consumption after updating of 9,712,000 kWh). When the electricity rate is assumed to be 10 PHP/kWh (23.5 JPY/kWh, 1 PHP=2.35 JPY), this saves 13,060,000 PHP (30,691,000 JPY) per year.

Table 2-10 Energy Saving Effects by Updating to Inverter Type Air Conditioners

Reduction Effect	1 Year	5 Years	10 Years	15 Years	20 Years
Saving Electricity (kWh)	1,306,000	6,530,000	13,060,000	19,590,000	26,120,000
Savings Amount (JPY)	30,691,000	153,455,000	306,910,000	458,865,000	612,320,000
Savings Amount (PHP)	13,060,000	65,300,000	130,600,000	195,900,000	261,200,000
CO2 Reduction (t)	780	3,900	7,800	11,700	15,600

*Electricity rate is assumed to be 10 PHP/kWh

Since the total investment is 106,837,607 PHP (251,068,376 JPY), the investment is expected to be recovered in approximately 8.2 years with the reduction in electricity charges.

<Economic Effect>

- Total Investment Amount : 106,837,607 PHP (251,068,376 JPY)
- Simple Investment Recovery : Total investment (PHP) / Annual electricity reduction (PHP)

= 106,837,607 PHP ÷13,060,000 PHP

= **8.2 years**

Here, the results of calculation are shown below when a JCM model project and a 6 year leasing is shown in the Table 2-11. The calculations indicate that the annual savings in electricity charges exceed the annual leasing charges, indicating that the air conditioners can be introduced without bearing any additional real charges.

Table 2-11 Business Feasibility of Leasing Project

Item	Amount	
Total Investment Amount	106,837,607	PHP
JCM Model Project*1	7,872,765	PHP
Net Total Investment Amount	98,964,842	PHP
Total Cost for 6-Year Lease*2	87,452,792.64	PHP
Annual Lease Charge	14,575,465.44	PHP/year
Energy Saving Effect (During Lease Period)	13,060,000	PHP/year
Energy Saving Effect (After Lease Period)	15,608,530	PHP/year

*1 Subsidy rate is 11.53% of facility costs only
*2 Lease rate: 8.0% (based on LLFC's term sheet conditions)

<Annual Lease Charge Calculation Formula>

Annual Lease Charge (PHP/year)

= Net total investment amount (98,964,842 PHP) x Lease rate (8.0%) x 12 months

= 14,575,465.44 PHP/year

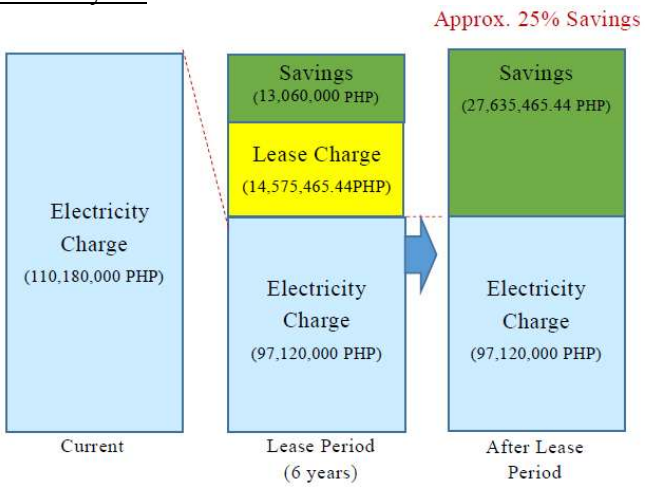


Figure 2-3 Image of Cost Reduction by Introducing Air Conditioners with Lease

Furthermore, electricity charges in the Philippines are higher compared to other countries in Southeast Asia. Complete privatization of electric power has been cited as the main reason for this, with no government subsidies being provided. This result in a trend to achieve a larger electricity cost saving through energy saving. In addition, the fact that there is stable air conditioning demand due to the high annual average temperature is another reason for a large amount of savings in electrical charges. Accordingly, it is expected that the implementation of an energy saving project to introduce inverter type air conditioners in the Philippines will have a large effect.

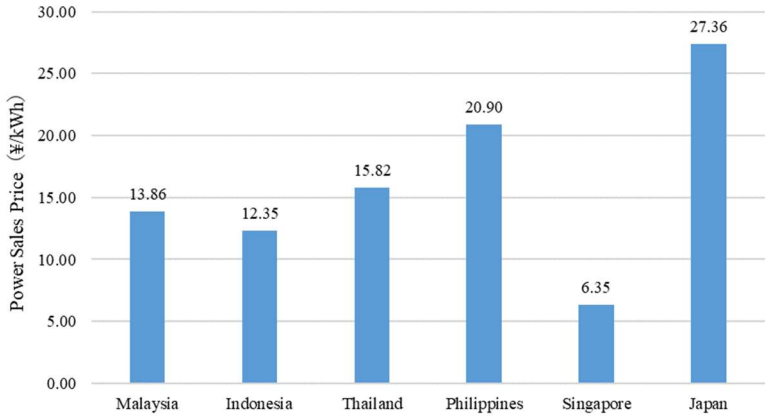


Figure 2-4　Electricity Sales Price in Asian Countries (2019)

Source: World Bank, Getting electricity: Price of electricity

The expected quantitative effects brought by implementation of this project are described below.

- GHG Emissions Reduction by air conditioner replacement　780 tCO2
- Reduction in Annual Electricity Consumption in Quezon City　1,306,000 kwh/year
- Reduction in Annual Electricity Charges in Quezon City × electricity rate =13,060,000 PHP

2.2.4 Packaging Proper Management of Fluorocarbons

Interviews were conducted to the Ministry of the Environment and the Global Environment Centre (GEC) as to whether or not the reduction in GHG emissions by proper management of fluorocarbons will be taken into consideration in the application requirements for JCM model project. This concluded that the reduction in GHG emissions by proper management of fluorocarbons has not been regarded as the achievement of JCM model project.

On the other hand, proper management of fluorocarbons (destruction or storage of fluorocarbons) is required for utilization of JCM model projects, and it was confirmed that the project implementation structure needs to consider fluorocarbons management.

Fluorocarbons are currently handled as a chemical substance in the Philippines, and a penalty has been prescribed for illegal discharge of chemical substances, but there is not a law that provides an obligation for recovery and destruction specifically for fluorocarbons. In addition, comprehensive laws have not been enacted for the recycling of E-waste (disused electric/electronic device) which would most likely include air conditioners. On the other hand, in DAO2013-22 (Revised Procedures and Standards for the Management of Hazardous Wastes), although an obligation to recover and properly process industrial and household E-waste is established, there is not specific mention for the processing of fluorocarbons. In actual practice, when air conditioners are disposed, items of value are purchased by repair and other such shops, and it appears that other parts are disposed without being processed in a proper manner.

Therefore, a packaged business model needs to be established that includes the proper processing of existing air conditioners including proper management of E-waste and fluorocarbons.

2.2.5 Possible Project Scheme in the Philippines

In the second year study, Quezon City was going to budget the replacement of the air conditioners with the premise of maximum utilization of JCM, but there was a change in policy after the city to city collaboration project started this fiscal year, and we were consulted concerning their desire to implement outsourcing as much as possible. Quezon City has proposed two outsourcing methods: Energy Service Company (ESCO) and Public Private Partnership (PPP), and has presented the requirements for both schemes and the operation rules related to company identification methods. Consideration of both methods resulted in the conclusion that for the ESCO method, since the ESCO company needs to conclude a performance contract that includes a guarantee of the energy saving effect, it would be difficult for this project to adapt to this method since the current energy usage volume has not been verified. Discussions with Quezon City resulted in the decision to basically proceed with the PPP method, and since it was confirmed that the lease method is suited to promoting this project for conceivable project schemes that were possible with the PPP method, it was decided that consideration of the project framework would be performed based on the lease method.

The Philippines has a history of introducing PPP projects before other countries in Asia, which was mainly triggered by the electric power crisis at the beginning of the 1990s and the financial crunch it experienced. The BOT law was enacted in 1990, and remains in effect with revisions being made subsequently. The PPP Center was established by a government ordinance, and is in charge of forming and promoting implementation of PPP projects. There are various PPP formats based on the BOT law, and they are used for different purposes according to the characteristics of the project, including the BOT and various other patterns provided.

Quezon City has enacted the “Quezon City PPP Code (Quezon City Ordinance No. SP-2336, S-2014).” According to the Implementing Rules and Regulations of Quezon City Ordinance No. SP-2336, S-2014, the Build-Lease-and-Transfer (BLT) method is thought to be the PPP project scheme that can be applied to this project. With the BLT method, a private sector company loans the leased property, with the ownership being transferred to the public entity side when the contract ends. We understand that Quezon City wishes to collaborate with the PPP Center to drive forward with this project by using leases.

The private sector company will retain ownership of the air conditioning facilities during the contract period for this project, and the Quezon City side will repay the introduction cost in the form of lease fees. This has the advantage on the Quezon City side of smoothing out the initial cost burden. This does result in the city bearing the interest and fees of the leasing company, but since the electricity bills can be reduced by the savings in energy for air conditioning, the cost burden can be dramatically reduced by applying that reduction to

the lease fees.

In principle, bidding is used to determine the company when implementing a PPP project, but negotiated contracts are also recognized. In this case, the private sector company submits an “Unsolicited Proposal.” The Unsolicited Proposal should include a new concept or new technology, and needs to be a proposal that is not included on the priority project list of a government organization or local government.

The private sector company needs to bear the cost itself, and obtain formal approval from Quezon City after the proposal is compiled. An overview of the specific procedures and the number of days required are described in the table below.

According to the PPP Manual for LGUs Volume 2 in the Philippines, the approval organization for PPP projects differs depending upon the scale of the project costs, and the approval organization for this project is the Provincial Development Council (PDC).

Table 2-12 Overview of PPP Project Procedure and Number of Days Required

Private Sector	Process	LGU (Local Government Unit)
Proposer prepares set of proposal documents consisting of feasibility study, company overview and contract proposal, and submits to LGU.	Proposal documents submitted	Provides advice to proposer on whether additional information is required within 7 days after verifying receipt.
	Evaluation of proposal	LGU reviews project proposal and notifies proposer of approval/rejection in writing within 30 days.
	Negotiation with proposer	LGU negotiates with proposer, and secures profitability specified by approval organization. Negotiating period is within 90 days.
	Approval of project proposal and contract by approval organization	LGU representative approves proposal made to approval organization and contract. Approval organization performs review within 30 days. Approval organization issues approval notice.
Letter of consent for approval organization conditions submitted to LGU within 45 days after receipt of approval notice issued by approval organization.	Acceptance of contract conditions by proposer	
Original proposer pays bidding deposit by date of competitive proposal publication. Proposal resubmitted in accordance with requirements.	Recruitment of competitive proposals	LGU publicly seeks competitive proposals
Competitive proposers are given 60 business days from issuance of the bidding documents.	Preparation and submission of competitive proposals	PCC Bids and Awards Committee (PBAC) holds pre-bidding meeting within ten business days after issuance of the bidding documents.
	Evaluation of proposals	PBAC evaluates bids within 30 days after submission deadline.
Original proposer has counter- match right for best proposal within 30 business days.	Determination of successful bidder	When other competitive bids are not judged to be superior to proposal by original proposer, it immediately becomes the successful bidder for the project.
	Approval of successful bidder	PBAC submits recommendations concerning bid to LGU within 7 days after completion of financial evaluation. LGU approves PBAC recommendations within 7 days.
Successful bidder complies with conditions and requirements stated in notice within 30 days.	Notice of award	LGU issues notice of award.
Successful bidder signs contract within 7 days.	Execution/ approval of contract	LGU signs contract within 7 days after confirming successful bidder is complying with conditions described in notice of award. Contract is submitted to approval organization within 7 days after signing.
Comply with conditions to be complied before implementation of contract	Issuance of start / contract implementation notice	Issue project start notice to proposer within 7 days after approval/signing of contract made by person in charge at LGU

Source: PPP Manual for LGUs Volume 2

2.2.6 Project Implementation Structure and Possible Project Implementation Schedule

This project will be implemented as a lease project. The contract format will consist of signing a lease contract between the lease company and Quezon City, and the leasing of the replacement air conditioners by the lease company to Quezon City. Ownership of the set of air conditioners covered will be transferred free of charge to Quezon City after the end of the lease contract. Furthermore, an international consortium will be formed between the representative company in Japan, the lease company and Quezon City in order to incorporate JCM facility assistance. The lease content and period conditions must satisfy the requirements for JCM facility assistance. An overview of each company/party's expected roles for the implementation structure is described below.

Table 2-13 Possible Project Structure and Roles

Company / Party	Role / Implementation Content
Representative Company	• Application for JCM facility assistance, receiving of subsidy • Review of overall plan, support for formulation of specifications • Monitoring report
Quezon City	• Introduction of air conditioners, achievement of energy savings and reducing CO2 emissions • Payment of leasing fees (including maintenance) • Cooperation for monitoring • Proper management of fluorocarbons (designation)
Lease Company	• Leasing of air conditioners (including maintenance) • Monitoring
Air Conditioner Manufacturer	• Delivery, installation and maintenance of new air conditioners • Proper processing of old air conditioners • Proper management/processing of fluorocarbons

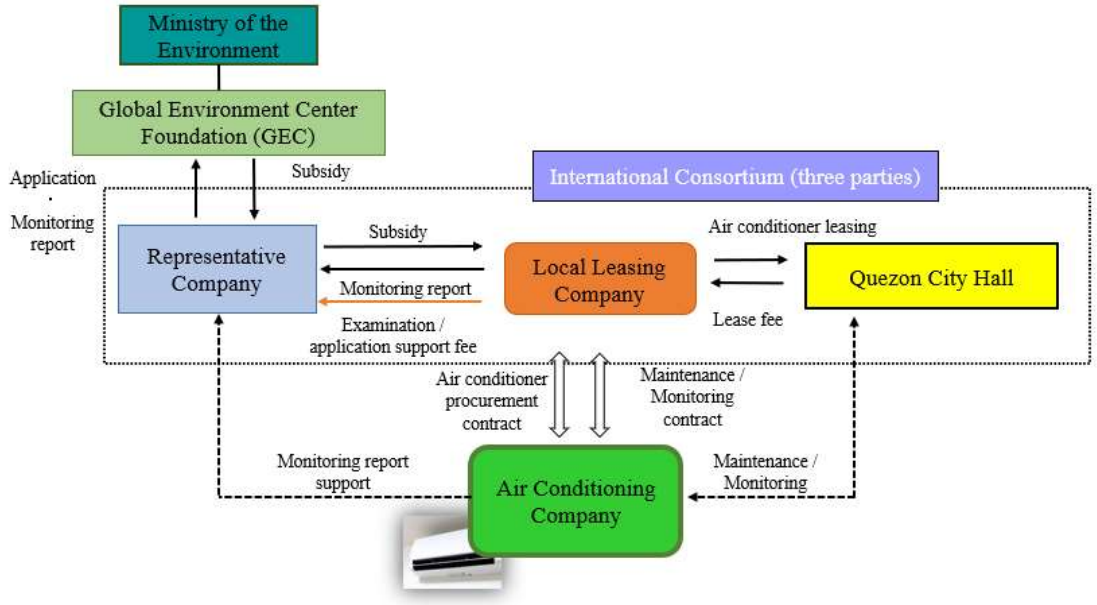
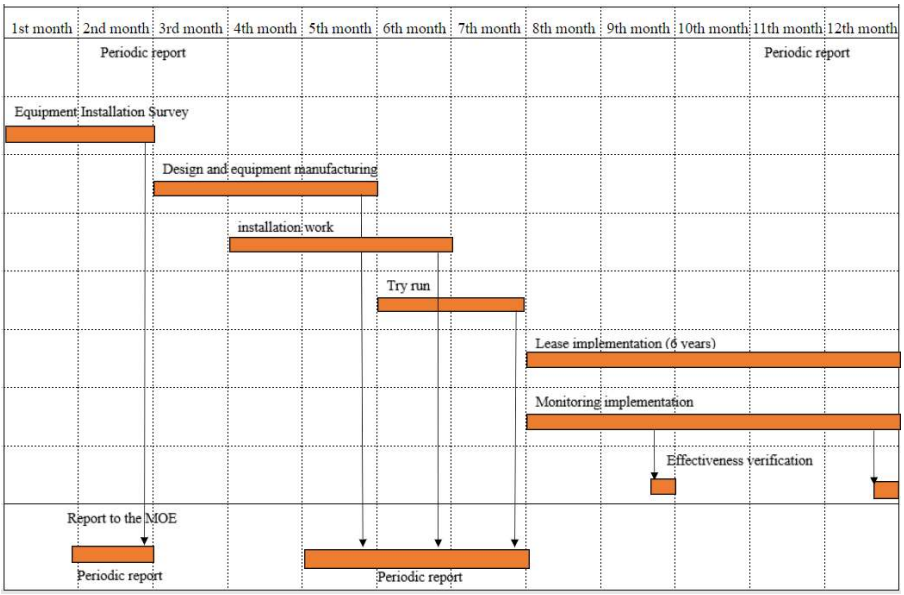


Figure 2-5 Possible Project Structure

Table 2-14 shows the planned schedule of the project including facility survey, design and manufacturing, installation work, test operation and monitoring.

Table 2-14　Possible Project Implementation Schedule (draft)



2.2.7 Establishment of Monitoring System

（1） Monitoring Implementation Structure

Quezon City will carry out onsite monitoring in support of air conditioner company and report the results to representative company. With the results, representative company report to MOE. Beforehand, representative company should confirm the applicability of the results via a third party entity. The following figure shows the monitoring implementation structure.

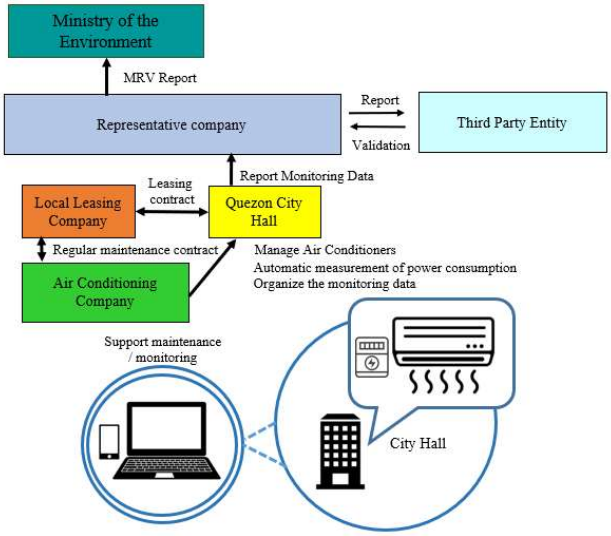


Figure 2-6　Monitoring Implementation Structure (draft)

（2） Monitoring System

To monitor, Quezon City personnel shall collect and compile measured data saved in a

server via Wi-Fi using a measuring meter (watt checker) installed in individual air conditioners (indoor/outdoor units) on a monthly basis.

This monitoring method will satisfy the criteria of "installing a measuring meter in each outdoor unit and measuring consumed electricity," "automatically transmitting measured data to server and recording it" and "ensuring the responsible staff report monthly to prevent any data from going missing" as shown in the "Measurement Method and Procedure," a monitoring method described in the Monitoring Plan Sheet of VN_AM006 Introduction of air conditioning system equipped with inverters (2016), the methodology approved by JCM and applied in the project.

Equipment with specifications as shown in Table 2-15 will be used for monitoring, which is a system of measuring and recording the hourly energy consumption for each piece of equipment via an electricity measuring meter: the data listed in Table 2-16 will be obtained as shown in Figure 2-7. Measured data can be extracted in CSV format.

Table 2-15 Specifications of Monitoring Equipment

Product Name (model)	Intelligent Touch Manager (DCM601B1)		
Power Source	AC100 to 240V, 50/60Hz		
Power Consumption	23W		
Emergency Shutdown Input	Constantly "a" contact, contact current: about 10mA		
Dimension	W290 x H243 x D50	Weight	2.4kg
Operating Temperature	0 to 40 degrees C	Operating humidity	85% or less
Units for Management	Up to 660 units		
Data Recording Capacity	Annual energy estimated data (kWh)*1: Two years Monthly energy estimated data (kWh)*1: Up to 13 months Undeleted data: Up to 13 months Preset temperature deviation data: Up to 13 months Data for units managed: Up to 13 months*2		

*1: Displayed by selecting energy types (electricity, gas and water)
*2: Up to two months if managed online.

Table 2-16 Data Output Items

Item		Data item	Recording frequency
Annual Energy Estimated Data*1		Actual, target and planned values of consumed energy	Monthly
Monthly Energy Estimated Data*1		Actual, target and planned values of consumed energy	Daily
Units for Management	Indoor Unit: D III-NET Connection*3	Preset temperature*2, suction temperature*2, operating time integrated value (cooling, heating, drying, blowing), maneuvering times	Hourly
	Total Heat Exchanger: D III-NET Connection*3 DESICA: D III-NET Connection*3	Operating time integrated value, maneuvering times	Hourly
	Chiller: D III-NET Connection*3	Water temperature at the cold/hot water inlet and outlet*2, operating time integrated value (cooling and heating), maneuvering times	Hourly
	Electricity Measuring Meter: Integrated Value	Power consumption (kWh)	Hourly
	Analog Value (average value)	Outdoor temperature sensor, etc.	Hourly

*1: Displayed by selecting energy types (electricity, gas and water)
*2: Display average, maximum and minimum values per hour
*3: Daikin's air conditioners, total heat exchangers, DESICA and chillers are applicable

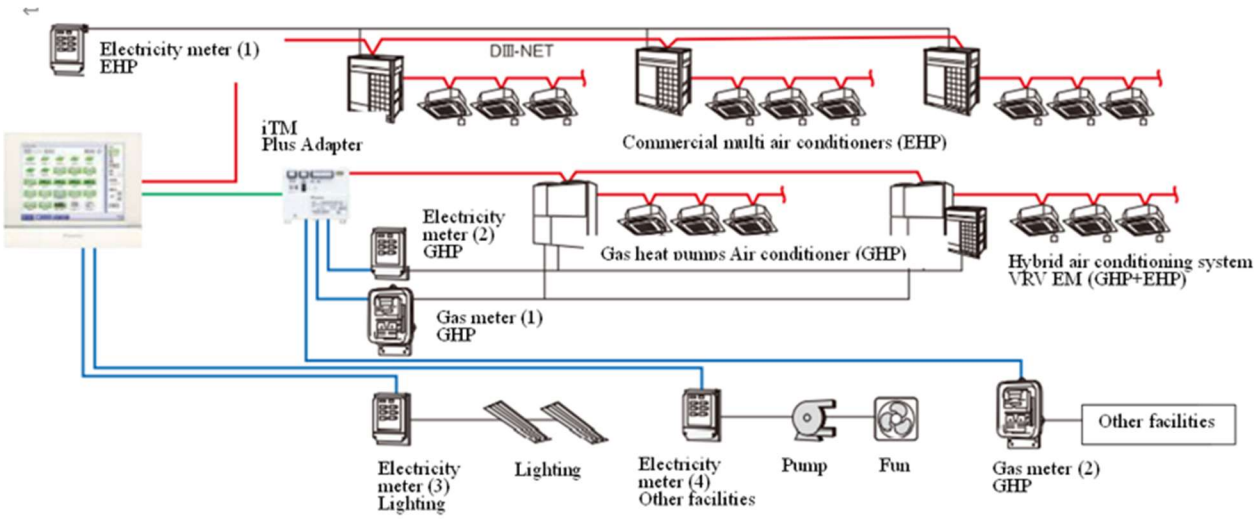


Figure 2-7 Image of Monitoring System

Source: Catalogue of manufacturer

2.2.8 Report of Monitoring Results

As shown in Figure 2-6, the monitoring results will be reported from Quezon City to representative company to the MOE.

Quezon City will report to representative company monthly while representative company will report to the MOE every fourth quarter. representative company will estimate the effect on a quarterly basis based on the data obtained, confirm its applicability via a third-party

entity and regularly report on annual measurement and analytical results to the MOE.

Table 2-17 Monitoring Schedule (draft)

Item	1st year	2nd year	3rd year	4th year	5th year	6th year
Lease (6 years)						
Monitoring (Install measurement equipment and acquire data based on the methodology)						
Effectiveness verification (Estimate the effect based on the data obtained every quarter)						
Reporting to the Ministry of the Environment (Annual report: report on measurement and analysis results throughout the year)	Periodic report	Periodic report	Periodic report	Periodic report	Periodic report	Monitoring Completion report

Chapter 3 Energy Saving Air Conditioning Systems in Other Public and Private Facilities

3.1 Survey of Existing Air Conditioning in Other Public Facilities

3.1.1 Overview of Quezon City Hall Compound

Quezon City is striving to further reduce GHG emissions by replacing air conditioners located at public facilities other than the four for which the survey was conducted the last fiscal year. The scope of this initiative also included examining the conversion to energy-saving air conditioners at the Quezon City Hall Compound. The compound comprises a total of 16 facilities, including those surveyed the last fiscal year.

Table 3-1 Buildings in Quezon City Hall Compound

No.	Name	Application
1	High-rise Building	City Hall
2	Legislative Building (* Previous fiscal year survey target)	Legislative
3	Annex Building (* Previous fiscal year survey target)	City Hall
4	OSCA (Office of the Senior Citizen Affairs)	Senior Citizen Affairs
5	Police Precinct	Police
6	GSD Motorpool	Parking Lot
7	QC Public Library	Library
8	YAKAP Daycare	Daycare Center
9	Civic Center C	City Hall
10	Civic Center A (* Previous fiscal year survey target)	City Hall
11	Civic Center B (* Previous fiscal year survey target)	City Hall
12	QC Red Cross	Red Cross
13	NGA (National Capital Region)	City Hall
14	DRRMO (Disaster Risk Reduction and Management Office)	Disaster Risk Reduction
15	DPOS (Department of Public Order and Safety)	Public Order and Safety
16	QC Cooperative	City Hall

Based on feedback received from Quezon City in Table 3-1concerning their schedule for upgrading air conditioning systems, the target facility was determined and the number of air conditioners in it identified as follows:

Table 3-2 Number of Air Conditioners in Target Facilities

No	Building	Indoor Unit	No. of Indoor Units	No. of Outdoor Units
9	Civic Center C	WINDOW TYPE	5	5
		CEILING CASSETTE	61	61
13	NGA (National Capital Region) * Compound 1	CEILING CASSETTE	51	51
14	DRRMO (Disaster Risk Reduction and Management Office)	WINDOW TYPE	1	1
		FLOOR MOUNTED	2	2
		WALL MOUNTED	7	7
		FLOOR MOUNTED	35	35
15	DPOS (Department of Public Order and Safety)	CEILING CASSETTE	41	41
		TOTAL	203	203

3.1.2 Overview of Public Facilities besides City Hall Compound

In order to achieve further GHG emissions reduction for Quezon City as a whole, GHG emissions reductions and cost-effectiveness in public facilities other than the City Hall Compound were examined. Based on feedback received from Quezon City concerning their schedule for upgrading air conditioning systems, the following facilities were selected as targets of the survey. The number of air conditioners in each facility was organized based on the information provided by Quezon City.

Table 3-3 Number of Air Conditioners in Target Facility (QCGH)

No	Building	Type of Indoor Unit	No. of Indoor Unit	No. of Outdoor Unit
9	Quezon City General Hospital(QCGH)	WINDOW TYPE	157	157
		SPLIT TYPE	58	58
		FLOOR STANDING	22	22
		TOTAL	237	237

3.2 Site Survey in Target Facilities

3.2.1 Overview of Site Survey

A field survey was conducted on the facilities subject to the JCM model project (excluding the Annex Building) and the City Hall Compound to confirm the capacity, specifications, and installation location of existing air conditioning facilities, as well as the number of units installed on each floor and in each building. A summary of the survey is shown in the table below.

Meanwhile, target public facilities other than the City Hall (Quezon City General Hospital) were excluded from the survey, since a simple site survey was conducted in the second year.

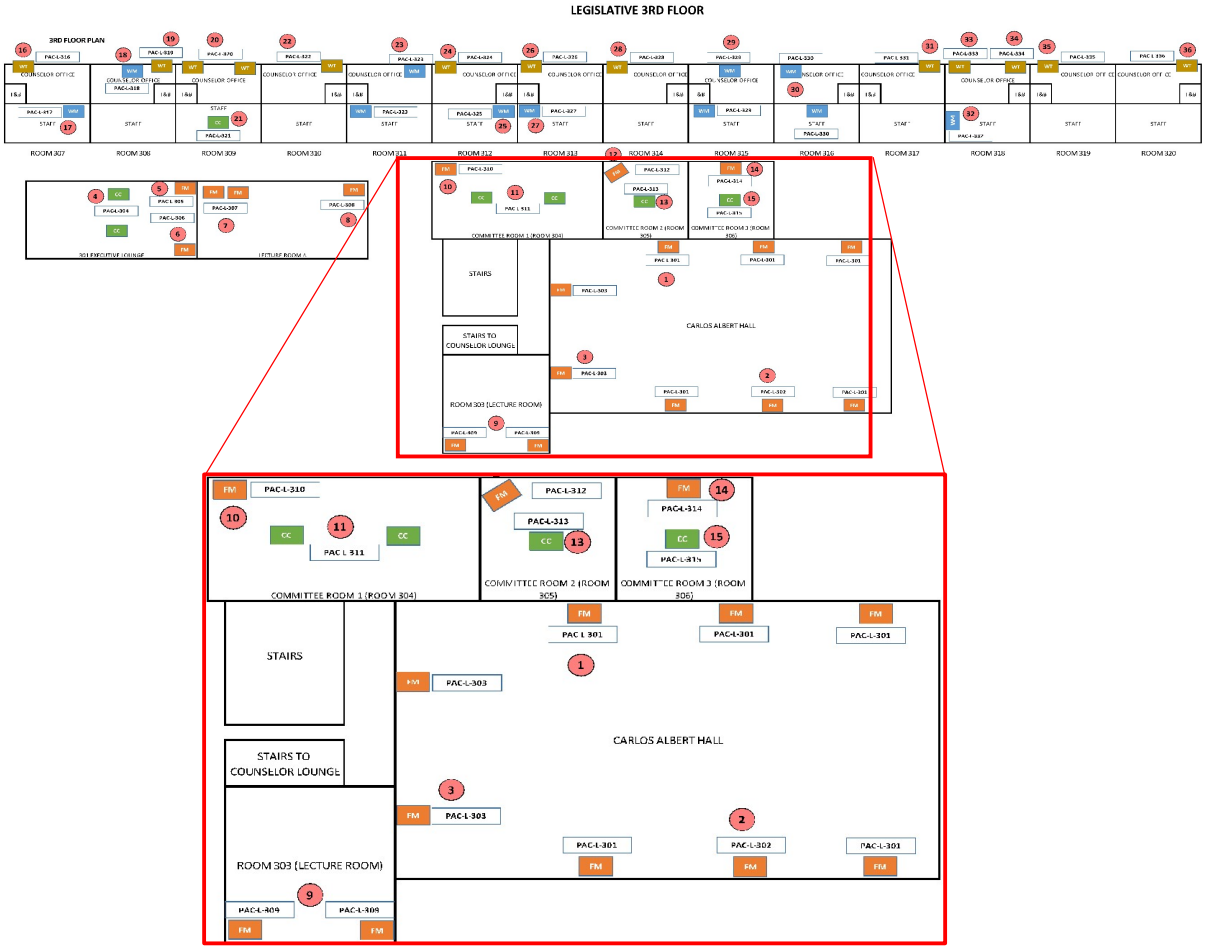
Table 3-4 Overview of Site Survey

Item	Overview
Survey Target	Seven facilities in City Hall Compound
Survey Period	January and February 2022
Survey Item	Capacity, specifications, number of units, and location of existing air conditioners (indoor units)

Building	Indoor Unit	Outdoor Unit
Legislative Building	146	146
Civic Center A	129	129
Civic Center B	134	134
Civic Center C	66	66
NGA	51	51
DRRMO	45	45
DPOS	41	41
Total	612	612



Figure 3-1 Site Survey



3RD FLOOR

Air-conditioning Units Inspected

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks/Brand
					KW	KW	V	Ph	Hz	kW		
1	3F	PAC-L-301	5	Carlos L. Albert Hall	35.2	175.9	230	3	60	120	Floor Mounted	Carrier
2	3F	PAC-L-302	1	Carlos L. Albert Hall	17.6	17.6	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
3	3F	PAC-L-303	2	Carlos L. Albert Hall	17.6	35.2	230	3	60	5.8	Floor Mounted-Split Type	Koppel
4	3F	PAC-L-304	2	301 Executive Lounge	8.8	17.6	220	1	60	4	Ceiling Cassette Split Type	Carrier
5	3F	PAC-L-305	1	301 Executive Lounge	17.6	17.6	220	1	60	5.13	Floor Mounted	Carrier
6	3F	PAC-L-306	1	301 Executive Lounge	17.6	17.6	230	3	60	5.5	Floor Mounted	Koppel
7	3F	PAC-L-307	1	302 Lecture Room A	16.7	16.7	230	3	60	5.5	Floor Mounted	Koppel
8	3F	PAC-L-308	3	302 Lecture Room A	16.7	50.0	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
9	3F	PAC-L-309	2	303 Lecture Room	17.6	35.2	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
10	3F	PAC-L-310	1	304 Committee Room 1	17.6	17.6	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
11	3F	PAC-L-311	2	304 Committee Room 1	14.0	28.0	230	1	60	5.224	Ceiling Cassette Split Type	Koppel
12	3F	PAC-L-312	1	305 Committee Room 2	17.6	17.6	220	1	60	5.13	Floor Mounted	Gree
13	3F	PAC-L-313	1	305 Committee Room 2	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Koppel
14	3F	PAC-L-314	1	306 Committee Room 3	17.6	17.6	220	1	60	5.13	Floor Mounted	Gree
15	3F	PAC-L-315	1	306 Committee Room 3	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Koppel
16	3F	PAC-L-316	1	307 Hon. Shaira "Shay" L. Liban	3.6	3.6	230	1	60	1.16	Window Type	LG
17	3F	PAC-L-317	1	307 Hon. Shaira "Shay" L. Liban	5.2	5.2	230	1	60	1.365	Wall Mounted-Split Type	Daikin
18	3F	PAC-L-318	1	308 Hon. Eric Z. Medina	5.4	5.4	230	1	60	2.34	Wall Mounted-Split Type	Idec
19	3F	PAC-L-319	1	308 Hon. Eric Z. Medina	3.6	3.6	230	1	60	1.16	Window Type	LG
20	3F	PAC-L-320	2	309 Hon. Franz S. Pumaren	3.6	7.2	230	1	60	1.16	Window Type	LG
21	3F	PAC-L-321	1	309 Hon. Franz S. Pumaren	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Condura
22	3F	PAC-L-322	1	310 Hon. Ram V. Medalla	3.6	3.6	230	1	60	1.16	Window Type	Carrier
23	3F	PAC-L-323	2	311 Hon. Jose A. Visaya	3.2	6.4	230	1	60	0.92	Wall Mounted-Split Type	Carrier
24	3F	PAC-L-324	1	312 Hon. Patrick Michael Vargas	3.6	3.6	230	1	60	1.16	Window Type	LG
25	3F	PAC-L-325	1	312 Hon. Patrick Michael Vargas	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
26	3F	PAC-L-326	1	313 Hon. Allan Buteh	3.6	3.6	230	1	60	1.16	Window Type	LG
27	3F	PAC-L-327	1	313 Hon. Allan Buteh	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Panasonic
28	3F	PAC-L-328	1	314 Hon. Karl Castelo	3.6	3.6	230	1	60	1.16	Window Type	LG
29	3F	PAC-L-329	2	315 Hon. Diorella Maria G. Sotto-Antonio	5.4	10.8	230	1	60	2.34	Wall Mounted-Split Type	Koppel
30	3F	PAC-L-330	2	316 Hon. Marivic Co Pilar	5.4	10.8	230	1	60	2.34	Wall Mounted-Split Type	Koppel
31	3F	PAC-L-331	1	317 Hon. Rogelio "Roger" P. Juan	3.6	3.6	230	1	60	1.16	Window Type	LG
32	3F	PAC-L-332	1	318 OVM-LAN	5.3	5.3	220	1	60	1.87	Wall Mounted-Split Type	Kolin
33	3F	PAC-L-333	1	318 OVM-LAN	5.3	5.3	230	1	60	1.8	Window Type	Panasonic
34	3F	PAC-L-334	1	318 OVM-LAN	3.6	3.6	230	1	60	1.16	Window Type	Kolin
35	3F	PAC-L-335	1	319 Hon. Melencio "Bobby" T. Castelo, Jr.	3.6	3.6	230	1	60	1.16	Window Type	LG
36	3F	PAC-L-336	1	320 Hon. Donato "Donny" C. Matias	3.6	3.6	230	1	60	1.16	Window Type	LG
1	3F	PAC-L-M01	2	Councilor's Lounge	17.6	35.2	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
			52			624.1						

Figure 3-2 Sample Result of Site Survey (Location of List of Equipment)

3.2.2 Result of Site Survey

The results of site survey and the number of air conditioners installed in each surveyed facility are shown below. As the as-built plans of each facility were not provided by Quezon City, we inspected each floor of each facility and drew up floor plans, checked the power supply system, and surveyed the cooling load on each floor. The results of the survey and the number of units installed in each facility are summarized in the table below.

Table 3-5 List of Air Conditioners in Surveyed Facilities

Facility	Floor Plans Created	Cooling Load	Number of Units		
			Before Survey	After Survey	Difference
Legislative Building	GF, 2-3F, M2	1,170 kW	146	150	+4
Civic Center A	GF, 2-8F, BF	1,518 kW	129	150	+21
Civic Center B	GF, 2-8F, BF, M2	1,439 kW	134	143	+9
Civic Center C	GF, 2-3F	467 kW	66	67	+1
NGA	1-4F	172 kW	51	50	-1
DRRMO	1-3F, M2	408 kW	45	49	+4
DPOS	GF, 2-3F	331 kW	41	48	+7
	Total	5505.14 kW	612	657	+45

The details of the survey results for each facility are as follows.

Table 3-6 Site Survey Result of Legislative Building (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks/Brand
					KW	KW	V	Ph	Hz	kW		
1	GF	PAC-L-101	1	IDAPS	6.4	6.4	230	1	60	1.896	Wall Mounted	Kolin
2	GF	PAC-L-102	1	Lobby	10.6	10.6	230	1	60	3.85	Floor Mounted-Split Type	Kolin
3	GF	PAC-L-103	1	Staff Room	2.6	2.6	230	1	60	0.754	Wall Mounted-Split Type	Kolin
4	GF	PAC-L-104	1	Technical Office	2.6	2.6	230	1	60	0.754	Wall Mounted-Split Type	Kolin
5	GF	PAC-L-105	1	Admin Head Office	2.6	2.6	230	1	60	0.754	Wall Mounted-Split Type	Kolin
6	GF	PAC-L-106	1	Staff Area	10.6	10.6	230	1	60	3.85	Floor Mounted-Split Type	Kolin
7	GF	PAC-L-107	1	Staff Area	3.6	3.6	230	1	60	1.16	Window Type	Koppel
8	GF	PAC-L-108	1	Head Office	3.6	3.6	230	1	60	1.16	Window Type	Kolin
9	GF	PAC-L-109	1	Hearing Room	10.6	10.6	230	1	60	3.4	Floor Mounted-Split Type	Koppel
10	GF	PAC-L-110	2	Tricycle Franchising Board	5.3	10.6	230	1	60	1.81	Window Type	Koppel
11	GF	PAC-L-111	2	QCADAAC	10.6	21.1	230	1	60	3.77	Ceiling Cassette Split Type	Kolin
12	GF	PAC-L-112	1		3.6	3.6	230	1	60	1.16	Window Type	Kolin
13	GF	PAC-L-113	1	Breastfeeding	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Samsung
14	GF	PAC-L-114	1		3.6	3.6	230	1	60	1.16	Window Type	Kolin
15	GF	PAC-L-115	1	Dept. Head Office	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Samsung
16	GF	PAC-L-116	1	Record Section	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Samsung
17	GF	PAC-L-117	1	Admin Office	3.6	3.6	230	1	60	1.16	Window Type	LG
18	GF	PAC-L-118	1	Asst. Dept. Head Office	3.6	3.6	230	1	60	1.16	Window Type	Carrier
19	GF	PAC-L-119	1	Stock Room	3.6	3.6	230	1	60	1.16	Window Type	National
20	GF	PAC-L-120	1	Archive Room	3.4	3.4	230	1	60	1.488	Wall Mounted-Split Type	Markes
21	GF	PAC-L-121	1	Reproduction Office	3.6	3.6	230	1	60	1.16	Window Type	Panasonic
22	GF	PAC-L-122	6	Office 1	3.6	21.7	230	1	60	1.16	Window Type	Koppel
23	GF	PAC-L-123	7	Waiting Area	8.8	61.8	220	1	60	4	Ceiling Cassette Split Type	Samsung
24	GF	PAC-L-124	1	Sports Room	17.6	17.6	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
25	GF	PAC-L-125	3	Operation Office	17.6	52.9	230	3	60	5.99	Ceiling Cassette Split Type	Kolin
			40			290.4						

Table 3-7 Site Survey Result of Legislative Building (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks/Brand
					KW	KW	V	Ph	Hz	kW		
1	2F	PAC-L-201	1	Lounge	3.4	3.4	230	1	60	1.488	Ceiling Suspended Split Type	Carrier
2	2F	PAC-L-202	1	Storage	3.4	3.4	230	1	60	1.488	Wall Mounted-Split Type	Koppel
3	2F	PAC-L-203	1	201 Hon. Gian Sotto	10.6	10.6	230	1	60	3.777	Ceiling Casstte-Split Type	Koppel
4	2F	PAC-L-204	3	Office Staff	10.6	31.7	230	1	60	3.777	Ceiling Casstte-Split Type	Koppel
5	2F	PAC-L-205	1	Office Staff	3.5	3.5	220	1	60	1.2	Wall Mounted-Split Type	Kolin
6	2F	PAC-L-206	1	Office Staff	6.7	6.7	230	1	60	2.18	Wall Mounted-Split Type	Carrier
7	2F	PAC-L-207	1	Office Staff	3.4	3.4	230	1	60	1.488	Wall Mounted-Split Type	Koppel
8	2F	PAC-L-208	1	Office Staff	6.8	6.8	230	1	60	2.099	Wall Mounted-Split Type	Midea
9	2F	PAC-L-209	1	Office	3.4	3.4	230	1	60	1.488	Wall Mounted-Split Type	Koppel
10	2F	PAC-L-210	1	202 Office of Hon. Dorothy A. Dela	3.8	3.8	230	1	60	2	Wall Mounted-Split Type	Alenaire
11	2F	PAC-L-211	1	202 Office of Hon. Dorothy A. Dela	3.9	3.9	230	1	60	1.2	Wall Mounted-Split Type	Kolin
12	2F	PAC-L-212	1	204 Office of Hon. Lena Marie P. Ju	5.0	5.0	220	1	60	1.49	Wall Mounted-Split Type	Carrier
13	2F	PAC-L-213	1	204 Office of Hon. Lena Marie P. Ju	5.0	5.0	220	1	60	1.49	Wall Mounted-Split Type	Carrier
14	2F	PAC-L-214	1	206 Legis Admin	3.6	3.6	230	1	60	1.16	Window Type	Kolin
15	2F	PAC-L-215	1	207 Office of Hon. Tony Joe "TJ" L.	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
16	2F	PAC-L-216	1	207 Office of Hon. Tony Joe "TJ" L.	3.8	3.8	230	1	60	2	Wall Mounted-Split Type	Koppel
17	2F	PAC-L-217	1	208 Office of Hon. Winston "Winn	3.5	3.5	230	1	60	1.21	Wall Mounted-Split Type	Kolin
18	2F	PAC-L-218	1	208 Office of Hon. Winston "Winn	3.9	3.9	230	1	60	1.2	Wall Mounted-Split Type	Kolin
19	2F	PAC-L-219	1	209 Office of Hon. Ramon P. Meda	3.5	3.5	230	1	60	1.09	Wall Mounted-Split Type	Carrier
20	2F	PAC-L-220	1	209 Office of Hon. Ramon P. Meda	3.5	3.5	230	1	60	1.09	Wall Mounted-Split Type	Carrier
21	2F	PAC-L-221	1	210 Office of Hon. Eden Delilah "C	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
22	2F	PAC-L-222	1	210 Office of Hon. Eden Delilah "C	3.8	3.8	230	1	60	2	Wall Mounted-Split Type	Koppel
23	2F	PAC-L-223	2	211 Office of Hon. Atty. Bong Liba	3.9	7.9	230	1	60	0.046	Wall-Mounted Split Type	Daikin
24	2F	PAC-L-224	1	211 Office of Hon. Atty. Bong Liba	3.6	3.6	230	1	60	1.16	Window Type	General Electric
25	2F	PAC-L-225	2	212 Hon. Star	3.8	7.6	230	1	60	2	Wall-Mounted Split Type	Koppel
26	2F	PAC-L-226	1	213 Hon. Mikey F. Belmonte	3.8	3.8	230	1	60	2	Wall-Mounted Split Type	Koppel
27	2F	PAC-L-227	1	213 Hon. Mikey F. Belmonte	3.6	3.6	230	1	60	1.16	Window Type	Koppel
28	2F	PAC-L-228	1	214 Office of Hon. Marra C. Suntay	5.4	5.4	230	1	60	2.142	Wall Mounted-Split Type	Carrier
29	2F	PAC-L-229	1	214 Office of Hon. Marra C. Suntay	3.6	3.6	230	1	60	1.16	Window Type	Kolin
30	2F	PAC-L-230	2	215 Office of Hon. Matias John T.	3.5	7.0	230	1	60	1.2	Wall Mounted-Split Type	Samsung
31	2F	PAC-L-231	1	216 Office of Hon. Wencerom Ben	3.5	3.5	230	1	60	1.2	Wall Mounted-Split Type	Carrier
32	2F	PAC-L-232	1	216 Office of Hon. Wencerom Ben	3.6	3.6	230	1	60	1.16	Window Type	Carrier
33	2F	PAC-L-233	1	217 Office of Hon. Peachy V. De Le	5.2	5.2	230	1	60	1.73	Wall Mounted-Split Type	Condura
34	2F	PAC-L-234	1	217 Office of Hon. Peachy V. De Le	3.6	3.6	230	1	60	1.16	Window Type	Carrier
35	2F	PAC-L-235	1	218 Hon. Ivy Lagman	3.8	3.8	230	1	60	2	Wall Mounted-Split Type	Kolin
36	2F	PAC-L-236	1	218 Hon. Ivy Lagman	3.0	3.0	230	1	60	1.05	Wall Mounted-Split Type	Kolin
37	2F	PAC-L-237	1	219 Hon. Victor	3.5	3.5	230	1	60	1.2	Wall Mounted-Split Type	LG
38	2F	PAC-L-238	1	219 Hon. Victor	5.4	5.4	230	1	60	1.6	Wall Mounted-Split Type	Gree
39	2F	PAC-L-239	1	220 Hon. Imee A. Rillo	5.1	5.1	230	1	60	1.73	Wall Mounted-Split Type	Panasonic
40	2F	PAC-L-240	1	220 Hon. Imee A. Rillo	5.3	5.3	220	1	60	1.94	Wall Mounted-Split Type	Samsung
41	2F	PAC-L-241	2	221 Hon. Hero M. Bautista	3.8	7.6	230	1	60	2	Wall Mounted-Split Type	Koppel
42	2F	PAC-L-242	1	222 Hon. Irene	2.6	2.6	230	1	60	0.904	Wall Mounted-Split Type	Haier
43	2F	PAC-L-243	1	223 Hon. Resty	3.3	3.3	230	1	60	1.18	Wall Mounted-Split Type	Panasonic
44	2F	PAC-L-244	1	223 Hon. Resty	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
45	2F	PAC-L-245	1	225 Hon. Kate Abigael G. Coseteng	3.6	3.6	230	1	60	1.16	Window Type	LG
46	2F	PAC-L-246	1	225 Hon. Kate Abigael G. Coseteng	5.4	5.4	230	1	60	2.34	Wall Mounted-Split Type	Koppel
47	2F	PAC-L-247	2	226 Hon. Jorge Banal	3.0	6.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
48	2F	PAC-L-248	1	Hon. Noe Dela Fuente	5.3	5.3	230	1	60	1.88	Wall Mounted-Split Type	Matrix
49	2F	PAC-L-249	1	Hon. Noe Dela Fuente	3.5	3.5	230	1	60	1.25	Wall Mounted-Split Type	Matrix
50	2F	PAC-L-250	1	Hon. Freddy S. Roxas	5.4	5.4	230	1	60	2.34	Wall Mounted-Split Type	Koppel
51	2F	PAC-L-251	1	Hon. Freddy S. Roxas	3.5	3.5	220	1	60	1.2	Wall Mounted-Split Type	Kolin
			58			255.9						

Table 3-8 Site Survey Result of Legislative Building (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks/Brand
					KW	KW	V	Ph	Hz	kW		
1	3F	PAC-L-301	5	Carlos L. Albert Hall	35.2	175.9	230	3	60	120	Floor Mounted	Carrier
2	3F	PAC-L-302	1	Carlos L. Albert Hall	17.6	17.6	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
3	3F	PAC-L-303	2	Carlos L. Albert Hall	17.6	35.2	230	3	60	5.8	Floor Mounted-Split Type	Koppel
4	3F	PAC-L-304	2	301 Executive Lounge	8.8	17.6	220	1	60	4	Ceiling Cassette Split Type	Carrier
5	3F	PAC-L-305	1	301 Executive Lounge	17.6	17.6	220	1	60	5.13	Floor Mounted	Carrier
6	3F	PAC-L-306	1	301 Executive Lounge	17.6	17.6	230	3	60	5.5	Floor Mounted	Koppel
7	3F	PAC-L-307	1	302 Lecture Room A	16.7	16.7	230	3	60	5.5	Floor Mounted	Koppel
8	3F	PAC-L-308	3	302 Lecture Room A	16.7	50.0	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
9	3F	PAC-L-309	2	303 Lecture Room	17.6	35.2	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
10	3F	PAC-L-310	1	304 Committee Room 1	17.6	17.6	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
11	3F	PAC-L-311	2	304 Committee Room 1	14.0	28.0	230	1	60	5.224	Ceiling Cassette Split Type	Koppel
12	3F	PAC-L-312	1	305 Committee Room 2	17.6	17.6	220	1	60	5.13	Floor Mounted	Gree
13	3F	PAC-L-313	1	305 Committee Room 2	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Koppel
14	3F	PAC-L-314	1	306 Committee Room 3	17.6	17.6	220	1	60	5.13	Floor Mounted	Gree
15	3F	PAC-L-315	1	306 Committee Room 3	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Koppel
16	3F	PAC-L-316	1	307 Hon. Shaira "Shay" L. Liban	3.6	3.6	230	1	60	1.16	Window Type	LG
17	3F	PAC-L-317	1	307 Hon. Shaira "Shay" L. Liban	5.2	5.2	230	1	60	1.365	Wall Mounted-Split Type	Daikin
18	3F	PAC-L-318	1	308 Hon. Eric Z. Medina	5.4	5.4	230	1	60	2.34	Wall Mounted-Split Type	Idec
19	3F	PAC-L-319	1	308 Hon. Eric Z. Medina	3.6	3.6	230	1	60	1.16	Window Type	LG
20	3F	PAC-L-320	2	309 Hon. Franz S. Pumaren	3.6	7.2	230	1	60	1.16	Window Type	LG
21	3F	PAC-L-321	1	309 Hon. Franz S. Pumaren	8.8	8.8	220	1	60	4	Ceiling Cassette Split Type	Condura
22	3F	PAC-L-322	1	310 Hon. Ram V. Medalla	3.6	3.6	230	1	60	1.16	Window Type	Carrier
23	3F	PAC-L-323	2	311 Hon. Jose A. Visaya	3.2	6.4	230	1	60	0.92	Wall Mounted-Split Type	Carrier
24	3F	PAC-L-324	1	312 Hon. Patrick Michael Vargas	3.6	3.6	230	1	60	1.16	Window Type	LG
25	3F	PAC-L-325	1	312 Hon. Patrick Michael Vargas	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Koppel
26	3F	PAC-L-326	1	313 Hon. Allan Buteh	3.6	3.6	230	1	60	1.16	Window Type	LG
27	3F	PAC-L-327	1	313 Hon. Allan Buteh	3.0	3.0	230	1	60	0.741	Wall Mounted-Split Type	Panasonic
28	3F	PAC-L-328	1	314 Hon. Karl Castelo	3.6	3.6	230	1	60	1.16	Window Type	LG
29	3F	PAC-L-329	2	315 Hon. Diorella Maria G. Sotto-Antonio	5.4	10.8	230	1	60	2.34	Wall Mounted-Split Type	Koppel
30	3F	PAC-L-330	2	316 Hon. Marivic Co Pilar	5.4	10.8	230	1	60	2.34	Wall Mounted-Split Type	Koppel
31	3F	PAC-L-331	1	317 Hon. Rogelio "Roger" P. Juan	3.6	3.6	230	1	60	1.16	Window Type	LG
32	3F	PAC-L-332	1	318 OVM-LAN	5.3	5.3	220	1	60	1.87	Wall Mounted-Split Type	Kolin
33	3F	PAC-L-333	1	318 OVM-LAN	5.3	5.3	230	1	60	1.8	Window Type	Panasonic
34	3F	PAC-L-334	1	318 OVM-LAN	3.6	3.6	230	1	60	1.16	Window Type	Kolin
35	3F	PAC-L-335	1	319 Hon. Melencio "Bobby" T. Castelo, Jr.	3.6	3.6	230	1	60	1.16	Window Type	LG
36	3F	PAC-L-336	1	320 Hon. Donato "Donny" C. Matias	3.6	3.6	230	1	60	1.16	Window Type	LG
1	3F	PAC-L-M01	2	Councilor's Lounge	17.6	35.2	220	1	60	5.13	Floor Mounted-Split Type	Fujiair
			52			624.1						

Table 3-9 Site Survey Result of CIVIC A (BASEMENT)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	BASE MENT	PAC-CA-B01	5	Records Section	3.6	17.8	220	1	60	4.38	Floor Mounted-Split Type	Mitsubishi Electric
2	BASE MENT	PAC-CA-B02	2	Records Section	17.6	35.2	230	1	60	5.4	Floor Mounted-Split Type	Kolin
			7			**53.0**						

Table 3-10 Site Survey Result of CIVIC A (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-CA-101	12	Business Permits and Licensing Department	10.6	126.6	230	1	60	3.4	Ceiling Suspended-split type	Koppel
2	GF	PAC-CA-102	11	Staff Area	10.6	116.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	GF	PAC-CA-103	2	Head Office	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	GF	PAC-CA-104	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			26			**278.0**						

Table 3-11 Site Survey Result of CIVIC A (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-CA-201	1	Waiting Area	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	2F	PAC-CA-202	11	Records Area	10.6	116.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	2F	PAC-CA-203	1	Server Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	2F	PAC-CA-204	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			14			**151.4**						

Table 3-12 Site Survey Result of CIVIC A (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-CA-301	1	Head Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	3F	PAC-CA-302	1	Conference Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	3F	PAC-CA-303	1	Records Storage Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	3F	PAC-CA-304	12	Office area	10.6	126.7	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	3F	PAC-CA-305	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-13 Site Survey Result of CIVIC A (4TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	4F	PAC-CA-401	3	Administrative Section/Special Program Section/Employment Section	10.6	31.7	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	4F	PAC-CA-402	1	Head Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	4F	PAC-CA-403	1	LMI Section	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	4F	PAC-CA-404	1	Conference Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	4F	PAC-CA-405	5	LLRB	10.6	52.8	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
6	4F	PAC-CA-406	2	Chairman's Room	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
7	4F	PAC-CA-407	2	Waiting area	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
8	4F	PAC-CA-408	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-14 Site Survey Result of CIVIC A (5TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	5F	PAC-CA-501	10	BCRB Office	10.6	105.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	5F	PAC-CA-502	2	Head Office	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	5F	PAC-CA-503	1	Storage Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	5F	PAC-CA-504	2	Planning Division	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	5F	PAC-CA-505	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-15 Site Survey Result of CIVIC A (6TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	6F	PAC-CA-601	9	Office Area	10.6	95.0	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	6F	PAC-CA-602	1	Head Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	6F	PAC-CA-603	1	Pantry	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	6F	PAC-CA-604	1	Admin Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	6F	PAC-CA-605	1	Conference Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
6	6F	PAC-CA-606	2	Storage Room	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
7	6F	PAC-CA-607	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-16 Site Survey Result of CIVIC A (7TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	7F	PAC-CA-701	6	SYDP/Sikap Buhay/GAD Office	10.6	63.3	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	7F	PAC-CA-702	1	Waiting Area	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	7F	PAC-CA-703	2	Head Office	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	7F	PAC-CA-704	1	GAD Council	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	7F	PAC-CA-705	5	SCDPO	10.6	52.8	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
6	7F	PAC-CA-706	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-17 Site Survey Result of CIVIC A (8TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	8F	PAC-CA-801	13	QCTD Office	10.6	137.2	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	8F	PAC-CA-802	2	Head Office	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	8F	PAC-CA-803	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split Type	Mitsubishi Electric
			16			**172.6**						

Table 3-18 Site Survey Result of CIVIC B (BASEMENT)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	BASEMENT	PAC-CB-B01	2	ARMD	10.6	21.1	230	1	60	3.4	Floor Mounted-Split Type	Kolin
2	BASEMENT	PAC-CB-B02	1	ARMD	16.3	16.3	230	3	60	5.2	Floor Mounted-Split Type	Carrier
3	BASEMENT	PAC-CB-B03	1	ARMD	16.3	16.3	230	3	60	4.61	Floor Mounted-Split Type	Mitsubishi Electric
4	BASEMENT	PAC-CB-B04	2	ARMD	11.1	22.3	230	1	60	3.1	Floor Mounted-Split Type	Koppel
5	BASEMENT	PAC-CB-B05	1	Record Section	10.6	10.6	230	1	60	3.4	Wall Mounted-Split Type	Carrier
			7			**86.5**						

Table 3-19 Site Survey Result of CIVIC B (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-CB-101	8	OSS Division/ARMD Division/	10.6	84.4	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
2	GF	PAC-CB-102	9	Tax Mapping Division/Server Room	10.6	95.0	220	1	60	4.18	Ceiling Suspended	Carrier
3	GF	PAC-CB-103	2	Tax Payer's Lounge	10.6	21.1	230	1	60	0.186	Floor Mounted-Split Type	Carrier
4	GF	PAC-CB-104	5	Tax Payer's Lounge	11.9	59.7	220	1	60	3	Ceiling Cassette-Split Type	Samsung
5	GF	PAC-CB-105	1	PABX/Audiovisual Room	10.6	10.6	230	1	60	3.4	Floor Mounted-Split Type	Koppel
6	GF	PAC-CB-106	1	PABX/Audiovisual Room	3.5	3.5	230	1	60	0.725	Window Type	Kolin
7	GF	PAC-CB-107	1	Lobby	17.6	17.6	220	3	60	5.63	Ceiling Cassette-Split Type	Mitsubishi Electric
			27			**291.9**						

Table 3-20 Site Survey Result of CIVIC B (MEZZANINE)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	Mezz	PAC-CB-M01	1	City Assessors Office	10.6	10.6	230	1	60	3.4	Floor Mounted-Split Type	Carrier
2	Mezz	PAC-CB-M02	1	City Assessors Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
3	Mezz	PAC-CB-M03	1	Vestibule	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
4	Mezz	PAC-CB-M04	2	Staff Area	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split Type	Mitsubishi Electric
5	Mezz	PAC-CB-M05	1	Conference Room	17.6	17.6	220	3	60	5.63	Ceiling Cassette-Split Type	Mitsubishi Electric
			7			**86.5**						

Table 3-21 Site Survey Result of CIVIC B (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-CB-201	1	Asst. Assessor Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
2	2F	PAC-CB-202	1	Conference Room	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
3	2F	PAC-CB-203	1	Division Head	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
4	2F	PAC-CB-204	2	Waiting Area	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
5	2F	PAC-CB-205	8	Paid Division/EDP Division	10.6	84.4	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
6	2F	PAC-CB-206	1	Lobby	17.6	17.6	220	3	60	5.63	Ceiling Cassette-Split type	Mitsubishi Electric
			14			**154.8**						

Table 3-22 Site Survey Result of CIVIC B (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-CB-301	1	Asst. Assessor Office	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
2	3F	PAC-CB-302	8	Conference Room	10.6	84.4	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
3	3F	PAC-CB-303	2	Division Head	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
4	3F	PAC-CB-304	2	Waiting Area	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
5	3F	PAC-CB-305	1	Paid Division/EDP Division	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
6	3F	PAC-CB-306	1	Lobby	10.6	10.6	220	1	60	4.09	Ceiling Cassette-Split type	Mitsubishi Electric
7	3F	PAC-CB-307	1	Lobby	17.6	17.6	220	3	60	5.63	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**175.9**						

Table 3-23 Site Survey Result of CIVIC B (4TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	4F	PAC-CB-401	1	Conference Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
2	4F	PAC-CB-402	1	Personnel Fiscal & Records Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
3	4F	PAC-CB-403	2	Technical Staff	8.2	16.4	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
4	4F	PAC-CB-404	1	Asst. City Assessor	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
5	4F	PAC-CB-405	1	Chief Admin	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
6	4F	PAC-CB-406	9	Staff Area	8.2	73.8	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
7	4F	PAC-CB-407	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**137.1**						

Table 3-24 Site Survey Result of CIVIC B (5TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	5F	PAC-CB-501	1	Conference Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
2	5F	PAC-CB-502	1	Personnel Fiscal & Records Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
3	5F	PAC-CB-503	2	Technical Staff	8.2	16.4	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
4	5F	PAC-CB-504	1	Asst. City Assessor	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
5	5F	PAC-CB-505	1	Chief Admin	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
6	5F	PAC-CB-506	9	Staff Area	8.2	73.8	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
7	5F	PAC-CB-507	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**137.1**						

Table 3-25 Site Survey Result of CIVIC B (6TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	6F	PAC-CB-601	1	Property & Supply Section	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
2	6F	PAC-CB-602	1	Accounting Section	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
3	6F	PAC-CB-603	1	City Engineer	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
4	6F	PAC-CB-604	1	Conference Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
5	6F	PAC-CB-605	9	Reception Area/IT/Admin Service	8.2	73.8	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
6	6F	PAC-CB-606	1	Records	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
7	6F	PAC-CB-607	1	201 File Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
8	6F	PAC-CB-608	1	Lobby	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**131.1**						

Table 3-26 Site Survey Result of CIVIC B (7TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	7F	PAC-CB-701	1	Conference Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
2	7F	PAC-CB-702	1	Personnel Fiscal & Records Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
3	7F	PAC-CB-703	2	Technical Staff	8.2	16.4	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
4	7F	PAC-CB-704	1	Asst. City Assessor	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
5	7F	PAC-CB-705	1	Chief Admin	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
6	7F	PAC-CB-706	9	Staff Area	8.2	73.8	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
7	7F	PAC-CB-707	1	Lobby	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**131.1**						

Table 3-27 Site Survey Result of CIVIC B (8TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	8F	PAC-CB-801	1	Conference Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
2	8F	PAC-CB-802	1	Personnel Fiscal & Records Room	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
3	8F	PAC-CB-803	2	Technical Staff	8.2	16.4	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
4	8F	PAC-CB-804	1	Asst. City Assessor	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
5	8F	PAC-CB-805	1	Chief Admin	8.2	8.2	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
6	8F	PAC-CB-806	9	Staff Area	8.2	73.8	220	1	60	3.9	Ceiling Cassette-Split type	Mitsubishi Electric
7	8F	PAC-CB-807	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-Split type	Mitsubishi Electric
			16			**137.1**						

Table 3-28 Site Survey Result of CIVIC C (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-CC-101	15	Waiting Area / Civil Registry	7.1	106.4	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
2	GF	PAC-CC-102	1	Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
3	GF	PAC-CC-103	1	Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
4	GF	PAC-CC-104	1	Commander Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
5	GF	PAC-CC-105	1	Lobby	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
6	GF	PAC-CC-106	3	Archives Room	7.1	21.3	220	1	60	0.094	Ceiling Cassette-Split Type	Carrier
			22			**156.0**						

Table 3-29 Site Survey Result of CIVIC C (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-CC-201	1	TESDA Heads Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
2	2F	PAC-CC-202	1	Admin Unit	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
3	2F	PAC-CC-203	1	Technical Unit	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
4	2F	PAC-CC-204	1	Immigration Unit	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
5	2F	PAC-CC-205	1	HURA	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
6	2F	PAC-CC-206	1	DFA Room	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
7	2F	PAC-CC-207	1	Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
8	2F	PAC-CC-208	1	Education Affairs	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
9	2F	PAC-CC-209	1	Hearing Room	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
10	2F	PAC-CC-210	1	Staff Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
11	2F	PAC-CC-211	2	Waiting Area	7.1	14.2	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
12	2F	PAC-CC-212	2	Administration Division	7.1	14.2	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
13	2F	PAC-CC-213	1	Seminar/Conference Room 1	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
14	2F	PAC-CC-214	1	Seminar/Conference Room 2	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
15	2F	PAC-CC-215	1	Common Conference Room	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
16	2F	PAC-CC-216	1	Office of the City Registrar	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
17	2F	PAC-CC-217	1	Supply Room	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split Type	Carrier
18	2F	PAC-CC-218	1	Lobby	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
			20			**141.8**						

Table 3-30 Site Survey Result of CIVIC C (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-CC-301	1	Admin, HCDRD	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
2	3F	PAC-CC-302	1	Division Head, HCDRD	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
3	3F	PAC-CC-303	1	Technical Section	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
4	3F	PAC-CC-304	1	C.M.P.	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
5	3F	PAC-CC-305	1	C.D.Q	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
6	3F	PAC-CC-306	1	D.S.S.	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
7	3F	PAC-CC-307	1	A.M.S.S.	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
8	3F	PAC-CC-308	1	Lobby	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
9	3F	PAC-CC-309	1	Head COPRISS	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
10	3F	PAC-CC-310	1	Head, HCDRD	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
11	3F	PAC-CC-311	2	Conference Room 1	7.1	14.2	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
12	3F	PAC-CC-312	4	Waiting Area/Hallway	7.1	28.4	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
13	3F	PAC-CC-313	1	Assistant Head, HCDRD	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
14	3F	PAC-CC-314	1	Conference Room 2	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
15	3F	PAC-CC-315	1	HCDRD Head	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
16	3F	PAC-CC-316	1	Hallway	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF Type	Mitsubishi Electric
17	3F	PAC-CC-317	1	TF COPRISS Receiving	5.4	5.4	230	1	60	1.75	Window Type	LG
18	3F	PAC-CC-318	1	TF COPRISS Admin	5.4	5.4	230	1	60	1.75	Window Type	LG
19	3F	PAC-CC-319	1	Storage Room COPRISS	5.4	5.4	230	1	60	1.75	Window Type	LG
20	3F	PAC-CC-320	1	TF COPRISS District Coordinators	5.4	5.4	230	1	60	1.75	Window Type	LG
21	3F	PAC-CC-321	1	Operation & Legal	5.4	5.4	230	1	60	1.75	Window Type	LG
			25			**168.9**						

Table 3-31 Site Survey Result of NGA (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-NGO-101	9	Waiting Area / Office staff	4.3	38.8	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	GF	PAC-NGO-102	1	Head Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
3	GF	PAC-NGO-103	2	Office	4.3	8.6	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
4	GF	PAC-NGO-104	1	Commander Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
5	GF	PAC-NGO-105	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
			22			**156.0**						

Table 3-32 Site Survey Result of NGA (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-NGO-201	7	Crime Research Analysis Section	4.3	30.1	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	2F	PAC-NGO-202	1	Office 3	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
3	2F	PAC-NGO-203	2	Office 2	4.3	8.6	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
4	2F	PAC-NGO-204	2	Office 1	4.3	8.6	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
5	2F	PAC-NGO-205	1	Chief Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
6	2F	PAC-NGO-206	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
			14			**60.3**						

Table 3-33 Site Survey Result of NGA (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-NGO-301	9	Waiting Area / Office staff	4.3	38.8	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	3F	PAC-NGO-302	1	Office of the District Fire Director	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
3	3F	PAC-NGO-303	1	Chief Fire Safety Enforcement	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
4	3F	PAC-NGO-304	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
			12			**51.67**						

Table 3-34 Site Survey Result of NGA (4TH FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	4F	PAC-NGO-401	1	DILG Head Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	4F	PAC-NGO-402	2	DILG Office	14.5	29.0	220	1	60	0.14	Ceiling Cassette-VRF type	Hitachi
3	4F	PAC-NGO-403	2	Conference Room	4.3	8.6	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
4	4F	PAC-NGO-404	1	LG Operations	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
5	4F	PAC-NGO-405	1	Cluster Head Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
6	4F	PAC-NGO-406	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
7	4F	PAC-NGO-407	1	Cluster Head Office	3.2	3.2	230	1	60	0.833	Wall Mounted Split type	Hitachi
8		PAC-NGO-408	1	Office	3.2	3.2	230	1	60	0.833	Wall Mounted Split type	Hitachi
			10			**61.2**						

Table 3-35 Site Survey Result of DRRMO (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-QC-101	2	Storage Room	5.4	10.8	230	1	60	1.75	Window Type	Kolin
2	GF	PAC-QC-102	1	BFP	14.2	14.2	220	3	60	5.89	Ceiling Cassette-VRF type	Koppel
3	GF	PAC-QC-103	1	Lobby	14.2	14.2	220	3	60	5.89	Ceiling Cassette-VRF type	Koppel
4	GF	PAC-QC-104	1	BFP	9.2	9.2	230	1	60	3.5	Floor Mounted-Split type	Mitsubishi Daiya
			5			**48.5**						

Table 3-36 Site Survey Result of DRRMO (MEZZANINE)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	MEZ	PAC-QC-M01	2	Ladies Quarter	5.6	11.2	220	1	60	0.071	Ceiling Cassette-Split type	Koppel
2	MEZ	PAC-QC-M02	1	Ladies Quarter	5.6	5.6	220	1	60	0.071	Floor Mounted-Split type	Hitachi
3	MEZ	PAC-QC-M03	2	Men's Quarter	7.1	14.2	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
4	MEZ	PAC-QC-M04	1	OCM	3.2	3.2	230	1	60	1.14	Wall Mounted-Split type	Hanabishi
			6			**23.0**						

Table 3-37 Site Survey Result of DRRMO (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-QC-201	4	Admin and Training Section	7.1	28.4	220	1	60	0.094	Ceiling Cassette-VRF type	Koppel
2	2F	PAC-QC-202	2	Conference Room	7.1	14.2	220	1	60	0.094	Ceiling Cassette-VRF type	Koppel
3	2F	PAC-QC-203	3	Research and Planning Section	7.1	21.3	220	1	60	0.094	Ceiling Cassette-VRF type	Koppel
4	2F	PAC-QC-204	3	Operation and Warning Section	9.0	27.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
5	2F	PAC-QC-205	1	Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF type	Koppel
6	2F	PAC-QC-206	1	Logistics and Training Room	7.1	7.1	220	1	60	0.094	Ceiling Cassette-VRF type	Koppel
7	2F	PAC-QC-207	1	Logistics and Training Room	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
8	2F	PAC-QC-208	1	OPS Office	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
			16			**123.0**						

Table 3-38 Site Survey Result of DRRMO (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-QC-301	6	Emergency Operations Center	10.6	63.3	220	1	60	4.09	Ceiling Suspended-VRF type	Koppel
2	3F	PAC-QC-302	1	Server Room	4.5	4.5	230	1	60	0.04	Wall Mounted-Split type	Carrier
3	3F	PAC-QC-303	2	Server Room	16.1	32.2	230	1	60	6.6	Floor Mounted-Split type	Kolin
4	3F	PAC-QC-304	2	Situation Room	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split type	Koppel
5	3F	PAC-QC-305	1	Research and Planning Section	9.0	9.0	220	1	60	0.173	Ceiling Cassette-Split type	Koppel
6	3F	PAC-QC-306	1	QCDRRMO Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
7	3F	PAC-QC-307	1	Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
8	3F	PAC-QC-308	1	Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
9	3F	PAC-QC-309	1	Office	6.4	6.4	230	1	60	1.953	Wall Mounted-Split type	Matrix
10	3F	PAC-QC-310	1	Conference	10.6	10.6	220	1	60	4.09	Floor Mounted-Split Type	Kolin
11	3F	PAC-QC-311	1	Conference	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
12	3F	PAC-QC-312	1	Office	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
13	3F	PAC-QC-313	1	Office of the City Mayor	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
14	3F	PAC-QC-314	2	Lobby	9.0	18.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
			22			**213.4**						

Table 3-39 Site Survey Result of DPOS (GROUND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	GF	PAC-DP-101	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	GF	PAC-DP-102	8	Waiting Area	4.3	34.4	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
3	GF	PAC-DP-103	3	DPOS SID	4.3	12.9	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
			12			**51.6**						

Table 3-40 Site Survey Result of DPOS (2ND FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	2F	PAC-DP-201	1	Communication Center	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
2	2F	PAC-DP-202	4	Records Section	4.3	17.2	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
3	2F	PAC-DP-203	1	Office	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
4	2F	PAC-DP-204	4	Office	4.3	17.2	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
5	2F	PAC-DP-205	1	Conference Room 1	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
6	2F	PAC-DP-206	1	Lobby	4.3	4.3	220	1	60	0.05	Ceiling Cassette-VRF type	Hitachi
7	2F	PAC-DP-207	2	Conference Room 2	7.1	14.2	220	1	60	0.06	Ceiling Cassette-VRF type	Hitachi
			14			**65.8**						

Table 3-41 Site Survey Result of DPOS (3RD FLOOR)

Item No.	Floor	EQUIPMENT TAG	No. of AC units	Room Name	Cooling Capacity	Total Cooling Capacity	Electrical Data				Type	Remarks /Brand
					kW	kW	V	Ph	Hz	kW		
1	3F	PAC-QC-301	6	Emergency Operations Center	10.6	63.3	220	1	60	4.09	Ceiling Suspended-VRF type	Koppel
2	3F	PAC-QC-302	1	Server Room	4.5	4.5	230	1	60	0.04	Wall Mounted-Split type	Carrier
3	3F	PAC-QC-303	2	Server Room	16.1	32.2	230	1	60	6.6	Floor Mounted-Split type	Kolin
4	3F	PAC-QC-304	2	Situation Room	10.6	21.1	220	1	60	4.09	Ceiling Cassette-Split type	Koppel
5	3F	PAC-QC-305	1	Research and Planning Section	9.0	9.0	220	1	60	0.173	Ceiling Cassette-Split type	Koppel
6	3F	PAC-QC-306	1	QCDRRMO Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
7	3F	PAC-QC-307	1	Head Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
8	3F	PAC-QC-308	1	Office	7.1	7.1	220	1	60	0.094	Ceiling Cassette-Split type	Koppel
9	3F	PAC-QC-309	1	Office	6.4	6.4	230	1	60	1.953	Wall Mounted-Split type	Matrix
10	3F	PAC-QC-310	1	Conference	10.6	10.6	220	1	60	4.09	Floor Mounted-Split Typle	Kolin
11	3F	PAC-QC-311	1	Conference	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
12	3F	PAC-QC-312	1	Office	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
13	3F	PAC-QC-313	1	Office of the City Mayor	9.0	9.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
14	3F	PAC-QC-314	2	Lobby	9.0	18.0	220	1	60	0.173	Ceiling Cassette-VRF type	Koppel
			22			**213.4**						

3.3 Survey of Existing Air Conditioning in Private Facilities

3.3.1 Candidate Facilities

In order to achieve a zero-carbon society in Quezon City, with an aim at replacing air conditioners at locations other than public facilities and promote the reduction of GHG emissions, the energy-saving effects of replacing air conditioners at private sector facilities in the city was considered. Shopping malls and hotels in Quezon City for which the number of air conditioners is large and operating hours are long were designated as the target private sector facilities. Information obtained from the websites (facility profile, sales floor space, number of guest rooms, etc.) and other sources clarified that there are 20 shopping malls and 41 hotels in the city.

Table 3-42 List of Target Shopping Malls in Quezon City

No.	Facility	Location	Sales floor area [m2]	Units	
				Reference	Project
1	SM City North EDSA	EDSA, North Avenue, Quezon City, 1100, Philippines	482,878	106	72
2	SM CITY FAIRVIEW	Quirino Highway corner Regalado Avenue, Novaliches, Quezon City, Philippines	282,681	62	42
3	ROBINSONS GALLERIA	EDSA corner Ortigas Avenue Ugong Norte, Quezon City, Manila,Philippines	216,000	48	32
4	Ayala Malls TriNoma	North Avenue corner, Epifanio de los Santos Ave, Lungsod Quezon, Kalakhang Maynila	195,000	43	29
5	TRINOMA (Triangle North of Manila)	EDSA corner North Avenue, Quezon City, Philippines	195,000	43	29
6	U.P. TOWN CENTER	249, U.P. Town Center, 216 Katipunan Ave., Diliman, Quezon City	174,000	38	26
7	SM CITY STA. MESA	R. Magsaysay cor. G Araneta Ave, Dona Imelda Quezon City 1113	133,327	29	20
8	FAIRVIEW TERRACES	Quirino Highway corner Maligaya Drive, Barangay Pasong Putik, Novaliches, Quezon City 1118	114,000	25	17
9	Fisher Mall	Quezon Ave, Quezon City	110,000	24	17
10	AYALA MALLS CLOVERLEAF	Ayala Malls Cloverleaf, A. Bonifacio Ave., Brgy. Balingasa, Quezon City	110,000	24	17
11	AYALA MALLS VERTIS NORTH	North Ave, Diliman, Quezon City, Metro Manila	106,040	23	16
12	GATEWAY MALL	Araneta Coliseum Araneta Center, Quezon City	100,000	22	15
13	SM CITY NOVALICHES	Quirino Highway, Brgy. San Bartolome, Novaliches, Quezon City, Philippines	77,222	17	12
14	ALI MALL	13th Avenue, corner P. Tuazon Blvd, Cubao, Quezon City	62,000	14	9
15	FARMERS PLAZA	Araneta Center, Cubao, Quezon City, Philippines	60,400	13	9
16	ROBINSONS NOVALICHES	Brgy. Pasong Putik, Quirino Highway, Novaliches, Quezon City	55,893	12	8
17	ROBINSONS MAGNOLIA	Aurora Blvd and Hemady St, Quezon City, Luzon Philippines	48,000	11	7
18	EASTWOOD MALL	116 Eastwood Ave, Bagumbayan, Quezon City	47,000	10	7
19	SM CHERRY CONGRESSIONAL	Pangilinan St, Project 8, Quezon City, Metro Manila	13,469	3	2
20	CENTRIS STATION	Eton Centris, Epifanio de los Santos Ave cor Quezon Ave, 1100 Quezon City, Philippines	11,128	2	2
		Total	2,594,038	571	389

* The assumption of total number of air conditioners in each facility is from the second year study report (reference: 22 units per 100,000 m2, project: 15 units per 100,000 m2)

Table 3-43 List of Target Hotels in Quezon City

No.	Facility	Location	Room	Building Area [m2]	Units	
					Reference	Project
1	B Hotel Quezon City	14 Sct. Rallos St, Brgy, Quezon City, 1103 Metro Manila	111	5,606	137	137
2	Novotel Manila Araneta City Hotel	General Aguinaldo Ave. Ataneta City, Quezon City, Metro Manila	401	20,251	493	493
3	Soleste Suites	193 Katipunan Avenue Blue Ridge,Quezon City	23	1,162	28	28
4	Eastwood Richmonde Hotel	17 Orchard Road, Eastwood City, Bagumbayan,Quezon City 1110 Manila	138	6,969	170	170
5	Luxent Hotel	51 Timog Ave,Diliman,Quezon City,1103 Metro Manila	117	5,909	144	144
6	Microtel by Wyndham UP Technohub	Commonwealth Avenue, UP Ayala Land Technohub,Quezon City, Manila,1121,Philippines	120	6,060	148	148
7	The Sulo Riviera	Matalino St, Diliman,Quezon City,1100 Metro Manila	70	3,535	86	86
8	West Avenue Suites	West Ave, Quezon City	91	4,596	112	112
9	BRENTWOOD SUITES	6 Dr Garcia Sr., Diliman,Quezon City, Metro Manila	74	3,737	91	91
10	Meranti Hotel	82 Scout Castor St, Tomas Morato Ave, Quezon City	60	3,030	74	74
11	SEDA VERTIS NORTH	Sola corner Lux Drives, Vertis North Quezon City, 1105 Philippines	438	22,119	539	539
12	Park Inn Radission North EDSA	North Avenue corner EDSA SM City North EDSA Complex, Quezon City, 1105 Metro Manila	238	12,019	293	293
13	Hotel Dream World Araneta Center	General Roxas Ave, Cubao, Quezon City	100	5,050	123	123
14	SEQUOIA HOTEL	91-93 Mother Ignacia Avenue,corner Timog Ave, Quezon City	137	6,919	169	169
15	Camelot Hotel	35 Mother Ignacia Ave,Diliman,Quezon City	127	6,414	156	156
16	The Grass Residence	Nueva Viscaya,Bago Bantay, Lungsod Quezon	90	4,545	111	111
17	Great Eastern Hotel	1403 R-7 Quezon Ave, Diliman,Quezon City	287	14,494	353	353
18	Madison 101 Hotel + Tower	Aurora Blvd, corner Madison, New Manila,Quezon City	48	2,424	59	59
19	Cocoon Boutique Hotel	61 Scout Rallos St, cor Sct. Tobias St, Diliman, Quezon City 1103 Metro Manila	39	1,970	48	48
20	Haeinsa Condotel	23 Makisig St, Diliman, Quezon City,1100 Metro Manila	50	2,525	62	62
21	Eurotel Vivaldi Araneta	629 EDSA Cubao, Quezon City	99	5,000	122	122
22	Microtel by Wyndham Acropolis	E. Rodriguez Jr. Ave., Brgy. Begumbayan, Quezon City 110 Philippines	84	4,242	103	103
23	Crowne Plaza Manila Galleria	Corner Asian Development Bank Ave, Ortigas Ave, Ortigas Corner, Quezon City, 1100 Metro Manila	263	13,282	323	323
24	Red Hotel Cubao	627 Eplfanio de los Santos Ave, Cubao, Quezon City, 1111 Metro Manila	199	10,050	245	245
25	Stone House Hotel	1315 E Rodriguez St. Ave, New Manila,Quezon City	70	3,535	86	86
26	Regal Residences	Lot Block 135,13 Regalado Hwy,Novaliches,Quezon City		0	0	0
27	Prime Hotel	70 Sgt. Esguerra St.Quezon City Philippines 1103	39	1,970	48	48
28	Verjandel Hotel	70 Kalayaan Ave, Diliman Quezon City	68	3,434	84	84
29	H Hotels - Metro North Uno	89 Rd 1,Brgy,Quezon City	20	1,010	25	25
30	Red Planet Quezon Timog	100 Timog Ave, Diliman, Quezon City	140	7,070	172	172
31	The Cirque Serviced Residences	Bagumbayan,Quezon City	55	2,778	68	68
32	Icon Hotel - North Edsa	967 EDSA, corner West Ave,Quezon City	50	2,525	62	62
33	Fernandina 88 Suites Hotel	222 P. Tuazon Blvd, Cubao,Quezon City	60	3,030	74	74
34	Hotel 99	#8 Pinatubo St, Corner Matulin,Cubao,Quezon City	120	6,060	148	148
35	MaxStays - Max Style @ One Eastwood Avenue	One Eastwood, One,1800 Eastwood Ave, Bagumbayan,Quezon City	4	202	5	5
36	Hotel Dream World North Edsa	967 EDSA cor.West Avenue Barangay Philam,Quezon City	96	4,848	118	118
37	Hotel Rembrandt	26 Tomas Morato Ave.Diliman Quezon City	71	3,586	87	87
38	Fersal Hotel	No.245 P. Tuazon Boulevard Cubao,Quezon City, Manila,Philippines	68	3,434	84	84
39	Fersal Hotel Kalayaan	No.130 Kalayaan Avenue Diliman, Quezon City,Manila,Philippines	49	2,475	60	60
40	Fersal Hotel Malakas	131 Malakas Street, Diliman, Manila, Quezon City,Manila 1100,Philippines	49	2,475	60	60
41	Red Planet Aurora Boulevard - Quezon City	901 Stanford St, corner of Aurora Blvd, Cubao, Quezon City, 1109, Philippines	167	8,434	205	205
			Tottal	228,765	5,572	5,572

* A unit area of 50.5 m2/room was applied for the number of hotel rooms.

* The assumption in the second year study report (1.23 units/room) was used to determine the number of air conditioning units in the total number of hotel rooms

3.3.2 Review of Air Conditioners to be Replaced

Due to the fact that a field survey of the number of air conditioners and models installed at private sector facilities could not be conducted as a result of the impact of the COVID-19 pandemic, the review was based on the results of second year study.

(1) Shopping Malls

As for the specifications of the air conditioning system in the shopping mall, no information was available, the reference and project device specifications assumed through an interview of a local air conditioner manufacturer were used as in the table below. The number of units was estimated using the conditions for device shown in the table below and the total store floor area at each shopping mall.

Table 3-44 Assumed Existing Air Conditioners and Air Conditioners to be Introduced

	Reference Device Reference Model	Project Device Reference Model
	Water-Cooled Screw Chiller	Magnetic Bearing Chiller
Model	ZUWY	WMC700AX
Capacity (kW)	1650	2461
Capacity (USRT)	470	700
Power Input (kW)	95	120
COP (kW/kW)	5	5.9
Refrigerant	R134a	R134a
INVERTER	NON	INV
Unit Price (1 unit)	16 million PHP	35 million PHP
Installation Cost	1 – 5 million PHP	1 – 5 million PHP
Product Image		

(2) Hotels

Information on the number of units, model and performance of the air conditioning system installed at the “MICROTEL ACROPOLIS” hotel was obtained. The number of units installed and various other conditions were determined for other facilities based on this information and on the number of hotel rooms.

Table 3-45 Site Survey Result of MICROTEL ACROPOLIS

Manufacturer	Model Name	Qty	SBU	INV /NON	Cooling Capacity (kW) (nominal)	Power Input (kW)	Indoor Type	Refrigerant Type
Panasonic	CS-PS24NKQ /CU-PS24NKQ	91	RA	INV	5.87	1.83	Wall mounted	R410a
Daikin	FTKC50QVM /RKC50QVM	12	RA	INV	5.2	1.37	Wall mounted	R32

3.4 Energy Saving Effects by Upgrading Air Conditioners

3.4.1 Air Conditioners Planned for Introduction

In the same manner as in the study results in the previous fiscal year, the energy-savings effects were calculated based on air conditioners from a manufacturer with a large market share in the Philippines for split-type and rooftop-type air conditioners.

Table 3-46 Example of Air Conditioners Expected to be Introduced

Type	VRV	Ceiling Cassette type	Shopping Mall
Model (Indoor unit)	RXQ16AYM	RZF140CYM	WMC700AX
Model (Outdoor unit)		RZF140CVM	
Photo			

Source: Brochure of Daikin Airconditioning Philippines, Inc.

3.4.2 Calculation Method

（1） Methodology

The methodology adopted is the approved methodology “VN_AM006 Introduction of air conditioning system equipped with inverters (2016),” which was used to calculate the reduction benefits in Chapter 2.

Table 3-47 Definition of Terms

Term	Definition
Inverter Type Air Conditioner	An inverter type air conditioner is a type of air conditioner that incorporates an inverter to control the compressor motor speed in order to maintain the ambient temperature. While non-inverter type air conditioners can only operate the compressor at full capacity or completely stop the compressor, inverter type air conditioners can adjust the speed of the compressor which is expected to provide energy-savings.
Coefficient of Performance (COP)	The Coefficient of Performance (COP) is the cooling capacity of an air conditioning system per rated power consumption. The cooling capacity and rated power consumption values are defined at the specific temperature described in ISO 5151:2010.
Cooling Capacity	Cooling capacity is the capability of an air conditioning system to reduce heat calculated by the amount of heat reduced per unit of time at a specific temperature.

Table 3-48 Overview of Methodology

Item	Overview
GHG Emissions Reduction Technique	Apply to project aimed at saving energy by introducing inverter type air conditioners for air conditioning at office buildings in the Philippines. Proposal: Energy can be saved by introducing inverter type air conditioners, enabling GHG emissions to be reduced by lowering power consumption.
Calculation of Reference Emissions	Reference emissions are calculated from the power consumption of the existing air conditioners and the power consumption CO2 emission factor calculated from the operating time and the load factor.
Calculation of Project Emissions	Project emissions are calculated from the power consumption of the air conditioners being introduced and the power consumption CO2 emission factor calculated from the operating time and the load factor.
Monitoring Parameter	Power consumption of the existing air conditioners and the air conditioners being introduced

（2） Eligibility criteria

The eligibility criteria are described below as in the study results of the previous fiscal year.

Table 3-49 Eligibility Criteria of Methodology "VN_AM006 Introduction of Air Conditioning System Equipped with Inverters (2016)"

Applicable Criteria
i) Air conditioning system with inverter is newly installed or installed to replace existing non-inverter air conditioning system.
ii) Cooling capacity of project air conditioning system is more than or equal to 14 kW.
iii) COP of project air conditioning system has a COP value higher than that of the value indicated in the table below.
iv) Ozon Depletion Potential (ODP) of the refrigerant used for project air conditioning system is zero.
v) Plans to prevent release of refrigerants into the atmosphere at the time of air conditioning system removal are prepared for both project air conditioning system and the existing air-conditioning system replaced by the project. In the case of replacing existing air conditioning system by project air conditioning system, execution of the prevention plan is checked at the time of verification, e.g. re-use of the refrigerant, in order to confirm that refrigerant used for the existing air conditioning system removed by the project is not released to the air.

Cooling capacity [kW]	COP
14≤x<28	2.97
28≤x<42	2.94
42≤x<56	2.91
56 ≤ X	2.56

（3） Estimation of emissions reduction by upgrading air conditioners

Calculation of the reduction effect in the JCM model project is applied to estimate the emissions effect of upgrading air conditioners.

1） Reference emissions

The calculation formula for the reference emissions is described below.

$$\mathrm{RE_p} = \sum_{\mathrm{i}} \mathrm{EC_{RE,i,p}} \times \mathrm{EF_{elec}}$$

$$\mathrm{EC_{RE,i,p}} = CC \div \mathrm{COP_{RE,i}}$$

RE_p	Reference emissions [tCO2/p]
$EC_{RE,i,p}$	Energy consumption of air conditioning equipment adopted in general facility renewal [MWh/p]
EF_{elec}	Power CO2 emission factor [tCO2/MWh]
$COP_{RE,i}$	COP of air conditioning equipment used for general equipment replacement [-]
CC	Cooling capacity [MW]
i	Type of air conditioner [-]

2） Project emissions

The calculation formula for the project emissions is described below.

$$\mathrm{PE_p} = \sum_{\mathrm{i}} \mathrm{EC_{PJ,i,p}} \times \mathrm{EF_{elec}}$$

$$\mathrm{EC}_{PJ,\mathrm{i,p}} = CC \div \mathrm{COP}_{PJ,\mathrm{i}}$$

PE_p	Project emissions [tCO2/p]
$EC_{PJ,i,p}$	Power consumption of air conditioners introduced in this project [MWh/p]
EF_{elec}	Power CO2 emission factor [tCO2/MWh]
$COP_{PJ,i}$	COP [-] of air conditioners introduced in this project
CC	Cooling capacity [MW]
i	Type of air conditioner [-]

3） Calculation formula of emissions reduction

The reduction is the difference between reference emissions and project emissions. The calculation formula is described below.

$$ER_p = RE_p - PE_p$$

ER_p	Emissions reduction [tCO_2/p]
RE_p	Reference emissions [tCO2/p]
PE_p	Project emissions [tCO2/p]

3.4.3 Calculation of GHG Emissions Reduction

（1） Conditions

1） City Hall Compound (4 facilities)

The prerequisites for calculation are described below.

Table 3-50 Conditions for Estimate of Emissions Reduction (City Hall Compound)

Item		Setting concept
Average Cooling Load per Hour (kWh)		Average cooling load per hour =7,278 kWh =(1) x (2) x (3) / (4) i) Heat load: The value for "Office, Area Category 8 (Okinawa Prefecture)" in the Appended Table (related to Article 10) of the Ministerial Ordinance Establishing Building Energy Consumption Performance Standards, etc. is used: 158 kWh/(m2/year). ii) Floor area: Calculated based on the facility shown on the diagram: 9,950 m2 iii) Average temperature ratio between the Philippines and Okinawa Prefecture: 1.21 (28.8 degrees C (Philippines)/23.9 degrees C (Okinawa Prefecture)) iv) Number of days of operation per year: 261 days (same as the second year study)
Average Cooling Operation Hours (h/day)		Nine hours (8:00～17:00)
Monthly Cooling Operation Days (day)		Set as annual operating days Annual operating days: 261 days (same as the second year study)
Emission Factor of Electricity (tCO2/MWh)		0.5979 The Luzon region in the Philippines was adopted based on the "FY2021 JCP Model Project List of Emission Factor of Electricity (tCO2/MWh)" published by the GEC on March 31, 2021 (at the time of the bid notice)
Reference Emissions		3,489 tCO2
Project Emissions		2,608 tCO2
Estimated Emissions Reduction	Single Year	881 tCO2
	Total[*1]	5,286 tCO2
No. of Air Conditioners		203 units
Introduction Cost[*2*3]		36,398,900 PHP (85,537,415 JPY)
Subsidy Rate[*4]		24%
Subsidy Amount		8,735,736 PHP (20,528,980 JPY)
Cost Effectiveness[*5]		1,653 PHP/tCO2 (3,884 JPY/tCO2)

*1: The legal durable years of the air conditioners in the City Hall Compound is set at 6 years.
*2: Based on an interview with a manufacturer
*3: 2.35 JPY/PHP (as of August 2, 2021)
*4: The subsidy rate is set as less than 1,702 PHP (4,000 JPY))/tCO2 which is a requirement of JCM model project.
*5: The following calculation formula is applied:
<Calculation Formula for Cost Effectiveness>
Cost Effectiveness (PHP/tCO2)
= Subsidy Amount (PHP) / [Estimated emissions reduction by energy-saving air conditioners (tCO2) x Legal durable years (years)]

2） Public Facilities besides City Hall Compound (Quezon City General Hospital)

The prerequisites for calculation are described below.

Table 3-51 Conditions for Estimate of Emissions Reduction (Public Facilities besides City Hall Compound)

Item		Setting Concept
Average Cooling Load per Hour (kWh)		Average cooling load per hour = 8,524 kWh = (1) x (2) x (3) / (4) i) Heat load: The value for "Hospital, Area Category 8 (Okinawa Prefecture)" in the Appended Table (related to Article 10) of the Ministerial Ordinance Establishing Building Energy Consumption Performance Standards, etc. is used: 181 kWh/(m2/year). ii) Floor area: Calculated based on the facility shown on the diagram: 14,290 m2 iii) Average temperature ratio between the Philippines and Okinawa Prefecture: 1.21 (28.8 degrees C (Philippines)/23.9 degrees C (Okinawa Prefecture)) iv) Number of days of operation per year: 365 days (same as the second year study)
Average Cooling Operation Hours (h/day)		24 hours (0:00～24:00) (same as the second year study)
Monthly Cooling Operation Days (day)		Annual operating days x bed occupancy rate Annual operating days: 365 Bed occupancy rate: 80.5% (based on overviews of medical institution (dynamic) survey in 2019 and hospital report)
Emission Factor of Electricity (tCO2/MWh)		0.5979 The Luzon region in the Philippines was adopted based on the "FY2021 JCP Model Project List of Emission Factor of Electricity (tCO2/MWh)" published by the GEC on March 31, 2021 (at the time of bid notice)
Reference Emissions		11,409 tCO2
Project Emissions		8,787 tCO2
Estimated Emissions Reduction	Single year	2,622 tCO2
	Total[*1]	15,732 tCO2
No. of Air Conditioners		224 units
Introduction Cost[*2*3]		45,257,400 PHP (106,354,890 JPY)
Subsidy Rate[*4]		50%
Subsidy Amount		22,628,700 PHP (53,177,445 JPY)
Cost Effectiveness[*5]		1,438 PHP/tCO2 (3,380 JPY/tCO2)

*1: The legal durable years of the air conditioners in the public facilities besides City Hall Compound (hospital) is set at 6 years.
*2: The price is set at about three times the normal equipment cost, based on interviews with the manufacturer and the unique installation environment of a hospital.
*3: 2.35 JPY/PHP (as of August 2, 2021)
*4: The subsidy rate is set as less than 1,702 PHP (4,000 JPY))/tCO2 which is a requirement of JCM model project.
*5: The following calculation formula is applied:
<Calculation Formula for Cost Effectiveness>
Cost Effectiveness (PHP/tCO2)
= Subsidy Amount (PHP) / [Estimated emissions reduction by energy-saving air conditioners (tCO2) x Legal durable years (years)]

3） Private Facilities

The prerequisites for calculation are described below.

Table 3-52 Conditions for Estimate of Emissions Reduction (Private Facilities)

Item	Setting Concept	
Average Cooling Load per Hour (kWh)	Average cooling load per hour = (1) x (2) x (3) / (4) { Shopping malls: 2,456,609 kWh Hotels: 140,651 kWh } i) Heat load: The value for "Commercial facility and hotel, Area Category 8 (Okinawa Prefecture)" in the Appended Table (related to Article 10) of the Ministerial Ordinance Establishing Building Energy Consumption Performance Standards, etc. is used: { Shopping malls: 358 kWh/(m2/year) Hotels: 186 kWh/(m2/year) } ii) Floor area: Calculated based on the facility shown on the diagram: { Shopping malls: 2,594,038 m2 Hotels: 228,765 m2 } iii) Average temperature ratio between the Philippines and Okinawa Prefecture: 1.21 (28.8 degrees C (Philippines)/23.9 degrees C (Okinawa Prefecture)) iv) Number of days of operation per year: 365 days (same as the second year study)	
Average Cooling Operation Hours (h/day)	Shopping malls: 12 hours (9:00～21:00) Hotels: 24 hours (0:00～24:00)	
Monthly Cooling Operation Days (day)	Shopping malls: annual operating days Hotels: annual operating days x occupancy rate Annual operating days: 365 days Hotel operating rate: 62.7% (based on the statistic survey on overnight travel (annual value in 2020 (preliminary))	
Emission Factor of Electricity (tCO2/MWh)	0.5979 The Luzon region in the Philippines was adopted based on the "FY2021 JCP Model Project List of Emission Factor of Electricity (tCO2/MWh)" published by the GEC on March 31, 2021 (at the time of bid notice)	
	Shopping malls	Hotels
Reference Emissions	1,286,674 tCO2	152,441 tCO2
Project Emissions	1,090,402 tCO2	96,028 tCO2
Estimated Emissions Reduction – Single year	196,272 tCO2	56,412 tCO2
Estimated Emissions Reduction – Total*1	2,944,080 tCO2	338,472 tCO2
No. of Air Conditioners	389 units	5,572 units

*1: The legal durable years of the air conditioners in each facility are below (same as the second year study).
Shopping malls: 15 years
Hotels: 6 years

4） Calculation results

i) Summary of emissions reduction in public facilities

The estimated GHG reduction and cost-effectiveness brought about by replacement of air conditioners at the City Hall Compound, public facilities other than City Hall Compound were calculated.

The largest GHG emissions reduction and cost-effectiveness is expected for public facilities other than City Hall Compound (Quezon City General Hospital), where the subsidy rate is about 50% to meet the

guideline of 4,000 JPY (1,834 PHP)/tCO2 for the JCM model project. This is because the facility's operating hours are longer than those of a regular government building facility, which contributes to the increased reduction. Since this estimation is based on assumptions regarding facility utilization (number of operating days and operating hours) and air conditioning system utilization (air conditioning usage hours) of the hospital with reference to domestic examples, it is necessary to conduct a detailed survey in the future to scrutinize the setting conditions.

The City Hall Compound, on the other hand, had a subsidy rate of about 22-28%.

In promoting the JCM model project in the future, priority will be given to Quezon City General Hospital, which is expected to achieve sufficient GHG emissions reduction. In addition, the City Hall Compound, which is expected to achieve a certain level of GHG emissions reduction, will be considered as a supplement to the JCM model project.

The Legislative Building and the Civic Center C are candidates for the City Hall Compound facilities, which are expected to achieve a certain level of GHG emissions reduction.

Table 3-53 Estimate of GHG Emissions Reduction and Cost-effectiveness

Item		City Hall Compound				Public Facilities besides City Hall Compound (QCGH)
		Civic Center C	NGA	DRRMO	DPOS	
No. of Air Conditioners Installed	Indoor Units	66 units	51 units	45 units	41 units	224 units
	Outdoor Units	11 units	4 units	8 units	4 units	224 units
Estimated Emissions Reduction figures in ( ) are total		251 tCO2 (1,506 tCO2)	185 tCO2 (1,110 tCO2)	209 tCO2 (1,254 tCO2)	185 tCO2 (1,110 tCO2)	2,622 tCO2 (2,826 tCO2)
Installation Cost		23,121,392 JPY	20,056,968 JPY	17,534,196 JPY	16,271,118 JPY	106,354,890 JPY
Subsidy Rate		26%	22%	28%	27%	50%
Subsidy Amount		6,011,562 JPY	4,412,533 JPY	4,909,575 JPY	4,393,202 JPY	53,177,445 JPY
Cost-effectiveness		3,992 JPY/tCO2	3,975 JPY/tCO2	3,915 JPY/tCO2	3,958 JPY/tCO2	3,380 JPY/tCO2

Item		City Hall Compound		
		Legislative Bldg.	Civic Center A	Civic Center B
No. of Air Conditioners Installed	Indoor Units	146 units	129 units	134 units
	Outdoor Units	146 units	129 units	134 units
Estimated Emissions Reduction figures in ( ) are total		471 tCO2 (2,826 tCO2)	85 tCO2 (510 tCO2)	0 tCO2* (0 tCO2)
Installation Cost		43,334,024 JPY	51,133,298 JPY	－ JPY
Subsidy Rate		26%	3.9%	－%
Subsidy Amount		11,266,846 JPY	1,533,999 JPY	－ JPY
Cost-effectiveness		3,987 JPY/tCO2	3,910 JPY/tCO2	－ JPY/tCO2

* The calculation method for emissions reduction specified in the JCM model project is to use catalog values without taking into account the load factor when using air conditioners. Therefore, when evaluated based on catalog values alone, reference emissions and project emissions may result in the same amount of reduction. Details of the effect of improvement in cooling capacity, etc. by load factor are shown in Table 2-4 in Chapter 2.

ii) Summary of estimates for the development of GHG reduction initiatives into private facilities

As described in the previous section, using the JCM model project for public facilities as a model case for further GHG emissions reduction by updating air conditioning systems, we estimated what would happen if private facilities (shopping malls and hotels) in Quezon City were to update their air conditioning systems to high-efficiency ones. This estimation is based on assumptions regarding the facility utilization status (number of operating days and operating hours) and air conditioning system utilization status (air conditioning usage hours) of shopping malls and hotels with reference to domestic examples, so a detailed investigation and close examination for setting conditions will be required in the future.

As a result, it was understood that even a single private facility with long operating hours and large scale can be expected to achieve sufficient reductions. Future efforts will target shopping malls with large reductions per facility and select businesses with needs for air conditioning system upgrades. In addition to collecting facility drawings and necessary documents such as lists and layouts of air conditioning equipment for the preparation of specific equipment renewal plans, field surveys on the usage status of air conditioning equipment and interviews with facility managers should be continued. Interviews were conducted with shopping malls in Quezon City under consideration as candidates for the study: Ayala Malls Vertis North (area: approx. 106,040 m2, estimated number of air conditioning units: approx. 20 units) and TriNoma (area: approx. 195,000 m2, estimated number of air conditioning units: approx. 40 units). Based on the results of the model project for energy-efficient air conditioning installation in Quezon City Hall discussed in Chapter 2, it was confirmed that presenting specific numerical values for the energy-saving and economic effects of upgrading to energy-efficient air conditioning would help promote consideration of specific measures to be taken. Establishing a model project for energy-efficient air conditioning upgrades for Quezon City Hall and other public facilities, and then expanding the project to private facilities, is expected to lead to the realization of “Decarbonization Domino.”

Table 3-54 Estimate of Emissions Reduction and Cost-effectiveness

Item	Shopping Malls	Hotels
Number of Facilities	20 facilities	41 facilities
Number of Units	389 units	5,572 units
Legal Durable Years	15 years	6 years
Estimated Emissions Reduction figures in ( ) are total	196,272 tCO2/year (2,944,080 tCO2)	56,412 tCO2/year (338,472 tCO2)
Estimated Emissions Reduction per Facility	9,814 tCO2	1,376 tCO2
Number of Units per Facility	19.5 units	136 units

Chapter 4　City to City Collaboration and Support for Environmental Policies

4.1 Support for Proper Treatment of Fluorocarbons at the Time of Replacement of Air Conditioners

4.1.1 Current Status Concerning Recovery and Destruction of Fluorocarbons in Air Conditioners

Air conditioners use incombustible non-toxic fluorocarbons as the refrigerant, and the fluorocarbons are circulated at high pressure in the liquid or gaseous state between the inside and outside of the room when air conditioners are operated in order to control the interior temperature. There are fluorocarbons that have between one thousand to ten thousand the greenhouse effect of CO2.

Fluorocarbons used in air conditioners and other such equipment have the problem of destroying the ozone layer and greenhouse effects, and when the fluorocarbons contained in air conditioners that are disposed when they are replaced with new units are discharged into the atmosphere instead of being disposed of in a proper manner, this results in acceleration of destruction of the ozone layer and global warming. The proper collection of fluorocarbons is a problem that cannot be avoided when air conditioners are replaced in Quezon City. When the refrigerant that is used in the air conditioners that are disposed differs from the refrigerant used in the air conditioner that is newly purchased, the old refrigerant cannot be reused. Therefore, the fluorocarbons that are discharged from air conditioners being disposed of needs to be stored and destroyed in a suitable manner.

Regulations for the recovery and destruction of fluorocarbons in the Philippines have not been enacted. Due to the fact that suitable comprehensive management regulations for the entire life cycle of fluorocarbons are lacking, a structure has not been created and fluorocarbons are not being recovered and destroyed in the country.

As of June 2020, there were 324 companies authorized in the Philippines to provide maintenance services for air conditioners, and these companies perform repairs and fill air conditioners with refrigerant. A grasp of the fluorocarbons recovered by service companies has not been obtained, and the fluorocarbons are not being stored in a proper manner in many cases. But the total volume of fluorocarbons consumed in the past continues to accumulate, and these fluorocarbons are being discharged without being destroyed in a suitable manner when air conditioners and other equipment using fluorocarbons are disposed.

4.1.2 Status Concerning E-waste in Quezon City and Support from Osaka City

If the suitable recovery and disposal of E-waste does not proceed, progress cannot be made on the collection of old fluorocarbons from E-waste that contains fluorocarbons and on the suitable processing. Quezon City has stipulated in chapter 4 item 5 of “An Ordinance Providing for the Environmental Protection and Waste Management Code of Quezon City No. SP-2350, S-2014” provisions concerning the collection and disposal of industrial waste

and E-waste. This ordinance requires the sorting of harmful waste and E-waste from households, industry and offices into such categories as fluorescent light bulbs and used batteries. In addition, this item states that the collection of E-waste is not the responsibility of cities.

Quezon City is promoting the collection of recyclable waste by notifying residents and through E-waste collection activities in co-sponsorship with mall operators. These activities have only resulted in a very small amount of E-waste being collected, with the annual volume of waste collected through this co-sponsorship amounting to less than 1% of the overall volume. The support provided from Osaka City to Quezon City concerning fluorocarbon management is expected to be the sharing of experience and knowledge related to the enactment of ordinances that contain stipulations on fluorocarbons and E-waste to facilitate the creation of a decarbonized society. Currently, E-waste that contains fluorocarbons flows to informal repair shops and junk shops, and the fluorocarbons are discharged without being suitably processed, with the parts other than those of value being disposed. Therefore, it is thought that the sharing of experience and knowledge on the education of the citizens will also represent support.

In consideration of the “Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Green Procurement Law),” Osaka City places priority on and promotes the procurement of goods and services that contribute to a lower environmental impact. When procuring goods and services, it is expected items that have the lowest possible load on the environment during their life cycle from production and usage to disposal are selected and procured. A number of provisions are specified for air conditioners, including high energy efficiency and a global warming potential of 750 or less for the substance used as the refrigerant.

Osaka City has shared information on its support with Quezon City since the second year. As the JCM model project requires proper treatment of fluorocarbons at the time of replacement of air conditioners in Quezon City, it will confirm their proper treatment by the supplier through the information sharing.

4.1.3 JCM Fluorocarbons Recovery and Destruction Model Project

The Department of Environment and Natural Resources (DENR) of the Philippines, with which we have built a relationship since the first and second years of this project, is highly interested in fluorocarbons countermeasures and endorsed the “Initiative on Fluorocarbons Life Cycle Management” proposed by the Japanese Ministry of Environment, which was also promoted by our efforts in this project.

In addition, Marubeni Corporation, which is also engaged in fluorocarbons recovery and destruction project in Vietnam, applied for and was adopted for the JCM F-gas project in the Philippines.

As the first two years of the Project have greatly contributed to the assistance project formation, Osaka City intends to provide indirect support for Quezon City to conduct the

efforts there in the future with cooperation from Osaka Prefecture that works on fluorocarbons recovery and destruction in Japan. If the assistance project leads to promotion of nationwide regulations in the Philippines, assistance for practical capacity building of local government employees involved in fluorocarbons recovery and destruction and E-waste management can be provided by Osaka City as part of the city to city collaboration project. Furthermore, Osaka's experiences can be utilized to raise awareness among residents and business operators in Quezon City that are users.

In the JCM F-gas project, to share the efforts to reduce fluorocarbons in Japan and the current status of the Philippines, Osaka City and Quezon City participated in the seminar in January 2022. In the seminar, Japan Association of Refrigeration and Air Conditioning Contractors (JARAC) members, as instructors, explained about leakage inspection and repair guidelines and recovery, filling and inspection licenses in addition to the need for fluorocarbons reduction measures and an overview of fluorocarbons laws (particularly the Fluorocarbons Emissions Control Law) in Japan. Quezon city employees also participated and thus it served as an opportunity to share knowledge and promoted their understanding of the need for proper fluorocarbons treatment.

4.2 Quezon City Environmental Policies

4.2.1 Quezon City's Interests and Last Year's Study Follow-up

At the completion of the second year of the Project, Quezon City expressed in writing its concerns about the replacement of city buses with electric buses, plastic waste treatment technology and river water quality and environmental improvement in addition to the introduction of energy-efficient air conditioners. In this fiscal year, to support its environmental measures, we conducted a total of four workshops to share information on Pues Corporation's EV technology and overview of overseas demonstration projects, plastic waste recycling technologies in Japan and their impacts on CO2 emissions reduction, and examples of Osaka's city projects to create an attractive city by improving river environment. As survey continuing from the second year, progress in organic waste treatment and solar power generation project was also confirmed.

Table 4-1 Study Items concerning Quezon City's Environmental Measures

Interests in FY2021
➢ Replacement of Quezon City bus with electric vehicles and establishment of solar-power charging stations ➢ Technology for plastic waste recycling and upcycling and conversion into fuel ➢ San Juan river water quality and environmental improvement
Study Items from FY2020
➢ Introduction of organic waste treatment device to public markets in Quezon City ➢ Installation of Solar power generation to public schools

4.2.2 Introduction of Electric Vehicles (EVs) to Quezon City Bus System

（1） Quezon City Bus

Quezon City operates buses to improve means of public transportation while giving consideration to measures to prevent the spread of COVD-19 infections. According to a report from the city, the traffic sector accounts for 21% of GHG emissions and thus the introduction is highly likely to contribute to CO2 emissions reduction. Currently, efforts to establish bicycle lanes and promote electric tricycles (E tricycles) are made and of particular interest is a planned BRT (bus rapid transit) system. Having a bus lane not affected by traffic congestion to enable punctual operation will lead to time-saving of users and safety improvement. The introduction of electric vehicles will also contribute to the reduction of local air pollution and GHG emissions. Quezon City is also studying the possibility of zero-emission system creation by using solar power to generate the electricity of the electric buses.

Quezon City assists easing of traffic congestion by launching the Quezon City bus increase program and providing commuters with more means of transportation through an agreement with the Land Transportation Franchising and Regulatory Board (LTFRB). In this program, buses stop only at designated bus stops (in the Philippines, there is no timetable of designated bus stops for local buses and they stop where passengers request and this is a cause of traffic congestion). The city limits the passenger capacity of public transportation to 50% of the actual capacity as a New Normal strategy. While means of transportation is limited due to the pandemic, it has enabled commuters to arrive at their destination quickly and safely. As more citizens use buses, the use of personal cars is expected to reduce. Currently, eight bus routes are operated from 5:00 to 21:00. The routes are described in Figure 4-1:

Route 1 -Quezon City Hall to Cubao (and vice versa)
Route 2 -Litex / IBP Road to Quezon City Hall (and vice versa)
Route 3 -Welcome Rotonda to Aurora Blvd. / Katipunan Avenue (and vice versa)
Route 4 -General LuisAve.to Quezon City Hall (and vice versa)
Route 5 -Mindanao Ave. cor. Quirino Highway to Quezon City Hall (and vice versa)
Route 6 -Quezon City Hall to Robinsons Magnolia (and vice versa)
Route 7 -Quezon City Hall to Ortigas Avenue Extension (and vice versa)
Route 8 -Quezon City Hall to Muñoz (and vice versa)

Figure 4-1 Quezon City Bus Route Map

Source: Quezon City

Figure 4-2 Quezon City Buses

Source: Quezon City

As of today, conventional diesel buses are introduced to BRT and they are planned to be replaced with electric vehicles. Where to build a solar-power charging station needs to be studied. The electric bus introduction guidelines of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan recommend the charging station be built at one of the beginning and end of the line, bus stop or nearest office for shorter distance of traveling not in service for charging. It is desired to be built in the parking lot of Quezon City Hall where the BRT line begins and ends or a nearby large commercial building. The introduction of electric buses benefits the environment and leads to raise citizens' awareness of environmental protection and sustainability.

（2） Introduction of Electric Buses and Solar-Power Charging Stations in Municipalities in Japan

In Japan, the MLIT launched a program to provide financial assistance for one-third of the cost to introduce electric vehicles (bus, taxi and truck), fuel cell trucks and excellent hybrid vehicles and 25 % to 50 % of charging facilities in FY2011 from the subsidy for comprehensive improvement of automobile environment (project to promote next-generation automobiles for green local transport). In this fiscal year, the green growth strategy for carbon neutrality 2050 sets the target ratio of electric vehicles in new automobile sales: as for vehicles for business use, small new cars being 20 to 30 % in 2030 and electric vehicles and decarbonized fuel vehicles being 100 % by 2040. Table 4-2 provides an overview of introduction of electric buses in Japan.

Osaka City will also implement the "Zero-carbon Promotion Project for Bus Service Providers on the Occasion of the World Expo 2025" as a FY2022 project, jointly with Osaka Prefecture, to subsidize the cost of introducing EV and fuel cell (FC) buses to public transportation (bus) operators that provide access to the Expo site.

Table 4-2 Overview of Introduction of Electric Buses in Japan

No.	Region	Year	Company	Vehicle/Manufacturer	Overview
1	Hamura City, Tokyo	2011	Nishi Tokyo Bus Company	Hino Pon'cho EX/ Hino Motors, Ltd.	"AZEMS project" in Hamura City is realizing zero-emission system through the installation of electric buses and solar power charging stations.
2	Miyako City, Iwate	2012	Northern Iwate Transportation Inc.	Hino Rainbow（remodel）/ Flat Field Co., Ltd.	EV was introduced as a symbol of the Great East Japan Earthquake as well as to reduce the burden of tourists to the restricted area for the purpose of nature conservation..
3	Kesennuma City, Miyagi	2013	East Japan Railway Company	Isuzu ERGAmio（remodel）/ Tokyo R&D Co., Ltd.	The BRT (Bus Rapid Transit) system, which was adopted for early recovery from the Great East Japan Earthquake, was introduced to reduce environmental impact and create tourism demand.
4	Ise City, Mie	2013	Mie Kotsu Co.,Ltd	Isuzu ERGA（remodel）/ Flat Field Co., Ltd	Ise City Council for the Creation of a Low Carbon Society Using Electric Vehicles, etc., which was established to coincide with the Shikinen Sengu Ceremony at Ise Jingu Shrine, introduced EV for reducing CO2 emissions and promotion of tourism.
5	Kitakyusyu City, Fukuoka	2013	City of Kitakyushu Bureau of Transportation	Korea Fiber HFG（remodel）/ Mitsubishi Heavy Industries, Ltd.	"zero-emission transportation system" combining solar power generation and electric buses was established to achieve zero-emission of electric buses.
6	Kyoto City, Kyoto	2015	Princessline inc.	Large EV bus K9/ BYD Company Ltd.	Five electric buses were put into operation between Kyoto Station Hachijo Exit and Kyoto Women's University.
7	Minato Ward, Tokyo	2017	Fujiexpress Co.,Ltd.	Hino Pon'cho（remodel）/ Flat Field Co., Ltd.	The ultra-fast charger that can charge the battery to over 80% of its capacity in 10 minutes was installed.
8	Fukusima	2019	Aizu Bus Co.,Ltd.	Middle EV bus K7/ BYD Company Ltd.	All three shuttle buses in Oze National Park were switched to electric buses. This was the first time in Fukushima Prefecture that electric buses were introduced to general routes.
9	Yamanashi	2020	Fuji Kyuko Co., Ltd.	Large EV bus K9/ BYD Company Ltd.	Three electric buses were introduced in the Fujigoko (Fuji Five Lakes) area for the first time kind in Yamanashi Prefecture,
10	Taito Ward, Tokyo	2020	Tokyo Metropolitan Bureau of Transportation	Small EV bus J6/ BYD Company Ltd.	The natural gas vehicles was in operation in place of the monorail in the Ueno Zoo, but now they introduced electric vehicles, which emit no CO2 and have a lower environmental impact.
11	Fukuoka City, Fukuoka	2021	Nishi-Nippon Railroad Co., Ltd.	Japanese large diesel bus/ RAC Electric Vehicles	The EV will be in operation during the morning and evening rush hours, and will be used as electricity source for air conditioning and lighting at the sales office during the daytime.
12	Kuki City, Saitama	2021	Kyodo Co., Ltd.	Small EV bus J6/ BYD Company Ltd.	One of the four buses currently in operation in the city has been changed to electric vehicles.
13	Chiba	2021	Heiwa Kotsu Co., Ltd.	Large EV bus K8、Small EV bus J6/BYD Company Ltd.	Two large vehicles and one small bus have been installed. Three chargers have been installed in the sales office premises so that one charger can be used for each vehicle.
14	Okuma Town, Fukushima	2021	Okuma Town, Fukushima	Small EV bus J6/ BYD Company Ltd.	As part of the town's efforts to become a zero-carbon city, electric buses were introduced to the town's circulation bus service (fares are free).
15	Kyoto City, Kyoto	2021	Keihan Bus Co.Ltd.	Small EV bus J6/ BYD Company Ltd.	All buses on the route from Kyoto Station to Keihan Railway's Shichijo Station and Umekoji was converted to electric vehicles. This is the first time in Japan that an entire route operated with multiple vehicles has been electrified.

Source: compiled based on the MLIT guidelines for electric bus introduction

However, there are few cases of solar-power charging facility and challenges for introducing it to Quezon need to be sorted out with the efforts of Kitakyushu City, etc., as reference. Recently, there have been many cases of introducing electric vehicles of a major Chinese EV manufacturer, BYD, in Japan. Whether technology advantage of Japan and its competitiveness for the introduction to Quezon can be demonstrated is also a challenge.

（3） CO2 Emissions Reduction through the Introduction of Electric Vehicles

In the third and fourth workshops, we introduced the EV development of Pues Corporation, which is an engineering company that provides various electric vehicles and EV components, including EV buses, as well as development and planning support. The company has experience in conducting the New Energy and Industrial Technology Development Organization (NEDO) Smart Community Projects, “Project to Demonstrate 10-Minute Charging of Large EV Buses (Malaysia)” and other projects. In the workshop, the points to be considered for the introduction of EV buses and the advantages of utilizing existing diesel buses were shared. We also reported that, based on the estimated annual travel distance of eight Quezon City bus routes, the annual CO2 emissions reduction is expected to be 527 tCO2 when the power source is the grid, and 1,629 tCO2 when the power source is solar power.

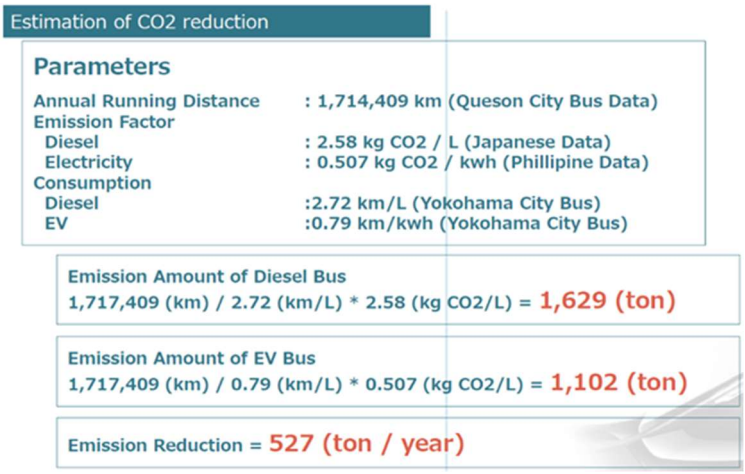


Figure 4-3 Estimated CO2 Emissions Reduction by EV buses

Source: Pues Corporation

The Quezon City bus program is operated free of charge and welcomed as a means of transportation that enables low-income earners to use, whereas the city is planning to charge fares when it replaces buses with electric vehicles. It is important to support the city in line with the clean and efficient local bus rapid transit system and government vehicles for air pollution improvement, which is the Action 12 in the Enhanced Quezon City Local Climate Change Action Plan in 1.4.3. Particularly, with regard to the development of BRT master plan, baseline studies and GHG emissions inventories and air quality monitoring plan that are interim goals to be completed in 2022 in the below table, Osaka City may be able to share its knowledge. More specifically, efforts to realize MaaS for smart city development jointly promoted by Osaka City and Osaka Prefecture in view of Expo 2025 Osaka and accompanying efforts to improve the traffic flow and air quality are useful for both Quezon and Osaka cities that are in cooperative relationship toward the decarbonized city development. The introduction of AI-assisted air quality monitoring is also planned to be studied.

Table 4-3 Milestones of Action 12 in Enhanced QC-LCCAP

MILESTONES AND INITIATIVES			
2021-2022	**2023-2025**	**2026-2030**	**2031-2050**
Develop BRT Master Plan: Links Between Growth Centers	Expand local bus rapid transit system to link growth centers	Bus modal share increased from 6.6% in 2016 to 8.5% in 2030, and railway modal share increased from 4.2% in 2016 to 6.0% in 2030	All barangays (142) declared as Green Zone Areas where only e-trikes ply
Develop Clean Vehicle Fleet Transition Plan	Implement air quality management plan (with focus on PM10 and PM2.5 as target indicators for air pollution exposure and health risks)	Additional 8 Green Zone Areas (40 barangays), 400 e-trikes, 4 solarized charging stations, covering a total of 75 barangays	All monitoring stations are capable of monitoring criteria pollutants and equipped with up-to-date technology for comprehensive monitoring
Decommissioning of unserviceable and non-compliant vehicle fleets	Skills training and knowledge transfer of OC department staff	Expansion of air quality management plan to include industrial monitoring locations	
Purchase of Euro 6 compliant vehicles: 4 buses, 10 SUVs	Additional 4 Green Zone Areas (20 barangays), 200 e-trikes, 2 solarized charging stations, covering a total of 35 barangays	Updated emissions inventories to include all air pollution sources (point, mobile, area) from all sectors	
Create Green Zone Area for E-Trikes from current one area (comprising of 5 barangays in District IV with 50 e-trikes) to three areas; solarized charging stations from three to four ; purchase of 100 e-trikes (total barangays covered 15)		Use of continuous emissions monitoring systems and/ or autonomous monitoring stations to monitor key pollutants: NO_2, SO_2, CO, PM10 and PM2.5)	
City-level baseline studies and emissions inventories			
Air Quality Monitoring Plan (combination of ambient and road side monitoring locations to target transport/mobile pollution sources)			

Source: Enhanced QC-LCCAP

Table 4-4 Priority Action of Strategy 12 in Enhanced QC-LCCAP

Priority Climate Action	Key Performance Indicators (KPIs)
Priority Action 21: Complement national mass transits with connectivity facilities	• Modal share: % of QC residents using MRT/LRT and its connected facilities • Reduction in traffic congestion • Transport plan developed and implemented to promote interconnection • Number of improved and newly built terminals in transit zones
Priority Action 22: Local bus rapid transit system	• Number of bus stops/stations • Number of bus units • Comfort and quality of BRT service (safety, reliability, frequency, crowding, availability of seats) on services/ routes used (e.g., by income groups, race/ethnicity, etc.) • Modal share: % of total population traveling within and beyond the City using bus fleets
Priority Action 23: Zero-emission government-owned buses & vehicles	• Number of EV purchases within QC vis projected vehicle purchase (annual) • Number of EV owned by the city government • Number of EV charging stations and their users
Priority Action 24: Air quality monitoring and information system	• Number of AQ sensors installed • % of relevant technical staff/personnel trained on the operation and maintenance of the AQ MIS • Number of programs/projects/policies/roadmaps supported by AQ MIS data • Number of reports produced using AQ MIS

Source: Enhanced QC-LCCAP

4.2.3 Promotion of Plastic Waste Recycling

（1） Status of Quezon City's Efforts concerning Plastic Wastes

According to the UN Environment Program[6], the Philippines is one of the countries where the marine plastic waste pollution is most serious and 280,000 t to 750,000t of plastic waste is estimated to flow from the Manila Bay coast into the ocean annually. According to a World Bank study report[7], the recycling rate of main plastics in the entire Philippines was 28% in 2019. Disposal of recyclable plastic products is equivalent to an annual loss of over 890 million USD as plastic material values. In Quezon City waste treatment, although urban waste is recycled, it is mostly land filled at the final disposal facility owned by the city. As the capacity of the final disposal facility of the city in charge of urban waste management is limited, treatment of waste that increases in line with economic development is becoming a serious issue year after year. In particular, according to a Quezon City survey in 2013, plastic waste accounted for 13.24 % of all waste. Waste of plastics used extensively in a large volume can result in a marine waste increase and deteriorate clogging of canals and drainage unless managed properly. Quezon City has already implemented various measures to reduce plastic waste. For example, it has enforced the ordinance to require all shopping malls, etc., to enable shoppers to purchase bags to replace disposable plastic bags at checkout counters (No. SP-2868, S-2019) and the ordinance to prohibit specific eateries from using disposable plastic and other materials (No. SP-2876, S-2019) Also, it has implemented a plastic waste trading program that has residents exchange recycled products with food through the Bring Your Own Bottle (BYO) project, promotion of reuse and distribution of washable bags, distribution of reusable tableware and buy-request protocol conducted by the Environmental Protection and Waste Management Department (EPWMD). In last fiscal year, in this Project, Osaka City shared information on new plastic bottle collection and recycling technology in collaboration with local business operators and we confirmed that Quezon City is very much interested in the technology of recycling plastic waste into school chairs and tables and reusing it as fuel.

（2） Japan's Advanced Efforts and Plastic Waste Recycling Technology

As the host city of G20 Osaka Summit in 2019 and Expo 2025 Osaka, Kansai, together with Osaka Prefecture, Osaka City made the Osaka Zero Plastic Waste Declaration and promotes disposable plastic reduction in collaboration with citizens and business operators.

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[6] SEA circular, UN Environment Programme
https://www.sea-circular.org/wp-content/uploads/2020/04/SEA-circular-Country-Briefing_THE-PHILIPPINES.pdf

[7] World Bank Group. 2021.Market Study for the Philippines: Plastics Circularity Opportunities and Barriers. East Asia and Pacific Region Marine Plastics Series; World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/35295 License: CC BY 3.0 IGO.

Table 4-5 Measures related to Osaka Zero Plastic Waste Declaration by Osaka Prefecture and Osaka City

Osaka Prefecture / Osaka City	Measures
Both	· Further promote reduction of use of disposable plastic and proper plastic waste disposal at prefectural government office and city hall. · Ensure that their employees reduce the use of disposable plastic and properly dispose of plastic waste. · Raise resident's awareness through environmental protection events, websites and fliers, etc. · Promote cleaning of rivers, coasts, roads and parks.
Osaka Prefecture	· Request municipalities to make a declaration and coordinate programs related to plastic waste reduction. · Request business and other relevant organizations to make a declaration. · Conduct micro-plastic survey in the Osaka Bay. · Promote 3Rs and proper disposal of plastic waste (creation of system to promote business operators to take new plastic measures).
Osaka City	· Promote a campaign to encourage the use of non-disposable bags (Osaka Eco-Bag Campaign) · Create a new plastic bottle collection and recycling system in collaboration with communities and business operators (plastic bottle circulation project participated in by all). · In collaboration with the UN Environment Programme (UNEP) and International Environmental Technology Centre (IETC), globally promote Osaka City's efforts concerning environmental protection including plastic resources circulation. · Ensure 3Rs and proper disposal in city to city collaboration for waste reduction with its sister city (Shanghai)

Source: Osaka City website

Furthermore, Osaka City formulated the plastic waste reduction goal in December 2021 to achieve the below goals by FY2025.

i. Reduce one-way plastics (container and packaging, etc.) by 25% (from FY2005).
ii. Recycle 60% of container and packaging plastic waste into resources.
iii. Recycle 100% of plastic bottles into resources.
iv. While continuing to promote remaining plastic waste to be reduced and recycled, effectively use 100% of plastic waste including heat recovery.

(Note) Percentage is ratio by weight.

Thinking that Osaka City can share information on its specific plastic waste reduction measures with Quezon City which expressed interest in them as mentioned above, it

introduced plastic waste recycling particularly in Japan in the third year of the Project. Below information was shared in the third workshop.

- In Japan, plastic waste collected as resources is recycled in three ways of material, chemical and thermal recycling.
- A new recycling method was developed as a result of technology development and it has been used.

  E.g.: Make plastic waste into chairs, etc.

  Refuse derived paper and plastics densified Fuel (RPF)

As Quezon City showed much interest intheCO2 emissions reduction effect of plastic waste reuse, in the fourth workshop, we introduced the case of making plastic containers and packaging into products resulting in CO2 emissions reduction of 1.8 million/t in FY2020.

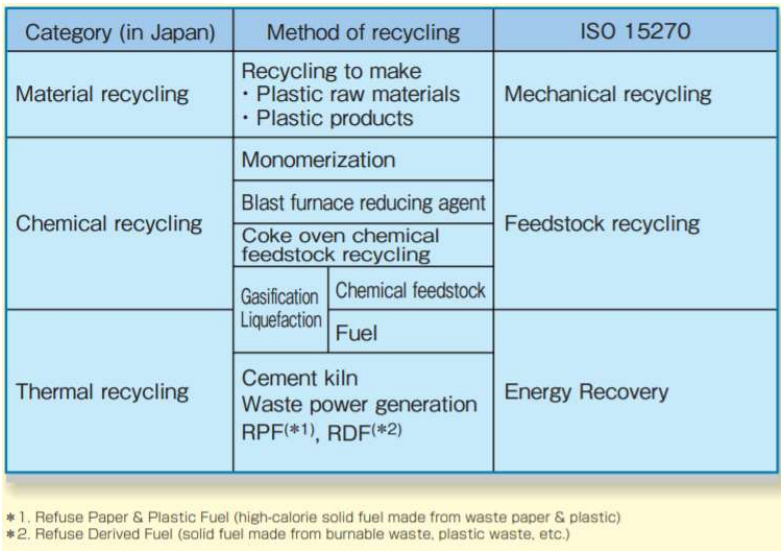

Figure 4-4 Plastic Recycling Methods and Outcomes

Source: Plastic Waste Management Institute

（3） Potential of Plastic Waste Reduction as City to City Collaboration Project

In Quezon City Enhanced QC-LCCAP, Strategy 4, prioritizing organic, paper and plastic waste toward a circular economy, states plastic waste reduction and it aims to shift from use and landfilling of disposable plastics as a priority action.

In cooperation with Hitachi Zosen Corporation, Quezon City has conducted survey to introduce waste power generation in the Recycling Industry Overseas Development Promotion Projects (waste power generation projects) sponsored by the Ministry of the Environment of Japan. Currently, it plans to implement a PPP project to construct a 36MW waste power generation plant to treat up to 3,000t of urban waste daily. The project implementing entity is Quezon City, and proposing entity is a consortium of Metro Pacific

Investments Corporation, Covanta Energy LLC and Macquarie Capital Limited. It is in the approval process and the construction and operation are slated to begin around 2023 and 2024, respectively. Osaka City expressed its intention to support Hitachi Zosen Corp. that participated in Team Osaka Network in the MOU it renewed with Quezon City. It believes that it can be promoted as a city to city collaboration project for developing a decarbonized society.

In paste experiences in Japan, it has been confirmed, as an example, that CO2 emissions from waste power generation conducted by municipalities that collect unsorted container and packaging plastic is approx. 1.92 t per ton of plastic, whereas that emitted from recycled plastics is approx. 0.45 t, resulting in CO2 emissions reduction of 1.47 t, according to the Tokyo Metropolitan Government, and therefore, the reduction effort can be implemented as a specific JCM model project.

Table 4-6 Milestones of Strategy 4 in Enhanced QC-LCCAP

MILESTONES AND INITIATIVES			
2021-2022	**2023-2025**	**2026-2030**	**2031-2050**
Undertake waste baseline survey and database updating, including the waste analysis and characterization for organic, paper and plastic waste	Scale up the construction and operation of materials recovery facilities with 100% coverage and compliance among barangays	Develop financing scheme to construct upgraded design of wastewater management and facilities	Construct upgraded design of wastewater management and facilities for all city-owned buildings
Adopt city-wide composting program and construct pilot anaerobic biodigester plants in strategic locations: up to six biodigester facilities for markets and urban farming communities	Implement the action plan for the Green Procurement Plan	Construct upgraded design of wastewater management and facilities for at least 50% of city-owned buildings	All socialized housing have proper drainage, sewage and water collection facilities
Develop communications plan to educate on recycling of organic, paper and plastic waste	Revisit plastic waste reduction ordinance		
Construction of Sewerage Treatment Plant (STP) within the Quezon City Hall Compound in compliance with the requirements of national agencies such as the Laguna Lake Development Authority (LLDA) and the Department of Environment and Natural Resources (DENR)	Expand the construction of anaerobic biodigester plants to more markets and areas with high household segregation		
Ensure socialized housing plans meet proper drainage, sewage and water collection facilities	Forge partnership between the barangay, food establishments, and public markets to ensure supply of quality organic waste and other feedstock		
	Undertake assessment of level of wastewater treatment systems in city-owned buildings		
	Institutionalize monitoring on compliance of wastewater effluent and water quality in rivers and waterways		
	Develop strategies to retrofit, upgrade and construct wastewater management facilities that are climate change and disaster resilient		
	Work with youth groups in studying and incubating initiatives around upcycling, organic waste management, and wastewater recovery, such as eco-friendly poop bricks, duckweed phytoremediation, household wastewater recovery, water filtration, and biofertilizers, which are youth solutions developed from WWF's Our City 2030 project		

Source: Enhanced QC-LCCAP

Table 4-7　Priority Action of Strategy 4 in Enhanced QC-LCCAP

Priority Climate Action	Key Performance Indicators (KPIs)
Priority Action 3: Nature-based solutions such as drainage basins and flood water storage tank	• Reduced exposure to flooding (displaced, injured or deaths, number of A&E admissions from injuries) • Reduced vulnerability to flooding (injured or deaths; the number of assets affected/damaged; the cost of repairs; cost to services; cost to economic productivity • % of assets protected from floods • Number of flood shelters for informal settlements
Priority Action 4: Organic waste resource circulation	• % of the city's solid waste that is biologically treated and used as compost or biogas • % of the city's solid waste that is diverted from disposal • % of organics treated/diverted • Tonnes of organic waste collected and converted into other uses (e.g., compost, biogas fuel)
Priority Action 5: Waste avoidance through the Green Procurement Plan and Single Use Plastic Ban	• Tonnes of plastic waste avoided per capita and diverted from the landfill • Socio-economic benefits of recycling plastic waste: employment (# jobs)

Source: Enhanced QC-LCCAP

4.2.4 San Juan River Water Quality and Environmental Improvement

（1） Current Status of San Juan River

The San Juan River that runs from Quezon City to San Juan, Mandaluyong and Manila is regarded as the most polluted water channel in metropolitan Manila. In August 2019, the DENR concluded a memorandum of agreement (MOA) to formulate and implement a San Juan River Recovery Plan with a local conglomerate, Aboitiz Group. The MOA aims to reduce the pollution level of the San Juan River that runs into the Manila Bay through collaboration with relevant municipalities, dredging and cleaning and regular monitoring.

Figure 4-5　San Juan River Basin

Source: San Juan City Environment and Natural Resource Office

Figure 4-6　Waste Collection Work in San Juan River (June 2021)

Source: Reuters

（2） Efforts in Osaka City

In the G20 Osaka Summit, Osaka Blue Ocean Vision that aims to prevent additional pollution by marine plastic litters by 2050 was shared and a joint action plan of Osaka Prefecture and Osaka City was formulated in March 2021. As a concrete plan, it aims to achieve the below goals in 10 years from FY2021 to FY2030.

i. Reduce the amount of plastic litters that flow into the Osaka Bay by 50% by FY2030 (Osaka prefecture and city).

ii. Achieve and maintain 100% of the national river and ocean water quality environmental standards and improve citizens' satisfaction rate with water environment to 40% (Osaka City).

As part of the plan, conservation and creation of comfortable waterfront space is promoted and thus information on the development project along the Dotonbori River was shared in the first workshop.

Because of the revetment as a flood control measure and water pollution, the Dotonbori River was distant from Osaka city downtown and the below three measures were taken to recover the water city of Osaka, which is an Osaka City development goal.

i. Construction of the Tombori River Walk path

ii. Construction of the floodgate of the Dotonbori and Higashi-Yokobori rivers to prevent flood damage and clean up the rivers

iii. Creation of space where people gather and relax by developing waterfront zone integrated with large-scale development projects (Minatomachi River Place, etc.)

Figure 4-7　Before and After Construction of Tombori River Walk

Source: Osaka City website

The Strategy 3 in the Enhanced QC-LCCAP, prevention of water damage and promotion of green and grey infrastructure to support water circulation mainly focuses on flood control measures. As disaster prevention and attractive city development is at the basis of decarbonized city development and rivers are important space in urban development, we intend to continue to share information and exchange views with Quezon City.

Table 4-8 Milestones of Strategy 3 in Enhanced QC-LCCAP

MILESTONES AND INITIATIVES			
2021-2022	**2023-2025**	**2026-2030**	**2031-2050**
Develop the City Draining Master Plan, incorporating nature-based solutions to flooding such as drainage basins (retention ponds) and flood water storage tanks	Implement infrastructure needs for flood mitigation measures	Regulation of floodplain areas	Long-term milestones and initiatives to be defined upon completion of the City Drainage Master Plan
Strengthen flood mitigation measures along with forecasting and pre-disaster risk assessments	Design early warning protocols informed by flood forecasting and pre-disaster risk assessments		
	Adopt policy making flood mitigation study and climate risk assessment as mandatory requirements for new buildings		

Source: Enhanced QC-LCCAP

4.2.5 Follow-up on the Introduction of Organic Waste Treatment Device

（1） Background

In the Philippines, waste management is governed by the Republic Act 9003-Ecological Solid Waste Management Act 2000 which was enacted in 2000. LGUs manage and dispose of solid waste. The daily amount of waste generated in Quezon City is 6,051 m3, of which approximately 54% is organic waste. In addition, 19% of Quezon City's overall GHG emissions in 2016 were derived from waste. Within the waste sector, 69% of emissions came from landfill disposal and open dumping of organic waste such as food waste. Quezon City is considering the small-scale introduction of organic waste treatment devices at two of the markets as a pilot project. Therefore, a method to compost with aerobic treatment technology of a Japanese company that already has a track record in the Philippines (Davao) was proposed as an alternative policy.

（2） Status of Introduction of Organic Waste Treatment Devices

We conducted a follow-up survey in this fiscal year and found out that competing bids for four treatment units for the budget of 800,000 PHP (approx. 1.8 million JPY) were sought (Figure 4-8) and the device in the below photographs were introduced to urban farms.

ITEM & DESCRIPTION	UNIT OF ISSUE	QTY.
BIODIGESTER SYSTEM - 1,000 liters IBC Water Tank Drum with capacity to digest 25 kilos of biodegradable wastes per day. - Capable to produce 1 to 2 hours of cooking gas; - Complete package with gas stove and safety gadgets: - 1 horse power shredder with capacity of 50 kilos of waste per hour - Gasoline or electric - inclusive of set-up and installation, and training	unit	4

Figure 4-8　Specifications in Bid Notice

Source: Quezon City

Figure 4-9　Introduced Treatment Device

Source: Quezon City

Due to the budget gap, the technology of a Japanese company we introduced was not chosen. However, there are a variety of approaches of reduction and effective use of organic waste. The Japanese company was adopted to conduct the “Project for Exporting Infrastructure Systems,” under the scheme of Japan External Trade Organization (JETRO) and is expected to explore their business possibility in the region and invite the government officials to Japan. After April 2022, if the infections of COVID-19 subside, we will be able to travel there under the JETRO scheme and study the possibility of introduction of Japanese composting technology as a project after the next fiscal year.

4.2.6 Follow-up on the Introduction of Solar Power Generation Facilities

（1） Background

The National Renewable Energy Program (NREP) has set a goal of increasing the power

supply volume of renewable energy approximately three times the volume in 2010 by the year 2030, and in the area of solar power generation, it is striving to add 284MW of capacity with an ambitious power generation capacity goal of 1,528MW. There is a large advantage of the ability to reduce electricity charges by installing self-consumption type solar power generation units on the roofs of schools in the Philippines since the power rates are high in the country. Quezon City is also promoting the expansion of solar power generation facilities in public facilities to achieve the national target.

The feasibility study (FS) for the introduction of solar power generation facilities at public schools in the city was performed by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH with the support of C40 Cities Finance Facility (CFF).

Figure 4-10 Schools with Solar Power Generation Facilities

Source: CFF

A total of 50 schools in Quezon City are the survey target of the FS, which consist of eight schools in each of the six Congressional Districts (I-VI) and two special support schools. It is anticipated that the introduction of a maximum of 5MW of solar power generation facilities (100 kW x 50 schools) will achieve an annual reduction in emissions of 1,966 tCO2. Furthermore, the goal of Quezon City is to expand funds available for the purchase of educational materials, facility improvement and the capacity building of teachers by reducing the energy cost paid to the electricity company. The recovery of investment and approximate reduction in CO2 emissions estimated last year are described in the table below.

Table 4-9 Estimated Years of Investment Recovery and CO2 Emissions Reduction

Power Generating Capacity	100 kW
Annual Power Generation	139.9 MWh
Facility Investment Cost*	5,077,830 PHP
Reduction in Electric Cost by Self Generation	1,398,682 PHP
Years to Recover Investment	3.6 years

* Introduction cost for 1 kW estimated as 1,000 USD
Electric Cost = 10 PHP/kWh
USD = 107.65 JPY
PHP = 2.12 JPY

JCM Project	JCM Model Project	Eco-Lease
CO2 Emission Factor	0.507	
Useful Life Designated by Law	17 years	5 years
CO2 Emissions Reduction/Year	70.91 tCO2	
Total CO2 Emissions Reduction	1,206 tCO2	355 tCO2
Facility Investment Cost	10,765,000 JPY	
Subsidy Rate	30%	10%
Subsidy Amount	3,229,500 JPY	1,076,500 JPY
Cost Effectiveness	2,679 JPY/tCO2	3,036 JPY/tCO2

（2） Status of Study of Introduction of Rooftop Solar Power Generation Facilities to Public Schools

We continued to study the possibility of applying for a JCM model project from last fiscal year and exchanged views with GIZ that conducted FS in December and found out that, because schools are currently closed due to the COVD-19 pandemic, it is difficult to implement a PPP project and there is no progress in the study of a solar power generation project. Although it seems that they are considering a plan change to introduce to such facilities to hospitals and universities that are used even in the pandemic, no detailed information is released.

4.3 Study of Measures in COVID-19 Pandemic

4.3.1 Needs Newly Emerged in the COVID-19 Pandemic

According to Reuters, in the Philippines, as of February 5, 2022, 33,300 individuals were infected with COVID-19 per one million, which is more than Japan (25,600). Because of the spread of the infections, the city bus operation that serves as the means of transportation for commoners in the country was totally suspended temporarily, from which the need for safe public transportation service emerged. Because of the lockdown, meal takeout and delivery service users increased, which is pointed out to have led to an increase in plastic container waste. To prevent the infection from spreading, waste generated from home-care

patients and their families also needs to be handled with care. Although air conditioners are turned on all year round because the country is hot, ordinary air conditioners are not equipped with a ventilation system and thus, to let out viruses and bacteria and other harmful substances, air is ventilated by opening the windows regularly or air conditioners with a ventilation system are used if available.

4.3.2 Support for Measures to Meet Needs Emerged from the COVID-19 Pandemic

As described in 4.2.2 , Quezon City provides a city bus operation program free of charge by limiting the passenger capacity of public transportation to 50% of the actual capacity to. If the pandemic leads to the improvement of public transportation services and introduction of electric vehicles and use of solar power as their power source, decarbonized city development can be accelerated. As for the recycling and reuse of plastic waste, we shared information in 4.2.3 and are considering support as a theme after the next fiscal year. We believe that we can share Japanese measures to prevent the infections related to waste treatment continuingly to respond to the request from Quezon City. In the third workshop, we introduced air conditioners with ventilation and air purification systems and the city showed much interest.

4.4 Future Action Plan under City to City Collaboration

4.4.1 City to City Collaboration between Osaka City and Quezon City

Osaka City and Quezon City began city to city collaboration related to Recycling Industry Overseas Development Promotion Projects (waste power generation projects) sponsored by the Ministry of the Environment of Japan in FY2015 to 2016.

Osaka City expanded its relationship of cooperation with Quezon City to the climate change response field in 2017, and implemented a feasibility study for the introduction of solar power generation/energy saving facilities adopted as a “City to City Collaboration Project for Low Carbon Society.”

Herbert M. Bautista, the mayor of Quezon City, visited Osaka City on Aug. 30, 2018, and signed a Memorandum of Understanding (MOU) with Mr. Yoshifumi Yoshimura, then Osaka City Mayor, on “Developing a Low Carbon City in Cooperation between Quezon City and Osaka City.”

Figure 4-11　MOU Conclusion (August 2018)

In May 2019, Mr. Tanaka, then Vice Osaka City Mayor, visited Quezon City and participated in the second mayoral-level policy dialogue in order to further efforts to develop a low-carbon city in the two cities. Presentations were made by Quezon City, Osaka City, the Japanese private sector and the Japan International Cooperation Agency (JICA) in this order. The presentations consisted of progress in Quezon City to achieving a low carbon structure, Osaka City's support for intercity collaboration in the future and progress of the JCM project. During an exchange of opinions, discussions were held on the utilization of JCM, as well as the installation and operation system for a solar power generation facility which a Japanese company proposed to install at the former Payatas waste disposal site in Quezon City.

Figure 4-12　Second Mayoral-Level Policy Dialogue (May 2019)

Since it was impossible to visit each other due to the impact of the coronavirus pandemic in 2020, Osaka City and Quezon City had a director-level dialogue in online format on February 5, 2021. At the opening of the seminar, Director Aono of the Osaka City Environment Bureau expressed expectations for strengthening the Osaka-Quezon relationship of cooperation in order to create a decarbonized city in both cities.

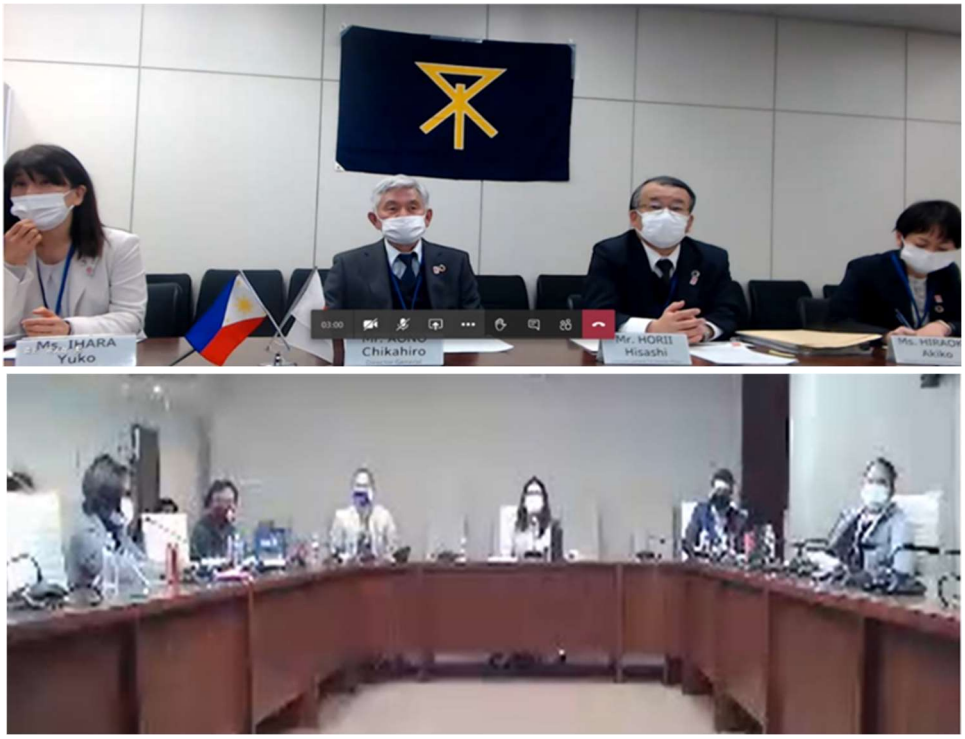

Figure 4-13　Director-Level Dialogue (February 2021)

In August 2021, Osaka City and Quezon City renewed the MOU concluded in 2018. An excerpt of the city to city collaboration is provided below. The boldface part is added to accelerate efforts from low-carbon to decarbonized city development and materialize cooperation toward the project development.

- Formulate standards and systems that contribute to low/**zero-carbon policies** in Quezon City.
- Share expertise and knowledge necessary for smooth implementation of measures, survey and evaluation related to GHG emissions toward low/**zero-carbon city development**.
- Promote public-private partnership projects in the field of climate change and environmental conservation.
- **Promote and share information on circular economy projects including effective use of renewable energies.**
- Conduct capacity development for steady implementation of low/**zero-carbon policies** of Quezon City.

The schedule of the policy dialogue in this fiscal year is being arranged to be held after mid-March 2022.

4.4.2 Workshops

（1） First Workshop

The first workshop was held as summarized in Table 4-11. Refer to Appendix 4-1 for materials used.

Table 4-10　Summary of Kickoff Meeting / First Workshop

Title	Kickoff meeting / first workshop
Date	Thu. September 16, 2021, 10:00 to 12:00 (Japan time)
Participants	· Quezon City: Ms. Andrea Valentine A. Villaroman, EPWMD Head, and others · Osaka City: Ms. Hiraoka, City to City Collaboration Section Chief, Environmental Measure Department, Environment Bureau, and others · Oriental Consultants and local partner
Style	Zoom Meeting
Contents	· Statement of the renewal of MOU and expectation for continued collaboration from Quezon City · Oriental Consultants shared 2021 project overview and workshop schedule. It also reported the reaction to submission of JCM model project application by Quezon City Hall and thanked for the cooperation. As this is the third year, it also agreed to discuss formulation of plans from the next fiscal year by the end of this fiscal year. · Quezon City shared information on project details from 2021 and mid- to long-term plan util 2050. Osaka City Government and Oriental Consultants requested for detailed information on the introduction of electric buses and LED lighting to the City Hall and installation of solar-power charging stations included in the city plan in the following workshops. · Presentation by Osaka City on the Dotonbori River environment improvement and waterfront development project and confirmation on the detail of policy dialogue schedule

Table 4-11　Agenda of Kickoff Meeting / First Workshop

Opening Remarks	
09:00-09:10	**<Opening Remarks>** ● "Opening Remarks" by Environmental Protection and Waste Management Department (EPWMD), Quezon City Government ● "Opening Remarks" by Environment Bureau, Osaka City Government
Session	
09:10-09:30 09:30-09:50 09:50-10:30 10:30-10:50	**<Presentations and Discussion>** ● Review of the 2021 project scope, expected results and timeline by Oriental Consultants ● Presentation of the approved projects and plans of EPWMD for 2021 by Quezon City Government ● Discussion on the project work details (e. g. adoption of EV buses for the city bus system, technology to reduce plastic waste, and San Juan River environmental and water quality improvement) for proposing City to City Collaboration Project (2022-2025) ● Progress report of JCM Subsidy for Installation of Energy Saving Air Conditioning System in Quezon City Hall Compound ● Presentation by Osaka City on the improvement of the river environment and confirmation on the detail of schedule for MOU and Policy Dialogue
10:50-11:00	**<Closing Remarks and Photo Session>** ● "Closing Remarks" by EPWMD and Osaka City Government ● Photo Session by zoom

Figure 4-14　First Workshop (September 2021)

（2） Second Workshop

The second workshop was held as summarized in Table 4-12. Refer to Appendix 4-2 for materials used.

Table 4-12 Summary of Second Workshop

Title	Second Workshop
Date	Fri. November 26, 2021, 10:30 to 12:00 (Japan time)
Participants	· Quezon City: Ms. Andrea Valentine A. Villaroman, EPWMD Head, and others · Osaka City: Ms. Hiraoka, City to City Collaboration Section Chief, Environmental Measure Department, Environment Bureau, and others · ENDO Lighting Corporation · Oriental Consultants and local partner
Style	Zoom Meeting
Contents	· Oriental Consultants reported progress and the project goal of the fiscal year was confirmed. Facility where air conditioners will be replaced in the facility subsidy project was discussed with Quezon City and lacking information was requested to be provided. · Quezon City explained about the city bus program and the current lighting system of the City Hall and we confirmed that it has secured the budget for the LED lighting in the next fiscal year. · Osaka City Government introduced various measures related to global warming action plan and the vision of 2050 Zero Carbon Osaka. In addition, examples of citizens' collaborative efforts to reduce plastic waste were introduced and shared through the “Osaka Special Event: International Workshop on Plastic Waste Reduction (Toward Realizing the Osaka Blue Ocean Vision),” an Osaka City-related event held in December. · ENDO Lighting Corporation introduced its experiences in introduction of lighting systems in the Philippines and LED and wireless dimmable lighting system, Smart LEDZ. Quezon City requested for a specific proposal for introduction and field survey was decided to be conducted.

Table 4-13　Agenda of Second Workshop

Opening Remarks	
9:30-9:35	**<Opening Remarks>** ● "Opening Remarks" by Environmental Protection and Waste Management Department (EPWMD), Quezon City Government ● "Opening Remarks" by Environment Bureau, Osaka City Government
Session	
9:35-9:40 9:40-10:20 10:20 -10:40 10:40-10:55	**<Presentation and Discussion>** ● Presentaiton by Oriental Consultants on the progress of of the 2021 project ● Presentation by Quezon City Government on adoption of EV buses and PV charging stations for the city bus system and the proposed LED lighting project in the City hall compound ● Presentation by Osaka City on the Osaka City Action Plan for Global Warming Countermeasures ● Presentation by ENDO Lighting Corporation on their LED lighting systems
10:55-11:00	**<Closing Remarks and Photo Session>** ● "Closing Remarks" by EPWMD and Osaka City Government ● Photo Session by zoom

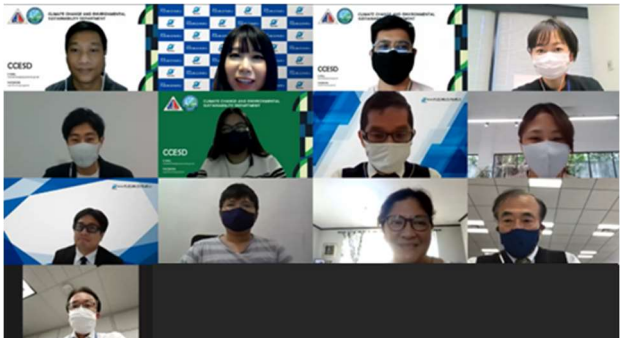

Figure 4-15　Second Workshop (November 2021)

（3） Third Workshop

The third workshop was held as summarized in Table 4-14. Refer to Appendix 4-3 for materials used.

Table 4-14 Summary of Third Workshop

Title	Third Workshop
Date	Thu. February 3, 2022, 10:00 to 12:30 (Japan time)
Participants	· Quezon City: Ms. Andrea Valentine A. Villaroman, EPWMD Head and others · Osaka City: Ms. Hiraoka, City to City Collaboration Section Chief, Environmental Measure Department, Environment Bureau, and others · Pues Corporation · Daikin Airconditioning Philippines Inc. · ENDO Lighting Corporation · Oriental Consultants and local partner
Style	Zoom Meeting
Contents	· Oriental Consultants reported on the progress of survey on AC replacement. Recycling of plastic waste into recycled furniture and fuel as well as Pues Corporation were introduced and Quezon City requested for information on its CO2 emissions reduction effect and it was decided to be provided in the following workshop. · Quezon City provided an overview of Green Building Code and Air Quality Management Initiatives and it was agreed to discuss potential cooperation from the next fiscal year in the following workshop. · Osaka City introduced Osaka Smart Energy Plan formulated in March 2021 in view of 2050 Zero Carbon Osaka. · Daikin Airconditioning Philippines Inc. provided information on high-performance energy-efficient ventilation system that has drawn attention in the pandemic as well as its energy-efficient AC system. · Endo Lighting presented a proposal on the introduction of LED lighting system and its energy-saving and CO2 emissions reduction effects based on the field survey it conducted in December. · Osaka City and Quezon City discussed the feasibility of policy dialogue and decided to arrange the schedule after mid-March.

Table 4-15　Agenda of Third Workshop

Opening Remarks	
10:00-10:05	**<Opening Remarks>** ● "Opening Remarks" by Climate Change and Environmental Sustainability Department, Quezon City Government ● "Opening Remarks" by Environment Bureau, Osaka City Government
Session	
10:05-10:25 10:25 –10:45 10:45-11:05 11:05-11:15 11:15-11:25	**<Presentation and Discussion>** ● Presentaiton by Oriental Consultants on the progress of of the 2021 project, - JCM Model Project, AC replacement in other public&private buildings, plastic waste management (plastic densifier, conversion into fuel) - Introduction of Pues Corporation (EV development) ● Presentation by Quezon City Government on Quezon City Green Building Code and Air Quality Management Initiatives ● Presentation by Osaka City on the energy plan ● Presentation by Daikin Airconditioning Philippines Inc. on energy efficient air conditioning system and high performance ventilation system ● Presentation by ENDO Lighting Corporation on potential CO2 reduction from LED
11:25-11:30	**<Closing Remarks and Photo Session>** ● "Closing Remarks" by Quezon City Government and Osaka City Government ● Photo Session by zoom

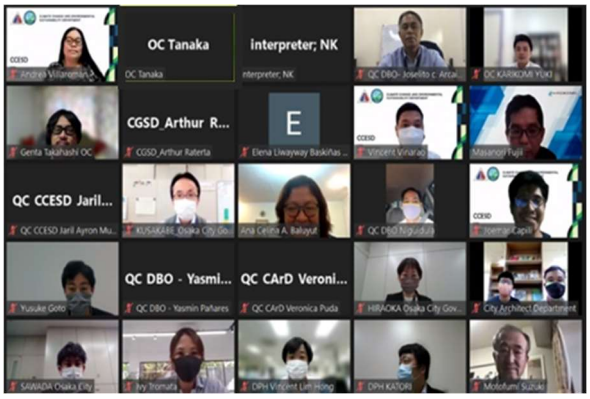

Figure 4-16　Third Workshop (February 2022)

（4） Fourth Workshop

The fourth workshop was held as summarized in Table 4-16. Refer to Appendix 4-4 for materials used.

Table 4-16　Summary of Fourth Workshop

Title	Fourth Workshop
Date	Tue. March 1, 2022, 14:00 to 15:00 (Japan time)
Participants	· Quezon City: Ms. Andrea Valentine A. Villaroman, EPWMD Head, and others · Osaka City: Ms. Hiraoka, City to City Collaboration Section Chief, Environmental Measure Department, Environment Bureau, and others · Pues Corporation · Oriental Consultants and local partner
Style	Zoom Meeting
Contents	· Oriental Consultants reported on the results of a survey on air conditioning renewal and proposed a study plan for the next fiscal year and beyond, and proposed possible themes (i) promotion of smart buildings, ii) improvement of air quality through traffic flow measures, and iii) promotion of waste plastic reduction. They also shared the effect of CO2 emissions reduction by recycling plastic waste. · A proposal by Pues Corporation to convert Quezon City buses to EVs and the estimated results of CO2 emissions reduction were reported. · Quezon City expressed a high interest in the proposed themes. Regarding the reduction of plastic waste, it was reaffirmed that consideration should be given to avoid duplication with the large-scale waste power generation project to be implemented. · We discussed the three-year plan for FY2022~2025 with Osaka City and Quezon City, and agreed to make preparations for the proposal in April and to continue to strengthen our collaboration to achieve the domino of commitment to net zero-carbon emissions and introduction of zero-carbon technologies. · The two cities discussed the contents of their presentations at the “Philippines-Japan Environmental Week” to be held on Thursday, March 3.

Table 4-17　Agenda of Fourth Workshop

Opening Remarks	
13:00-13:15	**<Introduction of Participants>** **<Opening Remarks>** ● "Opening Remarks" by Climate Change and Environmental Sustainability Department, Quezon City Government ● "Opening Remarks" by Environment Bureau, Osaka City Government
Session	
13:15-13:50	**<Presentation and Discussion>** ● Presentation by Oriental Consultants on the result of of the 2021 project and proposal for the next 3-year project plan ● Presentation by Pues Corporation on EV bus ● Q&A and Discussion
13:50-14:00	**<Closing Remarks and Photo Session>** ● "Closing Remarks" by Quezon City Government and Osaka City Government ● Photo Session by zoom

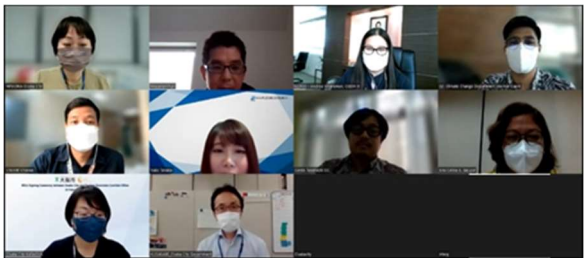

Figure 4-17　Fourth Workshop (March 2022)

4.4.3 Formulation of Plan to Continue Support for Zero-carbon City Development in Osaka City and Quezon City

（1） Overview of Study Next Fiscal Year

Based on the priority measures in Quezon City mid- to long-term plan, Enhanced QC-LCCAP, we studied our action from the next fiscal year and agreed to seek the potential of cooperation in the building sector that accounts for 60%of GHG emissions.

Table 4-18　Emissions Sources of Building Sector

Emission Source	% Share	$MtCO_2e$
Stationary Energy		
Residential Building	14.2%	1.14
Commercial and Industrial Building	30.7%	2.46
Manufacturing Industries and Construction	15.0%	1.20

Source: Enhanced QC-LCCAP

Quezon City has emphasized the improvement of Green Building code in Strategy 8, Green, Robust and Highly Efficient Buildings, in the plan, which reflects its intention to prioritize it until 2050.

Table 4-19 Milestones of Strategy 8 in Enhanced QC-LCCAP

MILESTONES AND INITIATIVES			
2021-2022	**2023-2025**	**2026-2030**	**2031-2050**
Updated QC Green Building Code with (i) expanded coverage to include residential buildings, and other projects even less than 1000 sq. m., (ii) stratification of building design and features required for Green Building Certifications suitable to the project size, typology and cost; (iii) simplification of procedures; and (iv) improved incentives/reward-award feature whether expressed or implied	80-100% building permits granted are compliant to updated Green Building Code, with incentives/tax rebates granted for green building compliant residential and commercial buildings	Incentives/tax rebates granted for green building compliant residential and commercial buildings	Review or revisit the amended QC Green Building Code by 2031, expanding the green building code to contain minimum energy efficiency requirements for existing buildings and robust incentives to install solar PV, among other features
Established monitoring and evaluation system to review the effectiveness of EE&C interventions; including Green Building Compliance, with the implementation of the Energy Efficiency Act	All households in 35 city housing projects utilize energy efficient appliances	Establish an evidence base covering most existing buildings through a building energy benchmarking program	
	Designation of Energy Conservation Officers in building construction and administration	Select an appropriate building energy labelling program for existing buildings and roll out citywide	
	In collaboration with Meralco, pursue the replacement and installation of LED streetlights that still make use of incandescent light bulb or inefficient lighting		
	Increased uptake of energy-efficient appliances and fixtures		
	Strengthened public awareness on the advantages of household-level energy efficiency measures		
	Mainstreaming energy-efficient building envelope designs, retrofits, and upgrades in residential and commercial buildings		
	Develop financing options for homeowners (new or existing homeowners) to acquire lower cost of energy efficiency improvements (i.e. purchase of energy- and cost-efficient appliances).		

Source: Enhanced QC-LCCAP

The Primer on the Green Building Program of Quezon City has been formulated based on the Green Building Ordinance of 2009, and Quezon City has been promoting energy saving. An evaluation system has been implemented with the Implementing Rules and Regulations (Part I) – Green Building Ordinance 2009 which is described in the table below, and the construction of buildings that do not comply with these regulations has not been allowed since 2011. Quezon City is currently considering revisions to heighten compliance with this ordinance, with a focus on increasing the minimum requirements for energy efficiency, while receiving C40 technology support. It is possible, based on the Quezon City's policy, to consider the introduction of specifications for decarbonized construction suitable for better aeration and materials in a country like the Philippines with high temperatures.

Table 4-20 Green Building Evaluation System

Item	Overview of Requirement
Land/Site Sustainability	Provide management plan to prevent run-off of rainwater and construction wastewater, subsidence of water channels, and air pollution by dust and particulate matter.
Energy Efficiency	Provide energy efficiency plan with high efficiency lights and suitable lighting level.
Water Efficiency	Reduce water usage with high efficiency water service facilities. Provide specifications for high efficiency devices to be installed.
Materials and Resources	Observe waste management plan for installation, operation and maintenance of waste sorting facilities after completion of construction.
Indoor Environment Quality	Observe smoking area designation rules.
Sewage Treatment Plant	Installation of wastewater treatment facilities complying with provisions made in plan, prediction and specifications and water quality management

Source: Quezon City

Although the current target buildings of the ordinance are shown in the below table, there is a plan to expand the target to include housing and various technological assistance can be provided and Osaka City's knowledge can be shared particularly concerning the improvement of energy efficiency.

Table 4-21 Target of Green Building Ordinance

Type of Building	Minimum Gross Floor Area	Type of Building	Minimum Gross Floor Area
COMMERCIAL		INSTITUTIONAL	
Hotel/Apartelles /Dormitories	2,000 sq. m.	Schools	5,000 sq. m.
Office Buildings	2,000 sq. m.	Office Buildings	5,000 sq. m.
Malls	5,000 sq. m.	Hospitals	5,000 sq. m.
Dry Markets	1,000 sq. m.	INDUSTRIAL	
Wet Markets / Slaughterhouses	All covered	Factories	All covered
		Warehouses	2,000 sq. m.

Source: Quezon City

In the Osaka Smart Energy Plan we introduced to Quezon City in the third workshop, energy consumption will become visible and AI, IoT big data and other digital technology

and nudge[8] and knowledge of other behavioral science will be utilized to work toward shifting to energy-efficient lifestyle and business style.

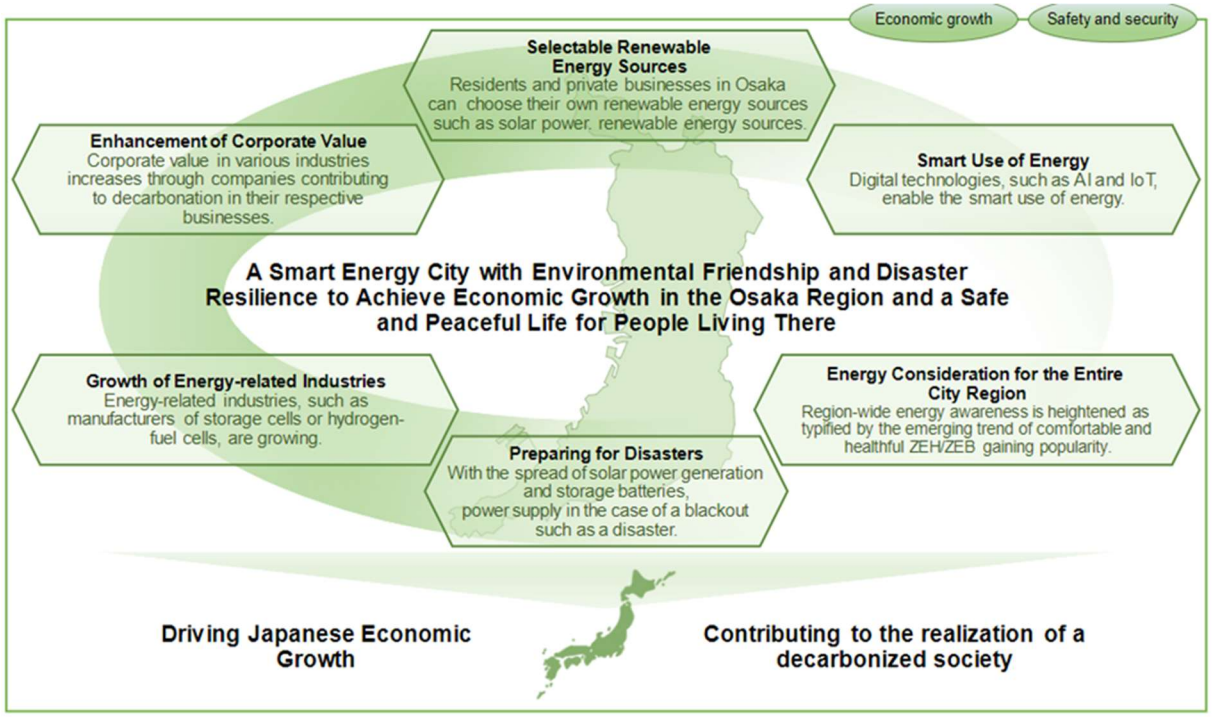

Figure 4-18　Osaka Smart Energy Plan

Source：Osaka City

Together with the measures of Osaka City, smart buildings that utilize IoT in Japan, Building Energy Management System (BEMS) and Home Energy Management System (HEMS) can be proposed to promote digitalized energy management and efficient energy use of buildings in Quezon City.

（2） Introduction of LED Lighting System to Quezon City Hall

Quezon City has already secured the budget in the next fiscal year for the introduction of LED lighting system and plans to introduce it to city-owned facilities by 2025 as part of Action 10 in the Enhanced QC-LCCAP, Energy Saving of City-Owned Buildings.

[8] Nudge, which means a gentle push, is a term defined as a suggestion to people to choose desirable behaviors voluntarily

Table 4-22 Milestones of Strategy 10 in Enhanced QC-LCCAP

MILESTONES AND INITIATIVES			
2021-2022	**2023-2025**	**2026-2030**	**2031-2050**
Updated Local Energy and Efficiency and Conservation Plan for Quezon City	Households in 35 city housing projects utilize energy efficient appliances	Medium-term milestones and initiatives to be defined during the updating of the Enhanced LCCAP by 2025	Long-term milestones and initiatives to be defined during the updating of the Enhanced LCCAP by 2025
Financing scheme developed to encourage household use of energy efficient appliances and fixtures	Integration of LED lighting fixtures in retrofitting and new construction of city-owned buildings		
Replacement of CFL Lighting Fixtures to LED lights in city-owned buildings	100% replacement and installation of LED streetlights in municipal buildings by 2023		
Replacement and installation of LED streetlights Integration of Sewage Treatment Facility in the design of public markets and hospitals	100% of municipal buildings surveyed for retrofit opportunities by 2023		
Conversion of R-22 air-conditioning units to R-410A Refrigerants (500 units) for Office Buildings			
Strengthen the local implementation of the energy efficiency programs of the Philippine Energy Efficiency Project (PEEP) such as the installation of heat-insulating upgrades (e.g., roofing materials, reflective coating, 'cool roofs'), promotion of energy-efficient building envelope designs for planned residential infrastructures, and increasing awareness on the economic advantages of energy efficiency and conservation at the household-level			

Source: Enhanced QC-LCCAP

In this fiscal year, ENDO Lighting Corporation conducted field survey in December and proposed detailed survey in the next fiscal year for its introduction. It emphasized the advantages of LED lighting being longer life than currently used fluorescent lamps and reduction and maintenance work and cost and implied the possibility of estimated annual energy saving of 292,300 kWh (approx. 135 tCO2 emissions reduction) and cost reduction of PHP 4,227,610 (approx. 9.5 million JPY) by the introduction of LED lighting.


Figure 4-19 Fluorescent Lamps Mainly Used in Quezon City Hall

Table 4-23 Comparison of Fluorescent Lamp and ENDO Lighting's LED

Type	Fluorescent lamp	LED ①	LED ②
Image			
Brand	Local	ENDO Lighting	ENDO Lighting
Model No.	-	GTM0008-65	GTM0010-65
Length	1200mm	1200mm	1200mm
Power consumption	36W	16W	21W
Lamp color	6500K	6500K	6500K
Lumen output	2700lm	2400lm	3700lm
Lamp lifespan	12000 hrs.	40000 hrs.	40000 hrs.

Computation condition

- 11 business hours per day
- 1kW=Php12
- 20 business days per month
- CO2 Emissions factor = 0.463(Kg-CO2/kWh)

	Power Consumption	Qty	Electricity Consumption (Day) (kWh)	Electricity Consumption (Year) (kWh)	Electric Bill (Year) (PHP)	CO2 Emissions (Year) (Kg-CO2)
Fluorescent Lamp	36W	5,536pcs	2,192	526,141	6,313,698	243,603
LED Tube ①	16W	5,536pcs	974	233,840	2,806,088	108,267
Reduction			1,217	292,300	4,227,610	135,336

Reduction Electricity Consumption
292,300 kWh
Saving/year

Reduction CO2 Emissions
135,336 Kg-CO2
Saving/year

Source: ENDO Lighting Corporation