MOEJ

Final Report

City to City
Collaboration for
Zero-carbon Society in FY2020

Zero Carbon Development in Quezon City
(Energy Saving Air Conditioning System
(Fluorocarbons Management Plan))

March 2021

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
EMB	Environmental Management Bureau
EPWMD	Quezon City Government - Environmental Protection & Waste Management Department
GHG	Greenhouse Gas
GIZ	GesellschaftfürInternationale Zusammenarbeit GmbH
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HPMP	HCFC phase-out management plan
NCCAP	National Climate Change Action Plan
NFSCC	National framework strategy on climate change
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
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 the implementation stage of the Paris Agreement. This agreement cites that central governments as well as local governments, cities and non-governmental organizations should accelerate measures against climate change, and states that cities and local governments are key players in order to examine/implement specific regional climate change measures and projects. In preparation for achievement of a decarbonized society throughout the world, efforts need to be made to establish a sustainable carbon society during the transition to a low carbon society with a focus on Asia that is experiencing dramatic growth, and to internationally strengthen movements to support the efforts of cities, that can support socioeconomic development, to facilitate their decarbonization/low-carbon transition activities.

Under this project, a study has been implemented in order to support efforts to create decarbonized/low-carbon societies and to introduce facilities that contribute to the formation of decarbonized/low-carbon societies in local governments overseas (Quezon City, the Philippines) jointly by research institutes, private sector companies, universities and other organizations in Japan and a city of Japan (Osaka City and Osaka Prefecture) that has accumulated experience and knowhow concerning decarbonization / formation of a low-carbon society.

1.2 Project Overview

Entrusted Project Name:	City to City Collaboration for Zero-carbon Society in FY2020 Zero Carbon Development in Quezon City (Energy Saving Air Conditioning System (Fluorocarbons Management Plan))
Implementation Period:	August 25, 2020 to March 10, 2021
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 Items

(1) Preparation of Project Plan

(2) Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning at City Hall

(a) Detailed survey for JCM facility assistance project

(b) Consideration for designation as model project

(3) Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning at Buildings Other Than City Hall

(a) Review of measures to save energy for air conditioning equipment

(b) Review of project plans / funding plans / other plans

(c) Planning / promotion of JCM project formation

(4) Review of Fluorocarbon Measures Related to Saving Energy in Air Conditioning Equipment / Sharing of Information

(5) Support for Environmental Measures in Quezon City

1.3.2 Project Flow

This project was implemented with the flow described in this section.

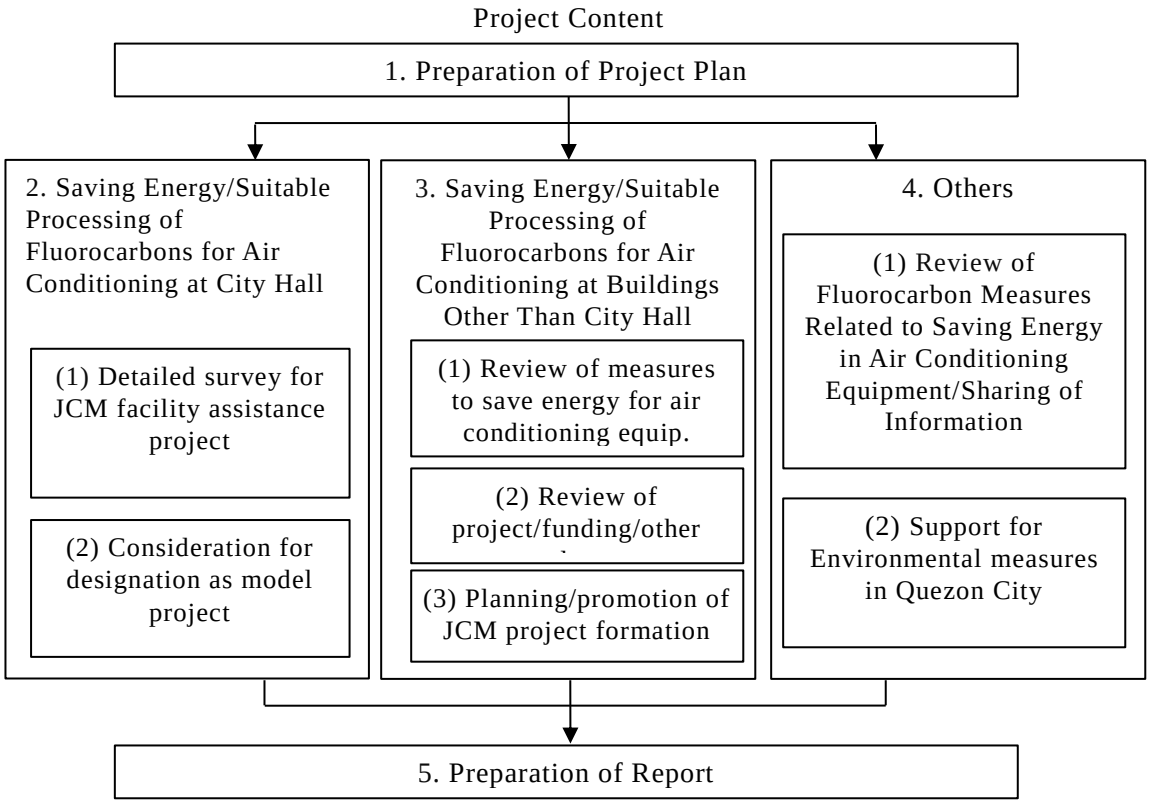


Figure 1-1 Work Flow for This Project

1.4 Project Implementation Process

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

Table 1-1 Processes for Project Implementation

Implementation Period: Aug. 25, 2020 - Mar. 10, 2021

Project Items	FY2020							
	8	9	10	11	12	1	2	3
Meetings		Kick off ▲			Mid-term report ▲		Final Report ▲	
Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning at City Hall		←	→					
Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning at Buildings Other Than City Hall		←	→					
Review of Fluorocarbon Measures Related to Saving Energy in Air Conditioning Equipment / Sharing of Information		←	→					
Support for Environmental Measures in Quezon City		←	→					
Field Survey (Remote)/Workshop		←					Policy Dialogue and Workshop ▲ ▲	
Seminar							▲	
Monthly Report			▲	▲	▲	▲	▲	
Final Report		←						→ ▲

1.5 Project Organization

The organization for this project is described in this section.

Table 1-2 Project Organization

Name	Content of Assigned Work
Masanori Fujii	• Integrated management of overall project
Motofumi Suzuki	• Negotiation with survey target country
Mai Suzuki	• Review of fluorocarbon measures related to saving energy in air conditioning equipment / Sharing of information • Support for environmental measures in Quezon City
Yuko Tanaka	• Review of fluorocarbon measures related to saving energy in air conditioning equipment / Sharing of information • Support for environmental measures in Quezon City
Takumi Kashiwakura	• Saving energy / Suitable processing of fluorocarbons for air conditioning at City Hall • Saving energy / Suitable processing of fluorocarbons for air conditioning in buildings other than City Hall
Yuji Sato	• Saving energy / Suitable processing of fluorocarbons for air conditioning at City Hall • Saving energy / Suitable processing of fluorocarbons for air conditioning in buildings other than City Hall

1.6 Background of Survey

1.6.1 Survey Background

The Philippines is deemed one of the countries that is the most vulnerable to climate change and the compound disaster risk due to typhoons, floods, droughts and landslides. The government of the Philippines formulated the National Framework Strategy on Climate Change (NFSCC) in 2010 targeting at a period until 2022, in order to build adaptation capacity to respond to climate change, prevent global warming and promote mitigation activities to facilitate sustainable development. Renewable energy and saving energy have been positioned as pillars of mitigation, and the following three cross-sectional strategies have been designated: 1) Capacity development, 2) Knowledge management, information, education and communication, and 3) Research and development (R&D) and technology transfer. Furthermore, the National Climate Change Action Plan (NCCAP) was formulated in 2011 in order to put into effect an action program based on the national strategy, indicating the necessity of strengthening sustainable energy development.

The bilateral document to start the Joint Crediting Mechanism (JCM) was signed in the presence of Prime Minister Abe and H.E. President Duterte in January 2017 under the above circumstances. The JCM will be used to quantitatively evaluate the contribution of Japan to reducing / absorbing greenhouse gas emissions, and help achieve the reduction targets of Japan. An agreement was reached in the bilateral document to establish a joint committee to operate the JCM, and that the emissions reduction and absorption volumes under the JCM can be used respectively as a portion of greenhouse gas mitigation efforts that are internationally expressed by means of mutual recognition. The first JCM joint meeting was held in February 2018, at which time facility assistance projects adopted by the Ministry of the Environment, JCM methodology and other issues were discussed, and a support structure concerning JCM promotion was established.

In addition, the Ministry of the Environment in Japan is proceeding with a “Collection / destruction project for alternative fluorocarbons using a bilateral credit system”, and is promoting the reduction of GHG emissions by recovering / destroying alternative fluorocarbons. This project will strive to record the volume of reduced emissions as the emission reduction volume by Japan through the JCM.

Quezon City in the Philippines has the largest area in metropolitan Manila, and issues such as waste, energy, transportation and urban greening are becoming more serious as the population increases. Therefore, waste management, the introduction of renewable energy, and the promotion of energy conservation have been positioned as essential measures for the city. In addition, under the initiative of the mayor of Quezon City, a climate-change-action-plan has been formulated, and projects are proceeding to introduce solar panels, LEDs and other such equipment at public facilities. Furthermore, a Green Building Ordinance has been compiled which is designed to contribute to mitigating climate change by reducing energy usage and greenhouse gas emissions. This ordinance officially announces and obligates various regulations for the rating and certification of green buildings. Quezon City has joined C40 (C40 Cities Climate Leadership Group), and is making other proactive efforts to address climate change. However, adequate

measures have not been taken due to a lack of technology required for implementation and financial issues.

Osaka City began exchange with Quezon City in the waste management field in 2015. While this relationship of cooperation between the two cities deepens, support has been provided for the formulation / implementation of the Quezon City Climate Change Action Plan and for the creation of JCM projects in coordination with Oriental Consultants as a means of effectively and efficiently supporting the above efforts and helping to create a low carbon society. In 2018, the Quezon City LCS Scenario that utilizes the Asia Pacific Integrated Assessment Model was completed, and it was announced at the Katowice Climate Change Conference (COP24). Furthermore, a Memorandum of Understanding (MOU) was concluded between Osaka City and Quezon City in 2018 concerning cooperation in preparation for achieving the formation of a low carbon city. Since the term for this MOU is August 2021 which is the 3rd year after it was signed, preparations are currently proceeding for the renewal of the MOU.

1.6.2 Survey Objective

(1) Background of Air Conditioning Equipment & Fluorocarbon Collection / Destruction and Project Objective

It has been predicted that GHG emissions due to power consumption by the refrigeration / air conditioning sector will increase to a maximum of 44.6 Mt-CO2 in the Philippines by the year 2050 due to the increasing in the number of air conditioners. It is expected that, when purchasing new or replacing old air conditioners, the introduction of inverter type air conditioners and other such equipment that conserves energy will have a large impact on reducing GHG emissions as part of global warming measures in the Philippines from now onward.

In addition, the demand for fluorocarbons used as a refrigerant in the refrigeration / air conditioning sector is increasing, and due to the fact that fluorocarbons have between several hundred times to over ten thousand times the greenhouse effect as carbon dioxide, it can be expected that a transition to air conditioning equipment that uses alternative substances with a low greenhouse effect, are safe and feature high energy efficiency, as well as promoting the suitable collection / destruction of fluorocarbons when existing air conditioning equipment is disposed will efficiently reduce greenhouse gas emissions. In particular, the suitable storage and destruction of old refrigerant (HCFC) contained in existing air conditioners is indispensable since this refrigerant cannot be reused.

There is a large volume of fluorocarbons used by existing air conditioners in Quezon City, and it is expected that leakage during operation and release into the atmosphere when air conditioners are disposed have a large adverse impact on the environment. JCM facility assistance projects will be reviewed and support will be provided again this fiscal year following the previous year in order to contribute to a reduction in greenhouse gas emissions and effective life cycle management of fluorocarbons, with the objective of achieving organized / systemic development and hence establishing a decarbonized society in Quezon City.

(2) Results of Initial Fiscal Year Survey and Issues

This survey was implemented according to the three-year project plan, and this fiscal year is the second year. An overview of the survey results of the initial fiscal year is compiled in this section.

1) Results of Energy Saving Air Conditioning Survey

In the initial fiscal year survey, the energy saving effects and introduction costs were calculated for the introduction of energy saving air conditioners in the four city hall buildings of the Quezon City Hall (ANNEX, LEGISLATIVE, CIVIC-A, CIVIC-B) for which replacement was planned to be made by 2022.

The results of the survey indicated that 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 air conditioning reference emissions was 649 t-CO2, and the project emissions was 542 t-CO2, resulting in an expected reduction in emissions of 107 t-CO2. In addition, when the waste fluorocarbons resulting from updating of the air conditioners have been recovered / destroyed, the reference emissions is 4,120 t-CO2, and the project emissions would be 431 t-CO2, resulting in an estimate of an expected reduction in emissions of 3,689 t-CO2.

2) Results of Fluorocarbon Collection / Destruction Survey

A basic survey on the legal framework and structure concerning the distribution and management of fluorocarbons in the Philippines was conducted by means of interviews of related organizations and companies. The survey made it clear that while there are regulations on the import and export of fluorocarbons (CFC, HCFC), there are not any regulations concerning alternative fluorocarbons (HFC), nor are there any regulations concerning the collection / recovery / destruction of fluorocarbons.

3) Results of Capacity Building Support

In order to provide support for capacity building of Quezon City, the guidelines for the promotion of JCM projects were improved and expanded / shared, knowledge of Osaka City was shared at city-to-city collaboration seminars, and the status of efforts was confirmed / shared at workshops. Presentation concerning the management of fluorocarbons and role of local governments in Japan was made by Osaka City, and the attendees from Quezon City voiced strong interest in the fluorocarbon management system in Japan.

4) Issues for Ongoing Consideration

During this fiscal year, the results of the survey on the air conditioning at the four city hall buildings described above will be examined based on an agreement with Quezon City, and it will be necessary to have a packaged model project scheme that incorporates the plan for the introduction of energy saving air conditioners and suitable processing of fluorocarbons. In addition, the possibility of expanding the survey target to places other than city hall buildings should be considered to enable further evolution of the project. Furthermore, for the next fiscal year, the goal

has been established of expanding the survey project concerning energy saving air conditioners and the processing of fluorocarbons by means of implementing JCM facility projects and through cooperation with metropolitan Manila and other cities.

Requests have been made by Quezon City for the ongoing sharing of information on experience and policies related to the transition to energy saving air conditioners and the collection / destruction of fluorocarbons in Japan and Osaka City, as well as other environmental policies being implemented by Quezon City. Plans call for the "Memorandum of Understanding on Developing a Low-Carbon City in Cooperation between Osaka City and Quezon City" to be renewed by Quezon City and Osaka City in August 2021, and it is expected that the relationship of cooperation will be strengthened.

1.6.3 Survey Content

The survey described below was implemented this fiscal year in consideration of the results of the previous fiscal year and the survey plan for the next fiscal year.

(1) Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning at City Hall

1) Detailed Survey for JCM Facility Assistance Project

Detailed confirmation of the individual air conditioning equipment (type of fluorocarbon for each unit, amount of fluorocarbon, etc.) for the four city hall buildings for which a survey was conducted in the initial year, rough estimation of the replacement costs, calculation of the air conditioning energy saving effects and other work was implemented in consideration of application as a JCM facility assistance project.

2) Consideration of Formulation as Model Project

The scheme for the creation of a model project that packaged replacement of air conditioning equipment and suitable processing of fluorocarbons for the four city hall buildings for which the survey was conducted in the initial year was considered.

(2) Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning in Buildings Other Than City Hall

1) Consideration of Transition to Energy Saving Air Conditioners

A survey was conducted on the energy saving effects, required costs and reduction in greenhouse gas emissions at schools, hospitals and public facilities other than city hall, as well as at shopping malls, hotels and other private sector facilities. Estimates on the energy saving and other effects at public facilities were made based on inventory and other materials to be provided by Quezon City, and estimates on the energy saving and other effects at private sector facilities were made based on the materials and other information extracted / provided concerning shopping malls, hotels and other such establishments.

2) Consideration of Project Planning / Funding Planning / Other Planning

The project structure, draft project plan and funding plan for the introduction of air conditioners were considered based on the information/data collected and interviews of domestic

and companies involved in this region.

3) Planning / Promotion of JCM Project Formulation

A JCM project formulation plan was promoted together with cooperating companies who may possibly apply for facility assistance and interested stakeholders based on an overview of the energy saving air conditioning project and JCM project promotion guide which describes the GHG reduction calculations and other figures.

(3) Consideration / Sharing of Information on Fluorocarbon Measures to be Provided by Energy Saving Air Conditioning

Due to the fact that replacement of air conditioning equipment involves measures for fluorocarbons, a survey was conducted on the status of fluorocarbons also in this survey as in the previous fiscal year. Policies concerning the collection/recovery/destruction of fluorocarbons were considered from the standpoint of an administrative organization and taking into account advice from Osaka City, and efforts were made to share this information with Quezon City. The link with the Philippines Ozone Desk (POD) which is the administrative organization in the Philippines responsible for dealing with fluorocarbons was strengthened through cooperation between Quezon City and Osaka City. Furthermore, the knowledge, experience, legal system and other information possessed by Osaka City and Japan on fluorocarbon processing were shared with Quezon City.

(4) Support for Environmental Policies of Quezon City

Seminars and other events concerning environmental policies being considered by Quezon City were held in order to share information on the knowledge, experience, legal system and other information possessed by Osaka City and Japan, and provide support for policy formulation. The formulation of projects which can be achieved was considered by making efforts to facilitate matching of mutual needs with companies in Japan interested in this field.

1.6.4 Implementation Structure Overview

Oriental Consultants Co., Ltd. became the representative sponsor for this project, and the project proceeded in cooperation with Osaka City as the cosponsor, in cooperation with the Quezon City Government - Environmental Protection & Waste Management Department (EPWMD), the counterpart.

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

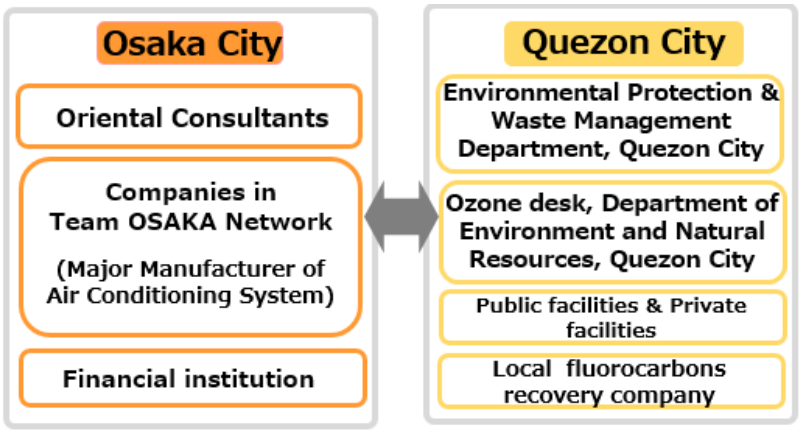


Figure 1-2 Survey Structure

Table 1-3 Role of Work Implementer

Role	Work Implementer	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 survey results, other such issues.
Air conditioning system / fluorocarbon measures, etc.	Team OSAKA Network	Reviews cooperation with air conditioning manufacturers in Team OSAKA Network. Provides technical advice on the introduction of fluorocarbon measures/air conditioning systems.
Fluorocarbon collection/recovery/ destruction	Fluorocarbon related companies / Fluorocarbon processing machine manufacturers, etc.	Companies working for fluorocarbon collection/recovery/destruction. Provides technical advice on introduction of related equipment.
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.

1.6.5 Team OSAKA Network

The Team OSAKA Network is a platform that links industry, academia and government, including companies that possess environmental technology in Osaka and the Kansai Region, Osaka City, the Global Environment Centre (GEC), universities and other organizations, aiming at creating and formulating projects for establishing a low-carbon society in Asian and other cities. The objective of this network is to help companies start operations overseas and revitalize the economy of Osaka and the Kansai Region through its activities, and contribute to the role of Japan in the international environmental field.

1.6.6 Holding of Preparatory Meetings, Workshops and Other Meetings

The plan called for field surveys, but local information was collected and other activities were performed in cooperation with our local partner due to the fact that we could not travel to the site as a result of the coronavirus pandemic. Consultation, workshops and other meetings with the project site were implemented online.

Table 1-4 Activity Content in This Project

No.	Date	Place	Overview
1	2020/9/16	MOE	• Kickoff meeting with Ministry of the Environment
2	2020/10/6	WEB	• Meeting with Quezon City (information requested)
3	2020/11/6	WEB	• Meeting with Quezon City (waste disposal operations)
4	2020/11/20	Osaka City	• Meeting with Osaka City (intermediate report)
5	2020/11/26	WEB	• Meeting with Quezon City (air conditioning replacement)
6	2020/12/2	WEB	• Meeting with Quezon City (air conditioning replacement)
7	2020/12/24	MOE	• Intermediate report to Ministry of the Environment
8	2021/1/21	WEB	• Meeting with Land Bank (air conditioning replacement)
9	2021/2/1	WEB	• Introduction of this project at city-to-city collaboration seminar
10	2021/2/5	WEB	• Discussion of policies at manager level between Quezon City and Osaka City
11	2021/2/19	WEB	• Workshop on city-to-city collaboration between Quezon City and Osaka City
12	2021/2/26	MOE	• Result report to Ministry of the Environment

1.7 Basic Information on Quezon City

Metropolitan Manila is comprised of 16 cities and 1 town, including Manila and the former capital of Quezon, and is the center of politics, economy, culture, transportation and information in the Philippines. It has an urban area population of 22.93 million people (2016), making it the 5th largest city in the world. 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. Therefore, waste management, introduction of renewable energy and promotion of energy conservation are positioned as essential measures for the city. Quezon City is implementing proactive efforts for projects in the environmental field, and received the Galing Pook Award in 2008 for its recycling operations at the Payatas Controlled Disposal Facility Project (award for excellent operations by local governments in the Philippines). The project was the first of its kind in the waste disposal field in South Asia to reduce greenhouse gases (GHG). In 2009, the same award was given for the management of the largest park in the Philippines. In addition, as it has joined C40 (C40 Cities Climate Leadership Group), Quezon City is making proactive efforts to address climate change.

Figure 1-3 Location of Quezon City

1.7.1 Efforts towards Climate Change Issues in Quezon City

(1) Quezon City Local Climate Change Action Plan (QC-LCCAP)

Quezon City has prepared the Quezon City Local Climate Change Action Plan for 2017 - 2027, and has selected the following seven priority fields based on the National Climate Change Action Plan. An overview is described below.

Table 1-5 Overview of Quezon City Local Climate Change Action Plan

Impact/Event due to Climate Change	Measure for Climate Change	Objective/Purpose
• More frequent and severe abnormal weather (typhoons, high tide, floods, torrential rain) • Change in rainfall patterns • Rise in temperatures	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

Quezon City is proceeding with the projects described below as detailed action items based on the above plan. It is hoped that projects that mitigate climate change will be promoted in a manner that matches the QC-LCCAP.

(1) Biogas power generation at waste disposal sites
(2) Introduction of solar power generation at public facilities
(3) Introduction of LEDs for street lights
(4) Introduction of electric vehicles by Quezon City Hall
(5) Promotion of energy saving businesses in industrial sector
(6) Promotion of solid waste management business

(2) Four Actions towards Low Carbon Society in Quezon City

Quezon City has made the following four action plans to achieve CO2 emissions reduction in order to realize a low carbon society by 2030: 1) Green energy, 2) Sustainable economy, 3) Environmentally friendly smart lifestyle, and 4) Clean and smart transportation.

1) Green energy: Install pilot solar power generation units at 50 public schools
2) Sustainable economy: Exhaust heat recovery at factories
3) Environmentally friendly smart lifestyle: LED lights, solar water heaters
4) Clean and smart transportation: Promote popularization of fuel efficient vehicles and electric vehicles

(3) C40 Efforts in Quezon City

Quezon City is an environmentally advanced city, and is the only city in the Philippines that has joined C40 (C40 Cities Climate Leadership Group). The C40 group has formulated a priority climate change mitigation action plan in the four fields of energy, buildings, transportation and waste.

Table 1-6 Priority Fields for Quezon City Climate Change Mitigation Action

Energy	Secure clean renewable energy at a reasonable price for all people. 1. Install solar power generation at all city owned buildings and facilities by 2030 2. Provide incentive for introducing mid to large scale renewable energy program in the sectors and facilities that consumes a large volume of energy
Buildings	Green resilient buildings that have high energy efficiency 1. Amend and enact green building code for the city, and strengthen the performance requirements for the energy efficiency of new and existing buildings in the commercial and manufacturing sectors 2. Implement energy efficiency measures in housing sector and at household level

	3. Reduce disaster risk in construction methods by establishing guidelines and standards for design and development
Transportation	Develop transportation infrastructure that provides comprehensive interconnection to facilitate mobility and mass transit of all people 1. Develop bicycle network and foot walks that are comprehensive, climate friendly, fair and can be conveniently accessed 2. Develop integrated local bus high-speed transport system that is accessible, reliable and reasonably priced 3. Improve air quality with zero emission government owned buses and vehicles, and develop atmosphere monitoring system 4. Support expansion of mass transit railway system led by country with integrated transport connection complexes
Waste	Strive to achieve zero landfill through waste resource recovery strategy and reduction in wastewater volume 1. Strengthen strategy to collect, divide and reduce solid waste in entire city 2. Improve resource circulation of organic waste with anaerobic treatment facilities and resource recovery facilities in all 142 areas 3. Reduce waste at source it is generated (green procurement plans, prohibit disposable plastic) 4. Support waste circulation model 5. Enhance functions of wastewater treatment systems and facilities to improve quality of wastewater and reduce wastewater volume

1.7.2 Local Government Organizations Related to This Survey

(1) Quezon City Government – Environmental Protection and Waste Management Department (EPWMD)

The Quezon City Government's Environmental Protection and Waste Management Department was established in 2000, and has jurisdiction over the formulation of a comprehensive environmental protection program that includes improving the hygienic environment, preventing environmental pollution, and services for the efficient transport and collection of waste. The planning division in EPWMD is responsible for determining the GHG inventory in Quezon City, and has received support for GHG inventory capacity building under the "Climate Change / Clean Energy Project" of USAID. It is also proceeding with a project to introduce solar power generation at public schools with the cooperation of the German Corporation for International Cooperation GmbH (GIZ). In this project, the EPWMD is the Philippine side counterpart which is receiving support for climate change policies and support for the formulation of projects in the climate change mitigation field.

(2) Philippine Ozone Desk (POD)

The POD is the section that has jurisdiction in the Environment Management Bureau (EMB) under the Department of Environment and Natural Resources (DENC) in the Philippines, and was established in May 1993 to facilitate measures to protect the ozone layer and efforts to reduce GHG emissions in order to implement the "Ozone depleting substance (ODS) phase-out projects under the Montreal Protocol". The plan to reduce CFC and HCFC fluorocarbons was started in accordance with the decisions made in the Montreal Protocol, and the POD is in charge of the management of ODS (Ozone Depleting Substances) and the formulation of policies.

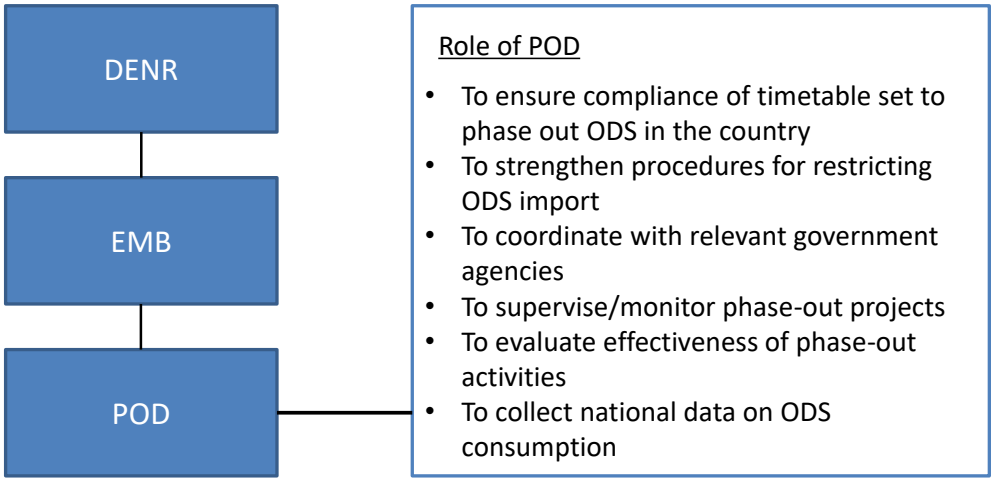


Figure 1-4 Fluorocarbon Related Government Organizations

Source: DENR Administrative Order No. 2003-43

Chapter 2　Energy Saving Air Conditioning / Suitable Fluorocarbon Processing for City Hall

2.1 Detailed Survey for JCM Facility Assistance Project

2.1.1 Overview of Survey Results of Previous Fiscal Year

(1) Survey Target Facility

In the previous fiscal year survey, the Quezon City Hall Compound was selected from the standpoint of having the city become a regional model, and the four city hall 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.

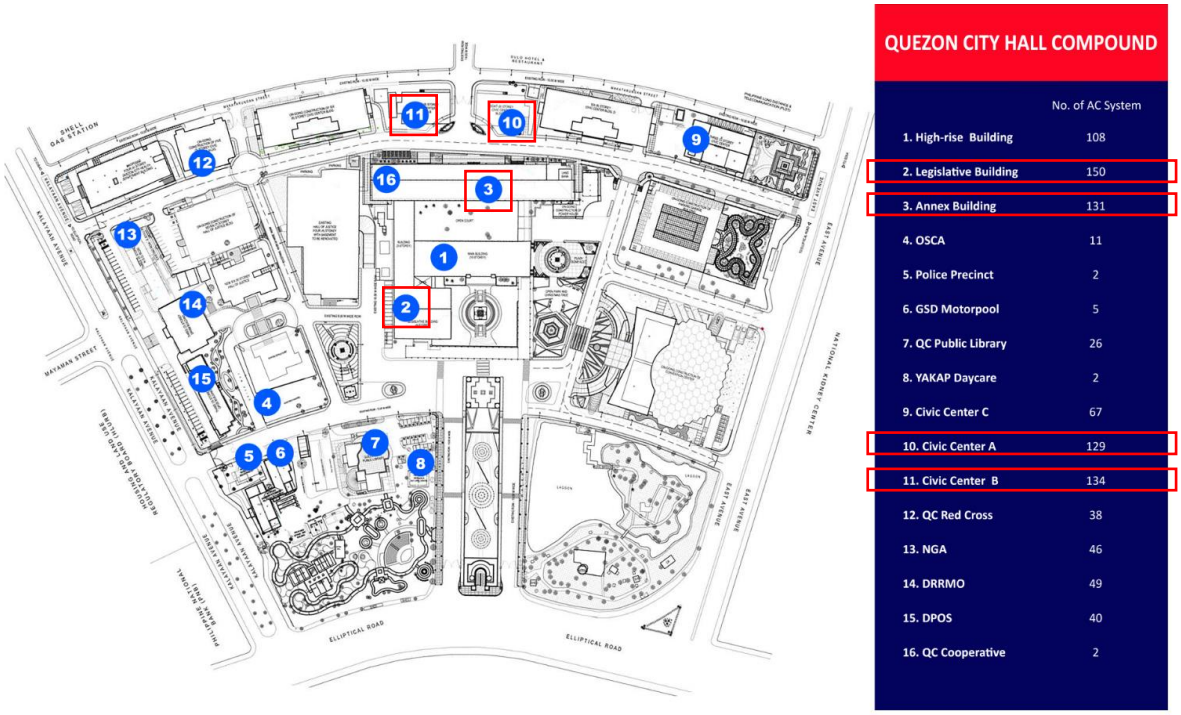


Figure 2-1 Location of Four Facilities at Quezon City Hall Compound Targeted in Previous Fiscal Year Survey

An overview of the air conditioning units in the four buildings is described below.

Interviews of Quezon City indicate 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, but there are a certain number of other types	Kolin Cariier 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)

(2) Survey Results

The results of the survey in the previous fiscal year for the amount of reduction in greenhouse gas by introducing energy saving air conditioners and suitable processing of fluorocarbons are described below.

Table 2-2 Reduction in Greenhouse Gas Emissions (Results of Survey in Previous Fiscal Year)

Item	Energy Saving Air Conditioning (1 year)	Suitable Processing of Fluorocarbons
Reference Emissions	649 tCO2	4,120 tCO2
Project Emissions	542 tCO2	431 tCO2
Expected Emissions Reduction	107 tCO2	3,689 tCO2

2.1.2 Examination of Previous Fiscal Year Survey Results

(1) Examination Standpoint and Method

Interviews of air conditioner manufacturers were conducted for the results of the survey in the previous fiscal year to enhance the accuracy of the plan in consideration of formation of a concrete project and application for JCM facility assistance, and efforts were made to examine the reference device COP, and refrigerant filling volume for the reference units and project units.

In addition, interviews of manufacturers indicate that air conditioners that use R22 refrigerant in existing units clarified that there is a high possibility they are old non-inverter type. The load factor for non-inverter type can be placed at 80%, which is higher than the load factor of 60% for inverter type. Therefore, the values were examined in consideration of the difference in load factor.

(2) Results After Examination

The results of the examination are described in this section.

The amount of greenhouse gas emissions reduction after examination is shown in the table below. Compared to the survey results in the previous fiscal year, and by taking the difference in load factors into account, the reduction in greenhouse gas emissions as a result of energy saving air conditioners becomes 826tCO2 larger. On the other hand, examination indicated the refrigerant filling volume was 1,485tCO2 less than the reduction in greenhouse gas achieved by destruction of fluorocarbons compared to the survey in the previous fiscal year.

Table 2-3 Greenhouse Gas Reduction (After Examination by Interview of Manufacturer)

Item	Energy Saving Air Conditioning (1 year)	Destruction 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

Information of existing equipment								Information on equipment to be installed										Proper Management of Fluorocarbons				Energy saving of air conditioning system					
Site	Number of units	Maker/Brand	Model name	Type	Cooling Capacity (kW)	Indoor unit type	Refrigerant type	Amount of refrigerant (kg)	Model name	Type	Cooling Capacity (kW)	Indoor unit type	Refrigerant type	Amount of refrigerant (kg)	price	discount	total cost (php)	price(yen)	Refrigerant of existing system	Refrigerant of new system to be installed	Amount of refrigerant of existing system (kg)	Amount of refrigerant of new system to be installed (kg)	①Coefficient of Performance (COP) of existing system	②COP of new system to be installed	④Electricity consumption of new system(kWh) ③×operation hours×load factor	⑤Electricity consumption of existing system (kWh) ④×②÷①	Source of COP of existing system	Source of COP of new system to be installed
Annex	2	ME	PUHY-P400THM-A	VRF	45	Ceiling cassette / R410A	R410A	11.5	RXQ16AYM+FXFQ140AVMx2	VRV	45	Ceiling cassette / R410A	R410A	8.2	852,000.00	639,000	1,278,000	2,786,040	R410A	R410A	23.0	16.4	3.39	3.49	49,890	36,363	catalogue	calculated from catalogue info
Annex	10	ME	PUHY-P350THM-A	VRF	40	Ceiling cassette / R410A	R410A	9.0	RXQ14AYM+FXFQ63AVMx5	VRV	40	Ceiling cassette / R410A	R410A	7.4	1,078,000.00	808,500	8,085,000	17,625,300	R410A	R410A	90.0	74.0	3.07	3.74	244,847	150,806	catalogue	calculated from catalogue info
Annex	4	ME	PUHY-P300THM-A	VRF	33.5	Ceiling cassette / R410A	R410A	9.0	RXQ12AYM+FXFQ63AVMx4	VRV	33.5	Ceiling cassette / R410A	R410A	6.8	834,400.00	625,800	2,503,200	5,456,976	R410A	R410A	36.0	27.2	3.68	3.85	68,427	49,047	catalogue	calculated from catalogue info
Annex	3	ME	PUHY-P250THM-A	VRF	28	Ceiling cassette / R410A	R410A	6.5	RXQ10AYM+FXFQ63AVMx3	VRV	28	Ceiling cassette / R410A	R410A	6.7	743,600.00	557,700	1,673,100	3,647,358	R410A	R410A	19.5	20.1	3.41	4.09	46,291	28,921	catalogue	calculated from catalogue info
Annex	2	ME	PUHY-P200THM-A	VRF	22.4	Ceiling cassette / R410A	R410A	6.5	RXQ18AYM+FXFQ140AVMx3	VRV	22.4	Ceiling cassette / R410A	R410A	8.4	981,400.00	736,050	1,472,100	3,209,178	R410A	R410A	13.0	16.8	3.91	3.27	21,531	43,128	catalogue	calculated from catalogue info
Civic A	7	ME	PU-5TJSA	SA	13.5	Ceiling Suspended / Ceiling Concealed / Floor Mounted R22	R22	5.1	FVA140AMVM/RZF140CVM	SA	14	Ceiling cassette / Ceiling Suspended / Ceiling Concealed / Floor Standing / R32	R32	1.9	205,000.00	153,750	1,076,250	2,346,225	R22	R32	35.7	13.3	2.40	2.56	73,994	53,966	catalogue	catalogue (Ceiling Cassette)
Civic B	7						R22	5.1					R32	1.9	205,000.00	153,750	1,076,250	2,346,225	R22	R32	35.7	13.3	2.40	2.56	73,994	53,966	catalogue	catalogue (Ceiling Cassette)
Annex	5						R22	5.1					R32	1.9	205,000.00	153,750	768,750	1,675,875	R22	R32	25.5	9.5	2.40	2.56	52,853	38,547	catalogue	catalogue (Ceiling Cassette)
Annex	21	ME	PU-4TJSA	SA	11	Wall Mounted / Ceiling Suspended / Ceiling Concealed	R22	4.6	FVA100AMVM/RZF100CVM	SA	11.2	Wall Mounted / Ceiling cassette / Ceiling Suspended /	R32	1.3	164,000.00	123,000	2,583,000	5,630,940	R22	R32	96.6	27.3	2.58	3.37	168,254	87,904	catalogue	catalogue (Ceiling Cassette)
Civic A	115	ME	PU-3NJA	SA	8	Wall Mounted / Ceiling Suspended / Ceiling Concealed / Floor Mounted / R22	R22	3.5	FVA71AMVM/RZF71CVM	SA	8	Wall Mounted / Ceiling cassette / Ceiling Suspended / Ceiling Concealed / Floor Standing / R32	R32	1.2	127,000.00	95,250	10,953,750	23,879,175	R22	R32	402.5	138.0	2.30	3.68	751,680	312,816	catalogue	catalogue (Ceiling Cassette)
Civic B	115						R22	3.5					R32	1.2	127,000.00	95,250	10,953,750	23,879,175	R22	R32	402.5	138.0	2.30	3.68	751,680	312,816	catalogue	catalogue (Ceiling Cassette)
Annex	1						R22	3.5					R32	1.2	127,000.00	95,250	95,250	207,645	R22	R32	3.5	1.2	2.30	3.68	6,536	2,720	catalogue	catalogue (Ceiling Cassette)
Annex	3	KOPPEL	KPC-36IH2	SA	10.55	Floor Standing / R22 / 220V, 1Phase, 60Hz	R22	2.7	FVA100AMVM/RZF100CVM	SA	11.2	Wall Mounted / Ceiling cassette / Ceiling Suspended /	R32	1.3	164,000.00	123,000	369,000	804,420	R22	R32	8.0	3.9	2.85	3.37	20,869	12,558	manual	catalogue (Ceiling Cassette)
Annex	8	CARRIER	38ASB600DC	SA	17.58	Floor Standing / R22 / 220V, 3Phase, 60Hz	R22	2.5	FVGR8PVL, RN80HTL	PAC	23.5	Large Floor Stanind, R410A, **NON-INVERTER**	R410A	2.6	215,000.00	161,250	1,290,000	2,812,200	R22	R410A	20.0	20.8	3.63	2.98	72,807	88,736	catalogue	catalogue (Ceiling Cassette)
Annex	1	CARRIER	38ASB360BA-1	SA	17.58	Floor Standing/ 10.55 kW / R22 / 220V, 1Phase, 60Hz	R22	2.5	FVA100AMVM/RZF100CVM	SA	11.2	Wall Mounted / Ceiling cassette / Ceiling Suspended /	R32	1.3	164,000.00	123,000	123,000	268,140	R22	R32	2.5	1.3	2.84	3.37	11,633	4,186	catalogue	catalogue (Ceiling Cassette)
Annex	1	CARRIER	38ASB240BA-1	SA	6.94	Floor Standing / 7.03kW / R22 / 220V, 1Phase, 60Hz	R22	2.1	FVA71AMVM/RZF71CVM	SA	7.1	Wall Mounted / Ceiling cassette / Ceiling Suspended /	R32	1.2	127,000.00	95,250	95,250	207,645	R22	R32	2.1	1.2	2.70	3.68	4,830	2,720	catalogue	catalogue (Ceiling Cassette)
Annex	15	KOPPEL	KPC-60IHOA	SA	17.5	Ceiling Mounted / R22, Floor Mounted / R22	R22	3.8	FHA140BVMA/RZF140CVM	SA	14	Ceiling Suspended/ R32	R32	1.9	195,000.00	146,250	2,193,750	4,782,375	R22	R32	56.3	28.5	3.19	2.56	154,636	115,641	instruction manual	catalogue (Ceiling Cassette)
Civic A	7	KOPPEL	KPC-36IHOA	SA	10.55	Ceiling Mounted / R22, Floor Mounted / R22 Horizontal Split Ducted Units,	R22	2.1	FHA100BVMA/RZF100CVM FVA100AMVM/RZF100CVM FBA100BVMA/RZF100CVM	SA	10	Ceiling Suspended/ R32, Floor Mounted / R32, Duct Connection Middle Static Pressure / R32	R32	1.3	164,000.00	123,000	861,000	1,876,980	R22	R32	14.7	9.1	3.11	3.37	44,623	29,301	instruction manual	catalogue (Ceiling Cassette)
Civic B	9						R22	2.1					R32	1.3	164,000.00	123,000	1,107,000	2,413,260	R22	R32	18.9	11.7	3.11	3.37	57,373	37,673	instruction manual	catalogue (Ceiling Cassette)
Annex	2						R22	2.1					R32	1.3	156,000.00	117,000	234,000	510,120	R22	R32	4.2	2.6	3.11	3.37	12,750	8,372	instruction manual	catalogue (Ceiling Cassette)
Annex	1	KOPPEL	KPC-12HH5B2	RA	3.405	Wall Mounted / R22/ 220V, 1Phase, 60Hz	R22	0.8	FTKC35TVM / FTKM35TVM	RA	3.5	Wall Mounted, R32	R32	0.68	42,100.00	31,575	31,575	68,834	R22	R32	0.8	0.7	3.15	3.89	2,031	1,268	instruction manual	catalogue (Ceiling Cassette)
Annex	1	CARRIER	38CVUR013-703	RA	3.5	Hi-Wall Mounted / R410a	R410A	0.8	FTKC35TVM / FTKM35TVM	RA	3.5	Wall Mounted, R32	R32	0.68	42,100.00	31,575	31,575	68,834	R410A	R32	0.8	0.7	3.82	3.89	1,722	1,268	instruction manual	catalogue (Ceiling Cassette)
Legislative ※	28						R410A						R410A						R410A	R410A	231.7	197.3			550,054	393,473		
Legislative ※	74						R22						R32						R22	R32	278.9	123.3			644,745	460,999		
合計	442	–	–	–	–	–	–			–	–	–	–	62	7,082,600	5,311,950	48,854,550	106,502,919					–	–	3,888,050	2,327,197	–	–

Figure 2-2 Calculation Results of Greenhouse Gas Reduction after Examination Made Through Interviews of Manufacturers

(3) Consideration of Cost Effectiveness of JCM Facility Assistance

The cost effectiveness of utilizing a JCM facility assistance project was considered.

The survey in the previous fiscal year indicated the cost for replacement is 35,000,000PHP (¥76,300,000) (1PHP=¥2.18). 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 1,834PHP (¥4,000)/tCO2 is the standard for the cost effectiveness (Subsidy target amount ÷ (Greenhouse gas reduction amount x life expectancy)) for JCM facility assistance 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 suitable manner. When considering the cost effectiveness of a JCM facility assistance project, the greenhouse gas reduction for the 6 year useful life designated by law is 5,598tCO2 (933tCO2 x 6 years) when the reduction in greenhouse gases by destruction of fluorocarbons is not taken into consideration. When an upper limit of 50% is used as the subsidy rate, the cost effectiveness of 3,126PHP (¥6,815)/tCO2 does not satisfy the requirements for a JCM facility assistance project. The subsidy target amount is 10,150,000PHP (¥22,127,000) for the standard cost effectiveness is 1,834PHP (¥4,000)/tCO2 or less. This is only approximately 29% of the initial project cost 35,000,000PHP (¥76,300,000). Accordingly, the upper limit for the subsidy rate is 20% if the fraction is rounded down, resulting in a cost effectiveness of 1,250PHP (¥2,726)/tCO2 in this case.

On the other hand, when the reduction in greenhouse gas volume by destroying the fluorocarbons is taken into consideration, the greenhouse gas reduction volume for the 6 year life expectancy is 7,802tCO2 (933tCO2 x 6 years + 2,204tCO2). When the upper limit for the subsidy rate is 50%, the cost effectiveness of 2,243PHP (¥4,890)/tCO2 does not satisfy the requirements for a JCM facility assistance project. The subsidy target amount is 14,000,000PHP (¥30,520,000) when the standard cost effectiveness is 1,834PHP (¥4,000)/tCO2 or less. This is only approximately 40% of the initial project cost 35,000,000PHP (¥76,300,000). Accordingly, the upper limit for the subsidy rate is 40% if the fraction is rounded down, resulting in a cost effectiveness of 1,794PHP (¥3,912)/tCO2 in this case.

Formulae for Calculation of Cost Effectiveness

1) For subsidy rate of 50% (No fluorocarbon destruction)

Cost effectiveness (No fluorocarbon destruction)

= Subsidy rate of 50% (17,500,000PHP (¥38,150,000)) ÷ [Expected emissions reduction by energy saving air conditioners (933tCO2) x Life expectancy (6 years)]

= 3,126PHP (¥6,815)/tCO2

2) For subsidy rate of 20% (No fluorocarbon destruction)

Cost effectiveness (No fluorocarbon destruction)

= Subsidy rate of 20% (7,000,000PHP (¥15,260,000)) ÷ [Expected emissions reduction by energy saving air conditioners (933tCO2) x Life expectancy (6 years)]

= 1,250PHP (¥2,726)/tCO2

3) For subsidy rate of 50% (Fluorocarbons destroyed)

Cost effectiveness (Fluorocarbons destroyed)

= Subsidy rate of 50% (17,500,000PHP (¥38,150,000)) ÷ [Expected emissions reduction by energy saving air conditioners (933tCO2) x Life expectancy (6 years) + Expected emissions reduction by fluorocarbon destruction (2,204tCO2)]

= 2,243PHP (¥4,890)/tCO2

4) For subsidy rate of 40% (Fluorocarbons destroyed)

Cost effectiveness (Fluorocarbons destroyed)

= Subsidy rate of 40% (14,000,000PHP (¥30,520,000)) ÷ [Expected emissions reduction by energy saving air conditioners (933tCO2) x Life expectancy (6 years) + Expected emissions reduction by fluorocarbon destruction (2,204tCO2)]

= 1,794PHP (¥3,912)/tCO2

When utilizing JCM facility assistance, the cost effectiveness needs to be 1,834PHP (¥4,000)/tCO2 or less, and when the subsidy rate is as in 2) and 4) above with fluorocarbon destruction not considered, it is 20%, and when fluorocarbon destruction is considered, it is 40%.

(4) Consideration of Energy Savings Effect in Quezon City

The cost effectiveness of saving energy in Quezon City by updating to inverter type air conditioning is described in this section.

Updating to inverter type air conditioning saves 1,560,853kWh per year (Power consumption before updating of 3,888,050kWh – Power consumption after updating of 2,327,197kWh). When the electricity unit price is assumed to be 10PHP/kWh (¥21.8/kWh, 1PHP=¥2.18), this saves 15,608,530PHP (¥34,026,595) per year.

Since the total investment is 35,000,000PHP (¥76,300,000), the investment can be recovered in approximately 2.3 years with the reduction in electricity charges, which is clearly less than the 6 years which is the useful life designated by law for air conditioners.

Table 2-4 Energy Saving Effects When Updating to Inverter Type Air Conditioners

Reduction Effect	1 Year	5 Years	10 Years	15 Years	20 Years
Saving Electricity kWh	1,560,853	7,804,265	15,608,530	23,412,795	31,217,060
Savings Amount	34,026,595	170,132,977	340,265,954	510,398,931	680,531,908
Savings Amt. (PHP)	15,608,530	78,042,650	156,085,300	234,127,950	312,170,600
CO2 Reduction (t)	933	4,665	9,330	13,995	18,660

* When electricity unit price is assumed to be 10PHP/kWh

○ Economic Effect

- Total Investment Amount : ¥76,300,000 (35,000,000PHP)
- Simple Investment Recovery : Total Investment (PHP) / Annual electricity reduction (PHP)

  = 35,000,000 PHP ÷15,608,530 PHP

  = **2.3 years**

Here, the results of calculation are shown below when a JCM facility assistance project and a 5 year lease is introduced. 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.

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

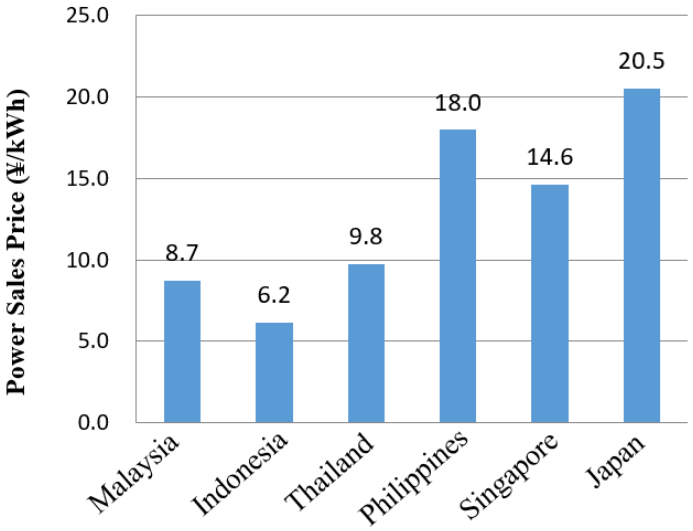


Figure 2-3 Electricity Sales Price in Asian Countries (2013)

Source: JETRO “Power Industry in Asia/Oceania and Policies”

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.

Table 2-5 Feasibility Estimation Results When Introduced with Lease

Item	Amount	
Total Investment Amount	35,000,000	PHP
JCM Facility Assistance*1	7,000,000	PHP
Net Total Investment Amount	28,000,000	PHP
Total Cost for 5-Year Lease*2	36,960,000	PHP
Annual Lease Charge	7,392,000	PHP/year
Energy Saving Effect (During Lease Period)	8,216,530	PHP/year
Energy Saving Effect (After Lease Period)	11,304,934	PHP/year

*1 Subsidy rate is 20% of facility costs and introduction costs

*2 Lease rate: 2.2% (Calculated using home loan interest of 6.00% [PNB home loan used as reference])

Annual Lease Charge Calculation Formula

Annual Lease Charge (PHP/year)

= Net total investment amount (28,000,000PHP) x Lease rate (2.2%) x 12 months

= 7,392,000PHP/year

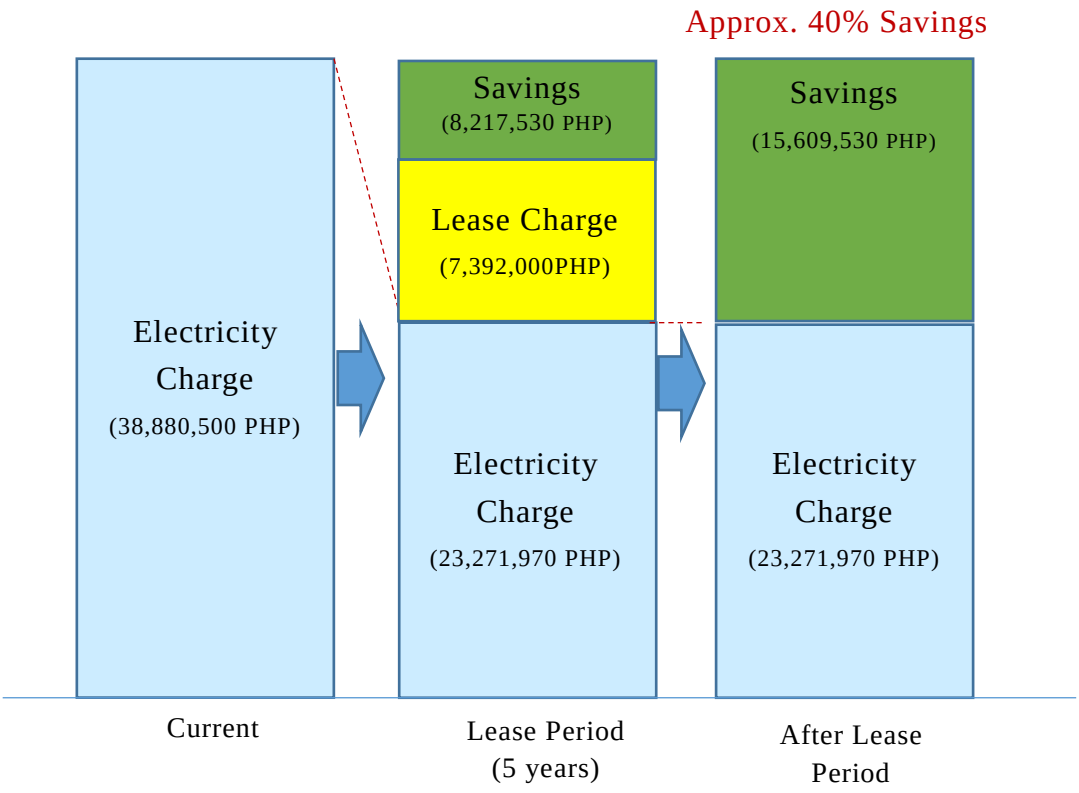


Figure 2-4 Image of Cost Reduction by Introducing Air Conditioners with Lease

2.2 Review for Creation of Model Project

2.2.1 Packaging of Suitable Fluorocarbon Processing Methodology

Interviews were conducted to the Ministry of the Environment and the Global Environment Centre (GEC) as to whether or not the reduction in greenhouse gas emissions by suitable fluorocarbon processing will be taken into consideration in the application requirements for JCM facility assistance. This clarified that according to past cases, the reduction in greenhouse gas emissions by suitable processing of fluorocarbons has not been considered for JCM facility assistance.

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

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 suitably 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 suitable manner.

Therefore, a packaged business model needs to be established that includes the suitable processing of existing air conditioners from the standpoint of the suitable processing of E-waste, in addition to the standpoint of the suitable processing of fluorocarbons.

2.2.2 Assistance Project That Can Conceivably be Applied

It is expected that a “Facility assistance project (JCM assistance project) in the bilateral credit system fund support category” can be utilized for the replacement of air conditioners, consisting of either a normal JCM assistance project or a JCM eco-lease project. The differences between these two types of project 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 facility assistance project for this case.

Table 2-6 Difference Between JCM Facility Assistance Project and JCM Eco-Lease Project

Item	JCM Facility Assistance Project	JCM Eco-Lease Project
Subsidy Rate	Based on number of JCM projects using similar technology that have been adopted in the past. 0 projects: 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.

2.2.3 Envisioned Project Scheme

Initially, Quezon City was going to budget the replacement of the air conditioners with the premise of maximum utilization of JCM facility assistance, 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 in1990, 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)” (Appendix 2-1). 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.

Table 2-7 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 10 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

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).

2.2.4 Project Implementation Structure

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 roles for the implementation structure is described below. The details will be determined through discussions between involved parties. Furthermore, review will be made concerning the efficiency monitoring methods for several hundred air conditioners as a future issue.

Representative Company reviews the overall plan at the international consortium, provides support for the formulation of specifications, and makes an application for JCM facility assistance. After acceptance of the application, subsidy is received in accordance with the procedures, and is applied to the project funds. In addition, the prescribed monitoring report is made.

Lease Company procures air conditioners and leases them to Quezon City, collects data needed for monitoring and makes a report on such data to the representative company. Furthermore, LBP Leasing and Finance which is a division of Land Bank (Philippine state-managed bank) is a strong candidate for the lease company.

Quezon City cooperates in the introduction and monitoring of air conditioners. In addition, suitable measures will be taken for the processing of the fluorocarbons and old air conditioners in accordance with the requirements for JCM facility assistance after coordination between the lease company, air conditioner manufacturer and other parties.

Air Conditioner Manufacturer procures and installs the air conditioners as well as recovers fluorocarbons based on the order placed by the lease company, and cooperates for the monitoring and other work. There is potential for cooperation from the international consortium concerning the recovery and processing of fluorocarbons from old air conditioners, and a candidate will be the entity with an adequate structure for the suitable processing of fluorocarbons.

Table 2-8 Envisioned Project Structure and Roles

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

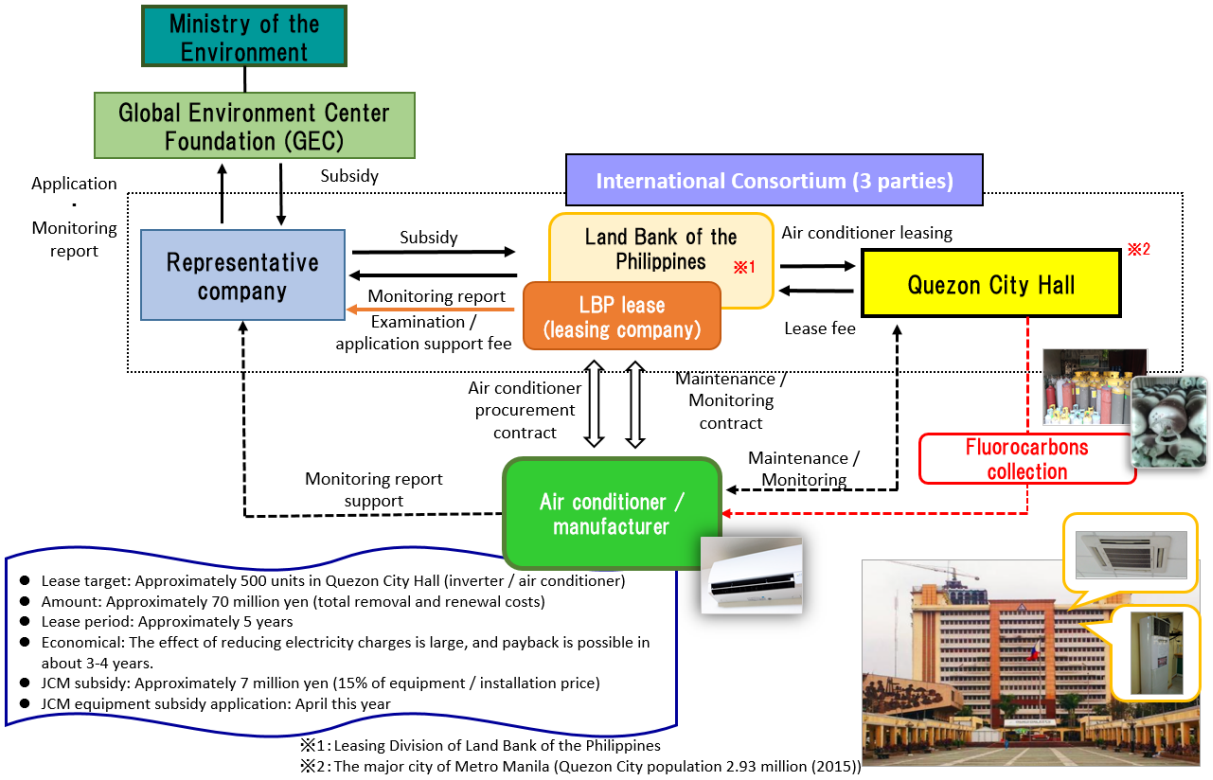


Figure 2-5 Envisioned Project Structure

2.2.5 Project Implementation Schedule

The schedule that is projected for introduction is described below. It is aimed to apply for JCM facility assistance at an early point and work to facilitate starting of the project, as soon as the structure is determined.

Table 2-9 Project Implementation Schedule

Item	2021										2022		
	3	4	5	6	7	8	9	10	11	12	1	2	3
Agreement for project implementation													
Application for JCM Model project		Preparation			Application				Adoption				
Procurement and installation of air conditioners													
Leasing/Monitoring													

2.2.6 Project Implementation Effects

The quantitative effects brought about by implementation of this project that can be expected are described below.

(1) Reduction in Greenhouse Gas Emissions

Air conditioner replacement 933 tCO2

Suitable fluorocarbon processing 2,204 tCO2

Total 3,137 tCO2

(2) Annual Electricity Usage in Quezon City

Reduction amount

1,560,853 kwh/year

(3) Annual Electricity Charges in Quezon City

Reduction amount…item (2) x electricity rate

15,608,530 PHP

This project to replace the air conditioners in four city hall buildings will be cited as a model project. The same scheme can be applied for the replacement of air conditioners at other Quezon City facilities and private sector facilities, saving energy and achieving fluorocarbon measures. If the methodology is established through this project for JCM facility assistance, JCM eco-lease can be applied, which should contribute to the promotion of popularization in the future.

Chapter 3 Saving Energy / Suitable Processing of Fluorocarbons for Air Conditioning in Buildings Other Than City Hall

3.1 Overview of Air Conditioners in City Hall Compound

3.1.1 Overview of Target Facility

Quezon City is making efforts to reduce energy consumption and greenhouse gas emissions since it is the largest discharger of greenhouse gases in the city, and to play a leading role for citizens and companies. For this purpose, Quezon City is striving to further reduce greenhouse gas emissions by replacing the air conditioners located at public facilities other than the four facilities for which the survey has been conducted in the last fiscal year. Therefore, conversion to energy saving air conditioners at the Quezon City Hall Compound was reviewed. The compound is comprised of a total of 16 facilities, including the facilities surveyed in the last fiscal year.

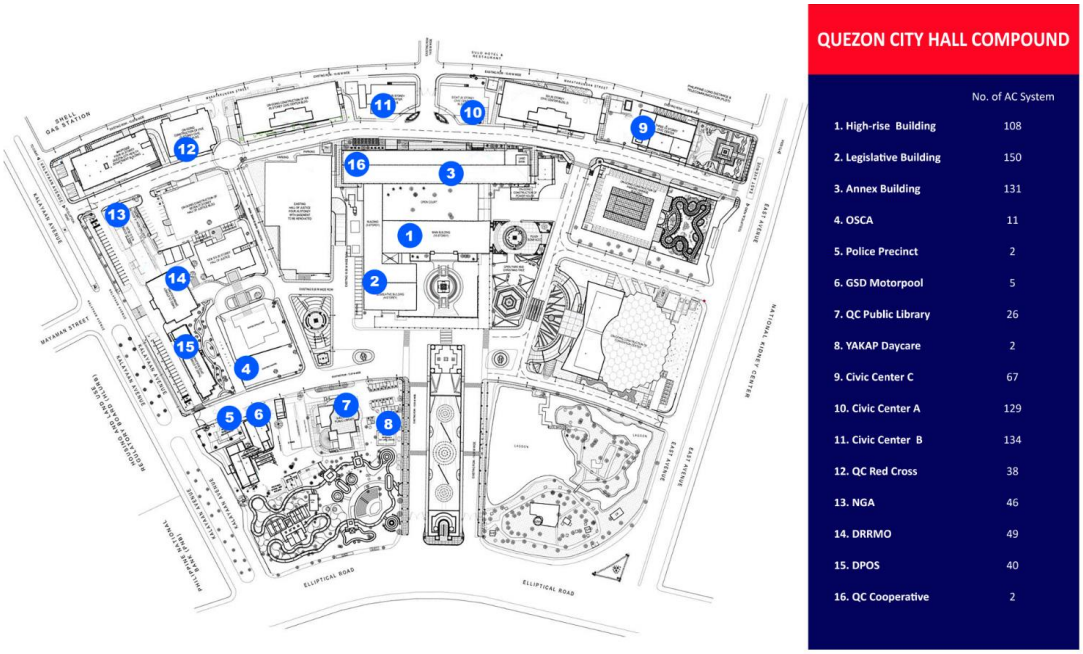


Figure 3-1 City Hall Compound Facilities

Table 3-1 Target Facilities

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

3.1.2 Overview of Target Air Conditioners for Replacement

(1) Number of Air Conditioners

The number of air conditioners at each facility was obtained based on interviews of Quezon City.

Table 3-2 Number of Air Conditioners at City Hall Compound

№	Building Name	Indoor Unit Type	No. of Indoor Units
1	High-rise Building	CEILING CASSETTE	216
		CEILING SUSPENDED	42
		WALL MAOUNTED	36
4	OSCA (Office Of The Senior Citizen Affairs) * Compound 2	WINDOW TYPE	7
		WALL MOUNTED	2
		FLOOR MOUNTED	2
5	Police Precinct * Compound 2	WALL MOUNTED	2
6	GSD (General Services Department) MOTORPOOL * Compound 2	WINDOW TYPE	4
		FLOOR MOUNTED	1
7	QC Public Library * Compound 1	WINDOW TYPE	1
		CEILING CASSETTE	24
		WALL MOUNTED	1
8	YAKAP Daycare * Compound 2	WINDOW TYPE	2
9	Civic Center C	WINDOW TYPE	5
		CEILING CASSETTE	62
12	Q.C. Red Cross * Compound 1	WINDOW TYPE	11
		FLOOR MOUNTED	27
13	NGA (National Capital Region) * Compound 1	CEILING CASSETTE	44
		WALL MOUNTED	2
14	DRRMO (Disaster Risk Reduction and Management Office)	CEILING CASSETTE	41
		FLOOR MOUNTED	8
15	DPOS (Department of Public Order and Safety)	CEILING CASSETTE	40
16	QC Cooperative * Compound 1	FLOOR MOUNTED	2
		Total	582

(2) Conditions

The operating time and introduction costs based on the results of the survey made in the previous fiscal year are set below.

Operating time: 2,349 hours (City Hall business hours: 8:00 – 17:00, Operating days: 261 days)

Introduction costs 60,000PHP/unit (Equip. cost: 40,000PHP/unit+ Installation: 20,000PHP/unit)

3.2 Overview of Air Conditioners for Public Facilities Other Than City Hall

3.2.1 Overview of Target Air Conditioners for Replacement

(1) Facilities and Number of Air Conditioners

The types of air conditioners and the number of units located at public facilities other than Quezon City Hall were known from materials provided by Quezon City. There are 50 target facilities, including hospitals, schools (universities) and sport facilities in addition to city hall facilities. Excluding the facilities that have no air conditioners, the total number of air conditioners installed at the above facilities is 1,483 units as shown in Table 3-3, 3-4 and 3-5.

Table 3-3 Overview of Air Conditioners at Public Facilities Other Than Quezon City Hall (1/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units
1	*MAYOR'S OFFICE			NO AIRCON DECLARED	-
2	*AMO			NO AIRCON DECLARED	-
3	*SECRETARY TO THE MAYOR			NO AIRCON DECLARED	-
4	*BORACAY MANSION			NO AIRCON DECLARED	-
5	*QCMC			NO AIRCON DECLARED	-
6	*ACCOUNTING			NO AIRCON DECLARED	-
7	CITY ADMIN			NO AIRCON DECLARED	-
8	AMORANTO SPORTS COMPLEX	AMORANTO SPORTS COMPLEX	Other	WINDOW TYPE	8
				SPLIT TYPE	3
				FLOOR MOUNTED	8
				NO SPECIFICATION	9
9	BUDGET			NO AIRCON DECLARED	-
10	BPLD	Business Permits And Licensing Office	City Hall Buildings	WINDOW TYPE	1
				SPLIT TYPE	1
11	CCRD	City Civil Registry Department	City Hall Buildings	WINDOW TYPE	1
				NO SPECIFICATION	2
12	*COA			NO AIRCON DECLARED	-
13	COMELEC-CIST.VI	Comission on Election	City Hall Buildings	WINDOW TYPE	4
14	COPRISS	Task Force Copriss Office	City Hall Buildings	WINDOW TYPE	5
15	CTO	City Treasurer's Office	City Hall Buildings	WINDOW TYPE	4
				SPLIT TYPE	23
				CEILING TYPE	3
				FLOOR MOUNTED	11
				WALL MOUNTED	1
16	DIVISION OF CITY SCHOOLS	Division of City School	City Hall Buildings	WINDOW TYPE	36
				SPLIT TYPE	243
				PACKAGE TYPE	12
				FLOOR MOUNTED	2
17	*EDUCATION AFFAIRS OFFICE			NO AIRCON DECLARED	-
18	ENGINEERING	Engineering Department	City Hall Buildings	WINDOW TYPE	9
				SPLIT TYPE	2
19	*EPWMD			NO AIRCON DECLARED	-
20	CGSD	The City General Services Department	City Hall Buildings	WINDOW TYPE	9
				SPLIT TYPE	12
				FLOOR MOUNTED	1
21	GADC			NO AIRCON DECLARED	-
22	*HCDRD			NO AIRCON DECLARED	-
23	*INVESTMENT AFFAIRS OFFICE			NO AIRCON DECLARED	-
24	KOR-PHIL	KORPHIL IT CENTER	City Hall Buildings	WALL MOUNT	70

Table 3-4 Overview of Air Conditioners at Public Facilities Other Than Quezon City Hall (2/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units
25	LIGA NG MGA BARANGAY	City Liga Ng Mga Barangay	City Hall Buildings	SPLIT TYPE	1
				KOLIN	2
26	MDAD	Quezon City Market Development and Administration Department	City Hall Buildings	WINDOW TYPE	2
27	MTC	Quezon City Metropolitan Trial Court	Other	WINDOW TYPE	24
				SPLIT TYPE	7
28	NDC	Novaliches District Center	City Hall Buildings	WINDOW TYPE	21
				SPLIT TYPE	23
				FLOOR MOUNTED	1
29	NDH	Novaliches District Hospital	Hospital	WINDOW TYPE	18
				SPLIT TYPE	31
				MITSUBISHI INDOOR	23
				MITSUBISHI OUTDOOR	-
30	PAISD	Public Affairs and Information Services Department	City Hall Buildings	NO SPECIFICATION	9
31	*PESO			NO AIRCON DECLARED	-
32	PDAD	Parks Development and Administration Department	City Hall Buildings	CASSETTE TYPE	15
				SPLIT TYPE	2
33	PLANNING			NO AIRCON DECLARED	-
34	PLEB	People's Law Enforcement Board	City Hall Buildings	WINDOW TYPE	1
				SPLIT TYPE	1
35	POLICE ACTION CENTER	POLICE ACTION CENTER	Other	HP-CEILING MOUNT	2
				HP-WALL MOUNT	3
36	PROCUREMENT			NO AIRCON DECLARED	-
37	QCGH	Quezon City General Hospital	Hospital	WINDOW TYPE	157
				SPLIT TYPE	58
				FLOOR STANDING	22
38	QCPD	Quezon City Police District	City Hall Buildings	FLOOR MOUNTED	6
39	QCHD	Quezon City Health Department	City Hall Buildings	WINDOW TYPE	210
				SPLIT TYPE	28
				FLOOR TYPE	4
40	QCPL	Quezon City Public Library	Other	WINDOW TYPE	27
				SPLIT TYPE	3
41	QCU-SAN FRANCISCO	Quezon City University-SAN FRANCISCO	School	WINDOW TYPE	2
				FLOOR STANDING	1
	QCU-SAN BARTOLOME	Quezon City University-SAN BARTOLOME	School	PORTABLE TYPE	16
	QCU-BATASAN	Quezon City University-BATASAN	School	WINDOW TYPE	9
				PORTABLE TYPE	1
42	QCX	The Quezon City Museum Complex	Other	FLOOR MOUNTED	1
				CEILING MOUNT	3
43	REGIONAL TRIAL COURT	REGIONAL TRIAL COURT	Other	WINDOW TYPE	13
				SPLIT TYPE	8
				CEILING TYPE	2
				PACKAGE TYPE	2
44	SK FEDERATION	Sangguniang Kabataan Federation	City Hall Buildings	SPLIT TYPE	2
45	SSDD	Social Services Development Department	City Hall Buildings	WINDOW TYPE	70
				SPLIT TYPE	1
				BOX TYPE	1
				FLOOR STANDING	2
46	SYDP			NO AIRCON DECLARED	-

Table 3-5 Overview of Air Conditioners at Public Facilities Other Than Quezon City Hall (3/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units
47	TFB	Tricycle Franchising Board	City Hall Buildings	WINDOW TYPE	2
				SPLIT TYPE	1
48	OVM-PROPER	Office of the Vice Mayor-Proper	City Hall Buildings	SPLIT TYPE	8
				WINDOW TYPE	11
				TR TYPE	38
49	VMO-QCADAAC	Office of the Vice Mayor-Quezon City Anti-Drug Abuse Advisory Council	City Hall Buildings	WINDOW TYPE	19
				SPLIT TYPE	5
	VMO-TAHANAN	Office of the Vice Mayor-Quezon City Drug Treatment and Rehabilitation Center(TAHANAN)	City Hall Buildings	WINDOW TYPE	16
				FLOOR MOUNTED	8
50	CITY SECRETARY	CITY SECRETARY	City Hall Buildings	WINDOW TYPE	10
				SPLIT TYPE	2
	DIST.-1 COUN. LENA MARIE JUICO		City Hall Buildings	SPLIT TYPE	2
	DIST.-1 COUN. NICOLE ELLA V.CRISOLOGO		City Hall Buildings	SPLIT TYPE	2
	DIST.-1 COUN. DOROTHY DELARMENTE		City Hall Buildings	SPLIT TYPE	1
	DIST.-1 COUN. VICTOR FERRER		City Hall Buildings	WINDOW TYPE	2
	DIST.-2 COUN. VALMOCINA		City Hall Buildings	WINDOW TYPE	8
				SPLIT TYPE	2
	DIST.-2 COUN. CASTELO			PERSONAL	-
	DIST.-3 COUN. KATE COSETENG		City Hall Buildings	SPLIT TYPE	1
				NO SPECIFICATION	1
	DIST.-3 COUN. DEFENSOR		City Hall Buildings	SPLIT TYPE	1
	DIST.-3 COUN. LAGUMBAY		City Hall Buildings	SPLIT TYPE	2
	DIST.-5 COUN. KARL CASTELO		City Hall Buildings	SPLIT TYPE	1
	DIST.-5 COUN. ALLAN FRANCISCO		City Hall Buildings	SPLIT TYPE	1
	DIST.-5 COUN. SHAILA LIBAN		City Hall Buildings	WINDOW TYPE	1
	DIST.-6 COUN. LALA SOTTO		City Hall Buildings	WINDOW TYPE	15
	DIST.-6 COUN. MARIVIC CO-PILAR		City Hall Buildings	WINDOW TYPE	2
	DIST.-6 COUN. DONATO MATIAS		City Hall Buildings	WINDOW TYPE	5
				FLOOR STANDING	1
				Total	1483

(2) Conditions

The operating hours described below are an assumption. In addition, the introduction costs were set based on the survey results from the previous fiscal year.

Operating hours (City hall): 2,349 hours (8:00 – 17:00, Operating days: 261 days)
Operating hours (hospitals): 8,760 hours (0:00 – 24:00, Operating days: 365 days)

Operating hours (Other): 3,285 hours (8:00 – 17:00, Operating days: 365 days)
Introduction costs: 60,000PHP/unit
(Equipment cost: 40,000PHP/unit + Installation cost: 20,000PHP/unit)

3.2.2 Field Survey

Considering that out of the public facilities other than city hall, hospitals have installed particular-kind of air conditioning compared to city hall facilities, the Daikin Airconditioning Philippines, Inc., an overseas division of Daikin Industries, Ltd., was requested to conduct a field survey of two hospitals: Quezon City General Hospital and Novaliches District Hospital. The results of the survey on already installed air conditioners are shown in Table below. The field survey could not be implemented for schools and sports facilities due to the impact of the coronavirus pandemic, but it was assumed that the same type of air conditioning equipment has been introduced as for city hall facilities, while a review of greenhouse gas reduction and other effects was implemented.

Table 3-6 Quezon City General Hospital Field Survey Results

Photos	Air Conditioning Information
 	Manufacturer: Samsung Model: aw18phb Type: Window Type HP: – *Installed since founding of the hospital. *Many rooms are still using the same model.
 	Manufacturer: Samsung Model: as18ua Type: Split type HP:―
 	Manufacturer: Kolin Model:― Type: Floor Mounted HP:―
	Manufacturer: Samsung Model: NS60CCRFA Type: Ceiling HP: 6.0
	Manufacturer: Kolin Model: KSM-IW30WAE-7J1M Type: Split type HP: 3.0

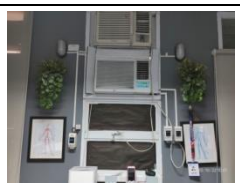
 	Manufacturer: LG Model:— Type: Window Type HP:— *Two units for rooms with 24 hour operation for alternate use.
 	Manufacturer: Koppel Model: KWR-09MB4 Type: Window Type HP: 1.0
	Manufacturer: Sanyo Model: SAP-KRV18GJ Type: Split Type HP:—
	Manufacturer: Sanyo Model: SAP-CF360P Type: Floor Mounted HP:—
 	Manufacturer: Panasonic Model: CW-MC65JPH Type: Window Type HP: 0.6
	Manufacturer: Carrier Model: Silencia Type: Window Type HP: 2.0
	Manufacturer: LG Model: HSN12ISS Type: Split Type HP:—
	Manufacturer: Kolin Model: KSG-150B1G Type: Split Type HP: 1.5
 	Manufacturer: Mitsubishi Model: PSY-SP48KA Type: Floor Mounted HP:—

Table 3-7 Novaliches District Hospital Field Survey Results

Photos	Air Conditioning Information
  	Manufacturer: Mitsubishi Model: PKFY-P25VBM-E Type: Split-Type HP:— *Majority of the units installed in the hospital
  	Manufacturer: Koppel Model: KWR-18M5A Type: Window Type HP: 2.0
 	Manufacturer: LG Gold Model: LA100RB Type: Window Type HP: 1.0
 	Manufacturer: Gree Model: KC-15p Type: Window Type HP: 0.69
	Manufacturer: Hitachi Model: RA-15SR Type: Window Type HP: 1.5
 	Manufacturer: Kolin Model: KAG-100HME4 Type: Window Type HP: 1.0
	Manufacturer: Kolin Model: KAG-260RS Type: Window Type HP: 2.5

3.3 Overview of Air Conditioning at Private Sector Facilities

3.3.1 Overview of Target Facilities

(1) Candidate Target Facilities

In order to achieve a decarbonized society in Quezon City, with an aim at replacing air conditioners at locations other than public facilities and promote the reduction of greenhouse gas 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 and other sources clarified that there are 26 shopping malls and 53 hotels in the city.

Table 3-8 List of Target Shopping Malls in Quezon City (1/2)

No.	Name	Location	Total Floor Space
1	GATEWAY MALL	Araneta Coliseum Araneta Center, Quezon City	100,000
2	U.P. TOWN CENTER	249, U.P. Town Center, 216 Katipunan Ave., Diliman, Quezon City	174,000
3	Fisher Mall	Quezon Ave, Quezon City	110,000
4	ALI MALL	13th Avenue, corner P. Tuazon Blvd, Cubao, Quezon City	62,000
5	ROBINSONS GALLERIA	EDSA corner Ortigas Avenue Ugong Norte, Quezon City, Manila,Philippines	216,000
6	ROBINSONS MAGNOLIA	Aurora Blvd and Hemady St, Quezon City, Luzon Philippines	48,000
7	ROBINSONS NOVALICHES	Brgy. Pasong Putik, Quirino Highway, Novaliches, Quezon City	55,893
8	ROBINSONS MAGNOLIA	Aurora Blvd, Doña Hemady St, New Manila, Quezon City	
9	Miniso	Trinoma, Quezon City	
10	SM City North EDSA	EDSA, North Avenue, Quezon City, 1100, Philippines	482,878
11	SM CITY STA. MESA	R. Magsaysay cor. G Araneta Ave, Dona Imelda Quezon City 1113	133,327
12	SM CITY NOVALICHES	Quirino Highway, Brgy. San Bartolome, Novaliches, Quezon City, Philippines	77,222
13	EASTWOOD MALL	116 Eastwood Ave, Bagumbayan, Quezon City	
14	EASTWOOD MALL	Eastwood City Bagumbayan, Quezon City, Luzon 1110 Philippines	47,000

Table 3-9 List of Target Shopping Malls in Quezon City (2/2)

No.	Name	Location	Total Floor Space
15	Ayala Malls TriNoma	North Avenue corner, Epifanio de los Santos Ave, Lungsod Quezon, Kalakhang Maynila	
16	AYALA MALLS VERTIS NORTH	North Ave, Diliman, Quezon City, Metro Manila	106,040
17	AYALA MALLS CLOVERLEAF	Ayala Malls Cloverleaf, A. Bonifacio Ave., Brgy. Balingasa, Quezon City	
18	Cubao Expo	Cubao Expo, 3 General Romulo Ave, Cubao, Quezon City	
19	TRINOMA (Triangle North of Manila)	EDSA corner North Avenue, Quezon City, Philippines	195,000
20	FARMERS PLAZA	Araneta Center, Cubao, Quezon City, Philippines	60,400
21	SM CITY FAIRVIEW	Quirino Highway corner Regalado Avenue, Novaliches, Quezon City, Philippines	282,681
22	SM CHERRY CONGRESSIONAL	Pangilinan St, Project 8, Quezon City, Metro Manila	13,469
23	FAIRVIEW TERRACES	Quirino Highway corner Maligaya Drive, Barangay Pasong Putik, Novaliches, Quezon City 1118	114,000
24	CENTRIS STATION	Eton Centris, Epifanio de los Santos Ave cor Quezon Ave, 1100 Quezon City, Philippines	
25	CENTRIS WALK	Eton Centris, Epifanio de los Santos Ave cor Quezon Ave, 1100 Quezon City, Philippines	
26	HEMADY SQUARE	86 Dona Hemady St. E. Rodriguez Sr. Avenue, Quezon City	
		Total	2,277,910

Table 3-10 List of Target Hotels in Quezon City (1/3)

No.	Name	Location	No. of Rooms
1	NAWAWALANG PARAISO RESORT AND HOTEL	Brgy. Camaysa Tayabas, Quezon 4327	
2	Pueblo por la Playa Leisure Club	Brgy. Bantigue, Pagbilao, Quezon	
3	Quezon Premier Hotel	Masin Sur, Candelaria, Quezon	
4	Batis Aramin Resort and Hotel	Lucban - Tayabas Rd, Lucban, 4328 Quezon	
5	Queen Margarette Hotel	Domoit Diversion Road, Lucena, Quezon City	
6	Dalampasigan Beach & Pool Resort	Brgy. Guis-guis, Sariaya, Quezon	
7	Balesin Island Club	Balesin, Polillo 4339 Quezon	
8	B Hotel Quezon City	14 Sct. Rallos St, Brgy, Quezon City, 1103 Metro Manila	111
9	Novotel Manila Araneta City Hotel	General Aguinaldo Ave, Araneta City, Quezon City, Metro Manila	401
10	Soleste Suites	193 Katipunan Avenue Blue Ridge, Quezon City	
11	Eastwood Richmonde Hotel	17 Orchard Road, Eastwood City, Bagumbayan, Quezon City, 1110 Metro Manila	138
12	Luxent Hotel	51 Timog Ave, Diliman, Quezon City, 1103 Metro Manila	117
13	Microtel by Wyndham UP Technohub	Commonwealth Avenue, UP Ayala Land Technohub, Quezon City, Manila, 1121, Philippines	120
14	Pansacola Beach Resort	Cagbalete Island, Mauban, Quezon Province, Mauban	
15	The Sulo Riviera	Matalino St, Diliman, Quezon City, 1100 Metro Manila	
16	West Avenue Suites	West Ave, Quezon City	
17	BRENTWOOD SUITES	6 Dr Garcia Sr., Diliman, Quezon City, Metro Manila	74
18	Meranti Hotel	82 Scout Castor St, Tomas Morato Ave, Quezon Cit	
19	SEDA VERTIS NORTH	Sola corner Lux Drives, Vertis North Quezon City, 1105 Philippines	438
20	Park Inn by Radisson North EDSA	North Avenue corner EDSA SM City North EDSA Complex, Quezon City, 1105 Metro Manila	238

Table 3-11 List of Target Hotels in Quezon City (2/3)

No.	Name	Location	No. of Rooms
21	Hotel Dream World Araneta Center	General Roxas Ave, Cubao, Quezon City	
22	SEQUOIA HOTEL	91-93 Mother Ignacia Avenue, corner Timog Ave, Quezon City	
23	Camelot Hotel	35 Mother Ignacia Ave, Diliman, Quezon City	
24	The Grass Residence	Nueva Viscaya, Bago Bantay, Lungsod Quezon	
25	Great Eastern Hotel	1403 R-7, Quezon Ave, Diliman, Quezon City	
26	Madison 101 Hotel + Tower	Aurora Blvd, corner Madison, New Manila, Quezon City	
27	Cocoon Boutique Hotel	61 Scout Rallos St, cor Sct. Tobias St, Diliman, Quezon City, 1103 Metro Manila	39
28	Haeinsa Condotel	23 Makisig St, Diliman, Quezon City, 1100 Metro Manila	
29	The Sulo Riviera	Matalino Road, Diliman, Quezon City, Manila, 1100, Philippines	70
30	Eurotel Vivaldi Araneta	629 EDSA Cubao, Quezon City	99
31	Microtel by Wyndham Acropolis	E. Rodriguez Jr. Ave., Brgy. Bagumbayan, Quezon City 110 Philippines	84
32	Crowne Plaza Manila Galleria	Corner Asian Development Bank Ave, Ortigas Ave, Ortigas Center, Quezon City, 1100 Metro Manila	263
33	Red Hotel Cubao	627 Epifanio de los Santos Ave, Cubao, Quezon City, 1111 Metro Manila	199
34	Stone House Hotel	1315 E Rodriguez Sr. Ave, New Manila, Quezon City	
35	Regal Residences	Lot Block 135, 13 Regalado Hwy, Novaliches, Quezon City	
36	Prime Hotel	70 Sgt. Esguerra St. Quezon City Philippines 1103	39
37	Verjandel Hotel	70 Kalayaan Ave, Diliman, Quezon City	

Table 3-12 List of Target Hotels in Quezon City (3/3)

No.	Name	Location	No. of Rooms
38	H Hotels - Metro North Uno	89 Rd 1, Brgy, Quezon City	
39	Red Planet Quezon Timog	100 Timog Ave, Diliman, Quezon City	
40	The Cirque Serviced Residences	Bagumbayan, Quezon City	
41	Icon Hotel - North Edsa	967 EDSA, corner West Ave, Quezon City	
42	Fernandina 88 Suites Hotel	222 P. Tuazon Blvd, Cubao, Quezon City	
43	Hotel 99	#8 Pinatubo St, Corner Matulin, Cubao, Quezon City	
44	MaxStays - Max Style @ One Eastwood Avenue	One Eastwood, One, 1800 Eastwood Ave, Bagumbayan, Quezon City	
45	Hotel Dream World North Edsa	967 EDSA cor. West Avenue Barangay Philam, Quezon City	96
46	Privato Hotel Quezon City	82 Scout Castor St, Tomas Morato Ave, Quezon City, 1103 Metro Manila	60
47	Madison 101 Hotel	1 Madison St. cor. Aurora Blvd. New 1102 New Manila	48
48	Hotel Rembrandt	26 Tomas Morato Ave. Diliman Quezon City	71
49	New Camelot Hotel	35 Mother Ignacia Ave, Diliman, Quezon City, Metro Manila	127
50	Fersal Hotel	No. 245 P. Tuazon Boulevard Cubao, Quezon City, Manila, Philippines	68
51	Fersal Hotel Kalayaan	No. 130 Kalayaan Avenue Diliman, Quezon City, Manila, Philippines	49
52	Fersal Hotel Malakas	131 Malakas Street, Diliman, Quezon City, Manila, 1100, Philippines	49
53	Red Planet Aurora Boulevard - Quezon City	901 Stanford St., corner of Aurora Blvd, Cubao, Quezon City, 1109, Philippines	167
		Total	3165

3.3.2 Overview of Target Air Conditioners for Replacement

(1) Estimation of Number of Air Conditioners

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 coronavirus pandemic, a survey was implemented remotely with the cooperation of a local concerned entities. However, since detailed information could not be obtained for air conditioners at shopping malls, the assumption was made that an air conditioner system (chiller) like the one shown in Table 3-13 has been introduced and was used as the reference model, and the conditions as to the number of units and other details were determined from the shopping mall total store floor area. Specifications for the reference and project devices were determined through an interview of Daikin Industries. In addition, information on the number of units, model and performance for the air conditioning system installed at one hotel were obtained. Information was obtained from one hotel on the number of devices and their performance. The number of units installed and various other conditions were determined for other hotels based on this information and on the number rooms which other hotels had.

1) Shopping Mall

Since, in this occasion, information for the target shopping malls could not be obtained, 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 3-13 Assumed Existing Air Conditioning Systems and Air Conditioners to be Introduced

	Reference Device Reference Model	Project Device Reference Model
	Water-Cooled Screw Chiller	Magnetic Bearing Chiller
Model name	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)	1.6 million PHP	3.5 million PHP
Installation Cost	1 – 5 million PHP	1 – 5 million PHP
Product Image		

2) Hotel

Information on the number of units, model and performance of the air conditioning system installed at the “MICROTEL ACROPOLIS” hotel were 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 3-14 Results of MICROTEL ACROPOLIS Field Survey

NAME	*MICROTEL ACROPOLIS*
LOCATION	*C5 Eulogio Rodriguez Jr. Avenue, Quezon City*
Main system	*RA*

Brand	Model Name	Qty	SBU	INV /NON	Cooling Capacity(kW) (nominal)	Power Input(kW)	Indoor Unit 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

(2) Conditions

The number of air conditioning units and device specifications for air conditioners installed at private sector facilities are described below.

1) Shopping Malls

Number of units installed: (Before replacement) 22 units per 100,000 m^2
(After replacement) 15 units per 100,000 m^2
Cooling capacity: (Before replacement) 1,650 kW
(After replacement) 2,461 kW
Operating hours: 4,380 hours (Operated 12 hours per day, 365 days a year)
Introduction cost: 40,000,000PHP/unit
(Device cost: 35,000,000PHP/unit + Installation cost 5,000,000PHP/unit)

2) Hotel

Number of units installed: 1.23 units/room
(103 units installed at MICROTEL ACROPOLIS, 84 rooms)
Cooling capacity: MICROTEL ACROPOLIS Panasonic product: 5.87kW / Daikin product: 5.20kW / Average: 5.79kW (Cooling capacity distributed among the two products at MICROTEL ACROPOLIS)
Operating hours: 4,380 hours (Operated 24 hours per day, 365 days a year)
Introduction cost: 60,000PHP/unit (Device cost: 40,000PHP/unit + Installation cost: 20,000PHP)

3.4 Calculation of Energy Savings Effects of Air Conditioners

3.4.1 Air Conditioners Planned for Introduction

In the same manner as in the survey 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 3-15 Air Conditioners Expected to be Introduced (Excerpt)

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

Source: Prepared using pamphlet from Daikin Airconditioning Philippines, Inc.

3.4.2 Calculation Method

(1) Overview of Methodology

The methodology described below is in the same manner as for the survey results for the previous fiscal year.

Table 3-16 JCM Approved Methodology Used as Reference

Methodology	Explanation
ID_AM004 Installation of Inverter-Type Air Conditioning System for Cooling for Grocery Store	Applied to project aimed at saving energy by introducing inverter type air conditioners for air conditioning at grocery store in Indonesia.
VN_AM002 Introduction of room air conditioners equipped with inverters, Version 01.1	Applied to project aimed at saving energy by introducing inverter type air conditioners for air conditioning at public office building in Vietnam.

Table 3-17 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 3-18 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 Requirements

The eligibility requirements are described below as in the survey results of the previous fiscal year.

Table 3-19 Methodology Eligibility Requirements

<table>
<tr><td>Requirement 1</td><td>Air conditioners for government or other office buildings are the target.</td></tr>
<tr><td>Requirement 2</td><td>Air conditioners to be introduced will be those of wall mounted type, floor mounted type or ceiling cassette type, different depending on the target site, and have a COP value higher than the values listed in the table below.
<table>
<tr><th>Cooling Capacity (kW)</th><th>COP</th></tr>
<tr><td>2.5<x≦4.1</td><td>4.00</td></tr>
<tr><td>4.1<x≦5.3</td><td>3.59</td></tr>
<tr><td>5.3<x≦7.1</td><td>2.96</td></tr>
<tr><td>7.1<x≦14.2</td><td>2.85</td></tr>
</table>
</td></tr>
<tr><td>Requirement 3</td><td>The Ozone Depletion Potential (ODP) of the refrigerant used in the air conditioners to be introduced is 0.</td></tr>
</table>

(3) Setting and Calculation of Reference Emissions and Project Emissions

1) Air Conditioners

Reference emissions are calculated using the power consumption of the existing air conditioners (kW/unit), the operating hours (h), the number of units (unit), and the load factor (%). The power consumption of the existing air conditioners is calculated from the cooling capacity and COP. The COP of the existing air conditioners is selected from the COP that is set at four levels for the cooling capacity value. When the power consumption, COP or load factor for each model has been obtained through the field survey, those values will be used for calculation.

1. There is a tendency for the COP to decrease as the cooling capacity increases.
2. The COP of existing air conditioners with a specific cooling capacity is set as the maximum value in each respective cooling capacity range.
3. The maximum COP value in respective cooling capacity range is defined as COP_{RE}.

The calculation formula for the reference emissions is described below.

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

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

RE_p	Reference emissions [tCO2/p]
$EC_{RE,i,p}$	Power consumption of existing air conditioners [MWh/p]
EF_{elec}	Power CO2 emission factor [tCO2/MWh]
$COP_{RE,i}$	COP [-] of existing air conditioners
CC	Cooling capacity [MW]
i	Type of air conditioner [-]

2) Project Emissions

The calculation formula for the project emissions is described below.

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

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

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) Reduction Calculation Formula

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]

4) Explanation and Source of Respective Parameters

An explanation and the sources of each parameter are described below for the settings before project implementation.

Table 3-20 Parameters Determined in Advance and Explanation

<table>
<tr><th>Parameter</th><th>Explanation of Data</th><th>Source</th></tr>
<tr><td>EF_{elec}</td><td>--Power Consumption CO2 Emission Factor--
The respective CO2 emission factor is applied when project air conditioners consume grid power or they only consume self-generated power.
Lower CO2 emission factor will be applied when the air conditioning system consumes both grid power and self-generated power.
Grid power emission factor: 0.5979*1 [tCO_2/MWh]
*1 Latest value that can be obtained from specified source will be applied during verification when grid power is used.
Generated power emission factor 0.8*2 [tCO2/MWh]
*2 The latest value that can be obtained from CDM approved small scale methodology AMS-I.A will be applied during verification.</td><td>--Grid Power--
Grid power emission factors published by the committee on Green Development Mechanism in the Philippines will be used unless otherwise specified by the joint committee (calculated in fiscal 2013).

--Self-Generated Power--
CDM approved small scale methodology AMS-I.A</td></tr>
<tr><td>$COP_{RE,i}$</td><td>--COP of Existing Air Conditioners--
The cooling capacity and rated power consumption values used for calculation of COP shall be obtained from product catalogs, specifications or website of main manufacturers in the Philippines.

Table COP of Existing Air Conditioners ($COP_{RE,i}$)<table><tr><th>Cooling capacity (kW)</th><th>COP</th></tr><tr><td>2.5< ≦4.1</td><td>4.00</td></tr><tr><td>4.1<x≦5.3</td><td>3.59</td></tr><tr><td>5.3<x≦7.1</td><td>2.96</td></tr><tr><td>7.1<x≦14.2</td><td>2.85</td></tr></table></td><td>Nominal values that can be used from product catalogs, specifications or website.
Default values will be set from COP of manufacturer that has high market share. Project participants shall correct default values as necessary based on survey results to be obtained every three years.</td></tr>
<tr><td>$COP_{PJ,i}$</td><td>--COP i of Air Conditioners Introduced under the Project--
Cooling capacity and rated power consumption values used for calculation of COP by manufacturer will be applied.</td><td>Manufacturer’s estimate or specifications available from factory acceptance testing data.</td></tr>
</table>

3.4.3 Results of Calculation of Greenhouse Gas Reduction

(1) Conditions

1) City Hall Compound

The prerequisites for calculation are described below.

Table 3-21 Conditions Used for Calculation of Estimated Emissions Reduction

(City Hall Compound)

Item		Value	Unit	Source
Operating Hours of Air Conditioners	City Hall	2,349	Hours/ Year	Interview of Quezon City
Reference Unit Power Consumption		2.8 – 14.2	kW	Average value for each type of indoor unit was obtained from survey results from previous fiscal year for other than high-rise building, and projected for each type of indoor unit
Reference Unit COP	2.5kW – 4.1kW	4.00	–	JCM approved methodology ID_AM004 used as reference
	4.1kW – 5.3kW	3.59	–	
	5.3kW – 7.1kW	2.96	–	
	7.1kW – 14.2kW	2.85	–	
Project Unit COP	WINDOW TYPE	4.81	–	Assumed to replace with Wall Mounted type
	WALL MOUNTED	4.81	–	D-Smart King max. COP value from Daikin catalog
	FLOOR MOUNTED	4.07	–	SkyAir Floor Standing (1 Phase) max. COP value from Daikin catalog
	CEILING CASSETTE	4.39	–	SkyAir Ceiling Cassette (1 Phase) max. COP value from Daikin catalog
	CEILING SUSPENDED	4.17	–	SkyAir Ceiling Suspended (1 Phase) max. COP value from Daikin catalog
Project Unit Power Consumption (Average Value)		2,392	kWh/unit	Power consumption x Operating hours x 60% (Load factor) * Load factor at 60% commonly applied to inverter type based on interview of Daikin
Power Emission Factor		0.5979	tCO2 /MWh	Combined Margin (2019) latest values for Luzon, the Philippines from “List of Grid Emission Factors” published by Institute of Global Environmental Strategies (IGES) (Feb. 2020 version)

2) Public Facilities Other Than City Hall

The prerequisites for calculation are described below.

Table 3-22 Conditions Used for Calculation of Estimated Emissions Reduction

(Public Facilities Other Than City Hall)

Item		Value	Unit	Source
Operating Hours of Air Conditioners	City Hall (Other Than City Hall Compound)	2,349	Hours/ Year	8:00 – 17:00, assumed to operate 261 days
	Hospitals	8,760	Hours/ Year	0:00 – 24:00, assumed to operate 365 days
	Other (Schools, sports facilities, etc.)	3,285	Hours/ Year	8:00 – 17:00, assumed to operate 365 days
Reference Unit Power Consumption		2.8 – 14.1	kW	Set based on power consumption of high-rise-building in City Hall Compound as reference
Reference Unit COP		2.85 – 4.00	–	Set based on power consumption of high-rise-building in City Hall Compound as reference
Project Unit COP	WINDOW TYPE	4.81	–	Assumed to replace with Wall Mounted type
	WALL MOUNTED	4.81	–	D-Smart King max. COP value from Daikin catalog
	FLOOR MOUNTED	4.07	–	SkyAir Floor Standing (1 Phase) max. COP value from Daikin catalog
	CEILING CASSETTE	4.39	–	SkyAir Ceiling Cassette (1 Phase) max. COP value from Daikin catalog
	CEILING SUSPENDED	4.17	–	SkyAir Ceiling Suspended (1 Phase) max. COP value from Daikin catalog
Project Unit Power Consumption (Average Value)		2,571	kWh/unit	Power consumption x Operating hours x 60% (Load factor) * Load factor commonly set as 60% for inverter type based on interview of Daikin
Power Emission Factor		0.5979	tCO2 /MWh	Combined Margin (2019) latest values for Luzon, the Philippines from “List of Grid Emission Factors” published by Institute of Global Environmental Strategies (IGES) (Feb. 2020 version)

3) Private Sector Facilities

The prerequisites for calculation are described below.

Table 3-23 Conditions Used for Calculation of Estimated Emissions Reduction

(Private Sector Facilities)

Item		Value	Unit	Source
Operating Hours of Air Conditioners	Shopping Malls	4,380	Hours/ Year	Assumed to operate 12 hours, 365 days a year
	Hotels	4,380	Hours/ Year	Assumed to operate 24 hours, 365 days a year, 50% operation rate
Reference Unit Cooling Capacity	Shopping Malls	1,650	kW	Projected from results of interview of manufacturer
	Hotels	5.20 – 5.87		Set by using value (5.79) calculated for power consumption by two products at same facility other than MICROTEL ACROPOLIS based on results of interview of manufacturer
Reference Unit COP	Shopping Malls	5.0	–	Projected from results of interview of manufacturer
	Hotels	2.96 – 3.59	–	Set by using value (3.03) calculated for two products at same facility other than MICROTEL ACROPOLIS based on results of interview of manufacturer
Project Unit COP	Shopping Malls	5.90	–	Projected from results of interview of manufacturer
	Hotels (WALL MOUNTED)	4.81	–	D-Smart King max. COP value from Daikin catalog
Project Unit Power Consumption (Average Value)	Shopping Malls	1,096,188	kWh/unit	Power consumption x Operating hours x Load factor Load factor obtained through interview of Daikin: Reference is 80% for non-inverter type For this project, 60% for inverter type Reference for hotels is also 60% for inverter type
	Hotels	2,841		
Power Emission Factor		0.5979	tCO2 /MWh	Combined Margin (2019) latest values for Luzon, the Philippines from “List of Grid Emission Factors” published by Institute of Global Environmental Strategies (IGES) (Feb. 2020 version)

(2) Calculation Results

The estimated greenhouse gas reduction and cost effectiveness brought about by replacement of air conditioners at the City Hall Compound, public facilities other than the city hall and private sector facilities were calculated. Since discussions with the Ministry of the Environment resulted in the conclusion not to include fluorocarbon recovery as a subsidy target for the JCM facility assistance, only the greenhouse gas reduction and cost effectiveness as the result of energy savings were evaluated in this survey.

The estimated emissions reduction per unit at the city hall compound was 1.4tCO2, and the estimated emissions reduction per unit at public facilities other than the city hall was 1.8tCO2. The reason for this difference is that the operating hours at public facilities other than the city hall which include hospitals and other such facilities are longer than those at the city hall. In addition, the estimated emissions per unit at private sector facilities was 28.1tCO2.

When the subsidy rate is set as 50%, at the city hall compound, public facilities other than the city hall and private sector facilities, the cost effectiveness was 2,724 – 3,762PHP (¥5,939 – ¥8,201) /tCO2, which is much larger than 1,834PHP (¥4,000), the criterion for JCM facility assistance. When looking at the cost effectiveness that satisfies the criterion for JCM facility assistance, that of the city hall compound was 1,468PHP (¥3,200/tCO2) at a subsidy rate of 20%, 1,634PHP (¥3,563/tCO2) for public facilities other than the city hall at a subsidy rate of 30%, and 1,505PHP (¥3,280)/tCO2 for private sector facilities at a subsidy rate of 20%.

Table 3-24 Estimated Emissions Reduction and Cost Effectiveness

Item	City Hall Compound	Public Facilities Other Than City Hall	Private Sector Facilities	
Reference Emissions	1,625 tCO2	5,002 tCO2	389,193 tCO2	
Project Emissions	832 tCO2	2,880 tCO2	249,649 tCO2	
Estimated Emissions Reduction	793 tCO2	2,722 tCO2	139,544 tCO2	
No. of Air Conditioners	582 units	1,496 units	4,962 units	
			369 units in shopping malls	4,593 units in hotels
Introduction Cost[*1]	34,920,000 PHP	88,980,000 PHP	15,035,580,000 PHP	
Introduction Cost (¥)[*2]	¥76,125,600	¥193,976,400	¥32,777,564,400	
Subsidy Rate[*3]	20%	30%	20%	
Subsidy Amount	6,984,000 PHP	26,694,000 PHP	3,007,116,000 PHP	
Subsidy Amount (¥)	¥15,225,120	¥58,192,920	¥6,555,512,880	
Cost Effectiveness[*4]	1,468 PHP/t-CO2	1,634 PHP /t-CO2	1,505 PHP /t-CO2	
Cost Effectiveness(¥)	¥3,200/t-CO2	¥3,563/t-CO2	¥3,280/t-CO2	

*1 Introduction cost per unit was set at 60,000 PHP based on the results of survey last fiscal year. Introduction cost per unit for shopping malls was set at 40,000,000 PHP.

As for private facilities, as a result of the survey, 20 shopping malls (facility area 11,128-482,878m2) and 29 hotels (3,746 rooms) could be targeted. The shopping mall could install 15 new air conditioners per 100,000 m2, and the hotel could install 1.23 new air conditioners per room. Emissions and cost-effectiveness of private facilities are listed for the total of shopping malls and hotels.

The introduction cost in the shopping mall is assumed to be 40,000,000 PHP/unit (the calculation result of the introduction cost in the entire facility is a reference value calculated based on the area ratio of the average conditions estimated through manufacturer hearing. Since the equipment and installation conditions are different, it is necessary to conduct a detailed survey

of conditions of air conditioners and specifications for each shopping mall in the study next year.)

*2 ¥2.18/PHP (As of 2020/9/10)

*3 Subsidy rate of 1,834PHP (¥4,000)/tCO2 or less was set which is criterion for JCM facility assistance.

*4 Useful life designated by law for air conditioners at the city hall compound, public facilities other than city hall and hotels is 6 years. Useful life designated by law for air conditioners at shopping malls is 15 years.

Calculation Formula for Cost Effectiveness

Cost Effectiveness (PHP/tCO2)

= Subsidy Amount (PHP) ÷ [Estimated emissions reduction by energy saving air conditioners (tCO2) x Life expectancy (years)]

Table 3-25 Calculation Results of Greenhouse Gas Reduction at City Hall Compound

No. in Map	Building Name	Construction year	Indoor unit type	Indoor unit type QTY	Cooling Capacity (kW)	Reference COP	Reference COP	Reference Electricity Consumption (kW)	Project Electricity Consumption (kW)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)
1	High-rise Building		CEILING CASSETTE	22	14.2	2.85	4.39	4.98	3.23	205,987	100,295	105,691	123.16	59.97
				67	11.2	2.85	4.39	3.93	2.55	494,790	240,914	253,876	295.83	144.04
				62	9.0	2.85	4.39	3.16	2.05	367,928	179,145	188,783	219.98	107.11
				33	7.1	2.85	4.39	2.49	1.62	154,490	75,222	79,269	92.37	44.97
				13	5.6	2.96	4.39	1.89	1.28	46,218	23,372	22,846	27.63	13.97
				19	4.3	3.59	4.39	1.20	0.98	42,766	26,230	16,537	25.57	15.68
			CEILING SUSPENDED	2	14.0	2.85	4.17	4.91	3.36	18,462	9,464	8,999	11.04	5.66
				22	11.2	2.85	4.17	3.93	2.69	162,468	83,280	79,189	97.14	49.79
				17	7.1	2.85	4.17	2.49	1.70	79,586	40,795	38,791	47.58	24.39
				1	4.0	4.00	4.17	1.00	0.96	1,879	1,352	527	1.12	0.81
			WALL MAOUNTED	17	4.0	4.00	4.81	1.00	0.83	31,946	19,925	12,021	19.10	11.91
				19	2.8	4.00	4.81	0.70	0.58	24,993	15,588	9,405	14.94	9.32
4	OSCA (Office Of The Senior Citizen Affairs) ※Compound 2		WINDOW TYPE	7	9.3	2.85	4.81	3.28	1.94	43,091	19,149	23,942	25.76	11.45
			WALL MOUNTED	2	3.4	4.00	4.81	0.84	0.70	3,163	1,973	1,190	1.89	1.18
			FLOOR MOUNTED	2	9.3	2.85	4.07	3.28	2.29	12,312	6,466	5,846	7.36	3.87
5	Police Precinct ※Compound 2		WALL MOUNTED	2	3.4	4.00	4.81	0.84	0.70	3,163	1,973	1,190	1.89	1.18
6	GSD (General Services Department) MOTORPOOL ※Compound 2		WINDOW TYPE	4	9.3	2.85	4.81	3.28	1.94	24,624	10,942	13,681	14.72	6.54
			FLOOR MOUNTED	1	9.3	2.85	4.07	3.28	2.29	6,156	3,233	2,923	3.68	1.93
7	QC Public Library ※Copound 1		WINDOW TYPE	1	9.3	2.85	4.81	3.28	1.94	6,156	2,736	3,420	3.68	1.64
			CEILING CASSETTE	24	9.3	2.85	4.39	3.28	2.13	147,741	71,936	75,806	88.33	43.01
			WALL MOUNTED	1	3.4	4.00	4.81	0.84	0.70	1,582	986	595	0.95	0.59
8	YAKAP Daycare		WINDOW TYPE	2	9.3	2.85	4.81	3.28	1.94	12,312	5,471	6,841	7.36	3.27
9	Civic Center C		WINDOW TYPE	5	9.3	2.85	4.81	3.28	1.94	30,779	13,678	17,101	18.40	8.18
			CEILING CASSETTE	62	3.4	4.00	4.39	0.84	0.77	98,063	67,013	31,050	58.63	40.07
12	Q.C. Red Cross ※Copound 1		WINDOW TYPE	11	9.3	2.85	4.81	3.28	1.94	67,715	30,092	37,623	40.49	17.99
			FLOOR MOUNTED	27	9.3	2.85	4.07	3.28	2.29	166,209	87,290	78,919	99.38	52.19
13	NGA (National Capital Region) ※Copound 1		CEILING CASSETTE	44	9.3	2.85	4.39	3.28	2.13	270,859	131,882	138,977	161.95	78.85
			WALL MOUNTED	2	3.4	4.00	4.81	0.84	0.70	3,163	1,973	1,190	1.89	1.18
14	DRRMO (Disaster Risk Reduction and Management Office)		CEILING CASSETTE	41	3.4	4.00	4.39	0.84	0.77	64,848	44,315	20,533	38.77	26.50
			FLOOR MOUNTED	8	9.3	2.85	4.07	3.28	2.29	49,247	25,864	23,383	29.44	15.46
15	DPOS (Department of Public Order and Safety)		CEILING CASSETTE	40	3.4	4.00	4.39	0.84	0.77	63,266	43,234	20,032	37.83	25.85
16	QC Cooperative ※Copound 1		FLOOR MOUNTED	2	9.3	2.85	4.07	3.28	2.29	12,312	6,466	5,846	7.36	3.87
	CoolingCapacity of No.4～No.16 was estimated from High-rise Building													
			Total number of units	582					Total	2,718,277	1,392,254	1,326,022	1,625.00	832.00
									Average	4,671	2,392	2,278	2.8	1.4

Table 3-26 Calculation Results of Greenhouse Gas Reduction at Public Facilities Other Than City Hall (1/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units	Cooling Capacity (kW)	Reference COP	Project COP	Reference Electricity Consumption	Project Electricity Consumption	Operation Hours (h/year)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
1	*MAYOR'S OFFICE			NO AIRCON DECLARED	-												
2	*AMO			NO AIRCON DECLARED	-												
3	*SECRETARY TO THE MAYOR			NO AIRCON DECLARED	-												
4	*BORACAY MANSION			NO AIRCON DECLARED	-												
5	*QCMC			NO AIRCON DECLARED	-												
6	*ACCOUNTING			NO AIRCON DECLARED	-												
7	CITY ADMIN			NO AIRCON DECLARED	-												
8	AMORANTO SPORTS COMPLEX	AMORANTO SPORTS COMPLEX	Other	WINDOW TYPE	8	9.34	2.85	4.81	3.28	1.94	3,285	68,871	30,605	38,265	41.18	18.30	22.88
				SPLIT TYPE	3	9.34	2.85	4.81	3.28	1.94	3,285	25,826	11,477	14,350	15.44	6.86	8.58
				FLOOR MOUNTED	8	9.34	2.85	4.07	3.28	2.29	3,285	68,871	36,170	32,701	41.18	21.63	19.55
				NO SPECIFICATION	9	9.34	2.85	4.39	3.28	2.13	3,285	77,479	37,725	39,755	46.32	22.56	23.77
9	BUDGET			NO AIRCON DECLARED	-												
10	BPLD	Business Permits And Licensing Office	City Hall Buildings	WINDOW TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
11	CCRD	City Civil Registry Department	City Hall Buildings	WINDOW TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				NO SPECIFICATION	2	9.34	2.85	4.39	3.28	2.13	2,349	12,312	5,995	6,317	7.36	3.58	3.78
12	*COA			NO AIRCON DECLARED	-												
13	COMELEC-CIST.VI	Comission on Election	City Hall Buildings	WINDOW TYPE	4	9.34	2.85	4.81	3.28	1.94	2,349	24,624	10,942	13,681	14.72	6.54	8.18
14	COPRISS	Task Force Copriss Office	City Hall Buildings	WINDOW TYPE	5	9.34	2.85	4.81	3.28	1.94	2,349	30,779	13,678	17,101	18.40	8.18	10.22
15	CTO	City Treasurer's Office	City Hall Buildings	WINDOW TYPE	4	9.34	2.85	4.81	3.28	1.94	2,349	24,624	10,942	13,681	14.72	6.54	8.18
				SPLIT TYPE	23	9.34	2.85	4.81	3.28	1.94	2,349	141,586	62,919	78,667	84.65	37.62	47.03
				CEILING TYPE	3	9.34	2.85	4.39	3.28	2.13	2,349	18,468	8,992	9,476	11.04	5.38	5.67
				FLOOR MOUNTED	11	9.34	2.85	4.07	3.28	2.29	2,349	67,715	35,563	32,152	40.49	21.26	19.22
				WALL MOUNTED	1	3.4	4.0	4.8	0.8	0.7	2,349	1,582	986	595	0.95	0.59	0.36
16	DIVISION OF CITY SCHOOLS	Division of City School	City Hall Buildings	WINDOW TYPE	36	9.34	2.85	4.81	3.28	1.94	2,349	221,612	98,482	123,131	132.50	58.88	73.62
				SPLIT TYPE	243	9.34	2.85	4.81	3.28	1.94	2,349	1,495,882	664,750	831,132	894.39	397.45	496.93
				PACKAGE TYPE	12	3.37	4.00	4.81	0.84	0.70	2,349	18,980	11,838	7,142	11.35	7.08	4.27
				FLOOR MOUNTED	2	9.34	2.85	4.07	3.28	2.29	2,349	12,312	6,466	5,846	7.36	3.87	3.50
17	*EDUCATION AFFAIRS OFFICE			NO AIRCON DECLARED	-												
18	ENGINEERING	Engineering Department	City Hall Buildings	WINDOW TYPE	9	9.34	2.85	4.81	3.28	1.94	2,349	55,403	24,620	30,783	33.13	14.72	18.40
				SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
19	*EPWMD			NO AIRCON DECLARED	-												
20	CGSD	The City General Services Department	City Hall Buildings	WINDOW TYPE	9	9.34	2.85	4.81	3.28	1.94	2,349	55,403	24,620	30,783	33.13	14.72	18.40
				SPLIT TYPE	12	9.34	2.85	4.81	3.28	1.94	2,349	73,871	32,827	41,044	44.17	19.63	24.54
				FLOOR MOUNTED	1	9.34	2.85	4.07	3.28	2.29	2,349	6,156	3,233	2,923	3.68	1.93	1.75
21	GADC			NO AIRCON DECLARED	-												
22	*HCDRD			NO AIRCON DECLARED	-												
23	*INVESTMENT AFFAIRS OFFICE			NO AIRCON DECLARED	-												
24	KOR-PHIL	KORPHIL IT CENTER	City Hall Buildings	WALL MOUNT	70	3.37	4.00	4.81	0.84	0.70	2,349	110,716	69,054	41,662	66.20	41.29	24.91
25	LIGA NG MGA BARANGAY	City Liga Ng Mga Barangay	City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				KOLIN	2	9.34	2.85	4.39	3.28	2.13	2,349	12,312	5,995	6,317	7.36	3.58	3.78
26	MDAD	Quezon City Market Development and Administration Department	City Hall Buildings	WINDOW TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
27	MTC	Quezon City Metropolitan Trial Court	Other	WINDOW TYPE	24	9.34	2.85	4.81	3.28	1.94	3,285	206,612	91,815	114,796	123.53	54.90	68.64
				SPLIT TYPE	7	9.34	2.85	4.81	3.28	1.94	3,285	60,262	26,780	33,482	36.03	16.01	20.02

Table 3-27 Calculation Results of Greenhouse Gas Reduction at Public Facilities Other Than City Hall (2/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units	Cooling Capacity (kW)	Reference COP	Project COP	Reference Electricity Consumption	Project Electricity Consumption	Operation Hours (h/year)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
28	NDC	Novaliches District Center	City Hall Buildings	WINDOW TYPE	21	9.34	2.85	4.81	3.28	1.94	2,349	129,274	57,448	71,826	77.29	34.35	42.94
				SPLIT TYPE	23	9.34	2.85	4.81	3.28	1.94	2,349	141,586	62,919	78,667	84.65	37.62	47.03
				FLOOR MOUNTED	1	9.34	2.85	4.07	3.28	2.29	2,349	6,156	3,233	2,923	3.68	1.93	1.75
29	NDH	Novaliches District Hospital	Hospital	WINDOW TYPE	18	5.60	2.85	4.81	1.96	1.16	8,760	247,862	110,147	137,715	148.20	65.86	82.34
				SPLIT TYPE	31	2.80	2.85	4.81	0.98	0.58	2,349	57,233	25,434	31,800	34.22	15.21	19.01
				MITSUBISHI INDOOR	23	2.80	2.85	4.39	0.98	0.64	2,349	42,463	20,675	21,788	25.39	12.36	13.03
				MITSUBISHI OUTDOOR	-												
30	PAISD	Public Affairs and Information Services Department	City Hall Buildings	NO SPECIFICATION	9	9.34	2.85	4.39	3.28	2.13	2,349	55,403	26,976	28,427	33.13	16.13	17.00
31	*PESO			NO AIRCON DECLARED	-												
32	PDAD	Parks Development and Administration Department	City Hall Buildings	CASSETTE TYPE	15	9.34	2.85	4.39	3.28	2.13	2,349	92,338	44,960	47,379	55.21	26.88	28.33
				SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
33	PLANNING			NO AIRCON DECLARED	-												
34	PLEB	People's Law Enforcement Board	City Hall Buildings	WINDOW TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
35	POLICE ACTION CENTER	POLICE ACTION CENTER	Other	HP-CEILING MOUNT	2	9.34	2.85	4.39	3.28	2.13	2,349	12,312	5,995	6,317	7.36	3.58	3.78
				HP-WALL MOUNT	3	3.37	4.00	4.81	0.84	0.70	2,349	4,745	2,959	1,786	2.84	1.77	1.07
36	PROCUREMENT			NO AIRCON DECLARED	-												
37	QCGH	Quezon City General Hospital	Hospital	WINDOW TYPE	157	5.28	2.85	4.81	1.85	1.10	2,349	546,590	242,897	303,693	326.81	145.23	181.58
				SPLIT TYPE	58	7.80	2.85	4.81	2.74	1.62	2,349	298,298	132,560	165,738	178.35	79.26	99.10
				FLOOR STANDING	22	14.10	2.85	4.07	4.95	3.46	2,349	204,536	107,419	97,117	122.29	64.23	58.07
38	QCPD	Quezon City Police District	City Hall Buildings	FLOOR MOUNTED	6	9.34	2.85	4.07	3.28	2.29	2,349	36,935	19,398	17,537	22.08	11.60	10.49
39	QCHD	Quezon City Health Department	City Hall Buildings	WINDOW TYPE	210	9.34	2.85	4.81	3.28	1.94	2,349	1,292,738	574,475	718,262	772.93	343.48	429.45
				SPLIT TYPE	28	9.34	2.85	4.81	3.28	1.94	2,349	172,365	76,597	95,768	103.06	45.80	57.26
				FLOOR TYPE	4	9.34	2.85	4.07	3.28	2.29	2,349	24,624	12,932	11,692	14.72	7.73	6.99
40	QCPL	Quezon City Public Library	Other	WINDOW TYPE	27	9.34	2.85	4.81	3.28	1.94	2,349	166,209	73,861	92,348	99.38	44.16	55.21
				SPLIT TYPE	3	9.34	2.85	4.81	3.28	1.94	2,349	18,468	8,207	10,261	11.04	4.91	6.13
41	QCU-SAN FRANCISCO	Quezon City University-SAN FRANCISCO	School	WINDOW TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
				FLOOR STANDING	1	9.34	2.85	4.07	3.28	2.29	2,349	6,156	3,233	2,923	3.68	1.93	1.75
	QCU-SAN BARTOLOME	Quezon City University-SAN BARTOLOME	School	PORTABLE TYPE	16	9.34	2.85	4.39	3.28	2.13	2,349	98,494	47,957	50,537	58.89	28.67	30.22
	QCU-BATASAN	Quezon City University-BATASAN	School	WINDOW TYPE	9	9.34	2.85	4.81	3.28	1.94	2,349	55,403	24,620	30,783	33.13	14.72	18.40
				PORTABLE TYPE	1	9.34	2.85	4.39	3.28	2.13	2,349	6,156	2,997	3,159	3.68	1.79	1.89
42	QCX	The Quezon City Museum Complex	Other	FLOOR MOUNTED	1	9.34	2.85	4.07	3.28	2.29	2,349	6,156	3,233	2,923	3.68	1.93	1.75
				CEILING MOUNT	3	9.34	2.85	4.39	3.28	2.13	2,349	18,468	8,992	9,476	11.04	5.38	5.67
43	REGIONAL TRIAL COURT	REGIONAL TRIAL COURT	Other	WINDOW TYPE	13	9.34	2.85	4.81	3.28	1.94	2,349	80,027	35,563	44,464	47.85	21.26	26.58
				SPLIT TYPE	8	9.34	2.85	4.81	3.28	1.94	2,349	49,247	21,885	27,362	29.44	13.08	16.36
				CEILING TYPE	2	9.34	2.85	4.39	3.28	2.13	2,349	12,312	5,995	6,317	7.36	3.58	3.78
				PACKAGE TYPE	2	3.37	4.00	4.81	0.84	0.70	2,349	3,163	1,973	1,190	1.89	1.18	0.71
44	SK FEDERATION	Sangguniang Kabataan Federation	City Hall Buildings	SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
45	SSDD	Social Services Development Department	City Hall Buildings	WINDOW TYPE	70	9.34	2.85	4.81	3.28	1.94	2,349	430,913	191,492	239,421	257.64	114.49	143.15
				SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				BOX TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				FLOOR STANDING	2	9.34	2.85	4.07	3.28	2.29	2,349	12,312	6,466	5,846	7.36	3.87	3.50
46	SYDP			NO AIRCON DECLARED	-												
47	TFB	Tricycle Franchising Board	City Hall Buildings	WINDOW TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
				SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04

Table 3-28 Calculation Results of Greenhouse Gas Reduction at Public Facilities Other Than City Hall (3/3)

№	Office Name		Category	Indoor Unit Type	No. of Indoor Units	Cooling Capacity (kW)	Reference COP	Project COP	Reference Electricity Consumption	Project Electricity Consumption	Operation Hours (h/year)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
48	OVM-PROPER	Office of the Vice Mayor-Proper	City Hall Buildings	SPLIT TYPE	8	9.34	2.85	4.81	3.28	1.94	2,349	49,247	21,885	27,362	29.44	13.08	16.36
				WINDOW TYPE	11	9.34	2.85	4.81	3.28	1.94	2,349	67,715	30,092	37,623	40.49	17.99	22.49
				TR TYPE	38	9.34	2.85	4.39	3.28	2.13	2,349	233,924	113,898	120,026	139.86	68.10	71.76
49	VMO-QCADAAC	Office of the Vice Mayor-Quezon City Anti-Drug Abuse Advisory Council	City Hall Buildings	WINDOW TYPE	19	9.34	2.85	4.81	3.28	1.94	2,349	116,962	51,976	64,986	69.93	31.08	38.85
				SPLIT TYPE	5	9.34	2.85	4.81	3.28	1.94	2,349	30,779	13,678	17,101	18.40	8.18	10.22
	VMO-TAHANAN	Office of the Vice Mayor-Quezon City Drug Treatment and Rehabilitation Center(TAHANAN)	City Hall Buildings	WINDOW TYPE	16	9.34	2.85	4.81	3.28	1.94	2,349	98,494	43,770	54,725	58.89	26.17	32.72
				FLOOR MOUNTED	8	9.34	2.85	4.07	3.28	2.29	2,349	49,247	25,864	23,383	29.44	15.46	13.98
	CITY SECRETARY	CITY SECRETARY	City Hall Buildings	WINDOW TYPE	10	9.34	2.85	4.81	3.28	1.94	2,349	61,559	27,356	34,203	36.81	16.36	20.45
				SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-1 COUN. LENA MARIE JUICO		City Hall Buildings	SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-1 COUN. NICOLE ELLA V.CRISOLOGO		City Hall Buildings	SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-1 COUN. DOROTHY DELARMENTE		City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
	DIST.-1 COUN. VICTOR FERRER		City Hall Buildings	WINDOW TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-2 COUN. VALMOCINA		City Hall Buildings	WINDOW TYPE	8	9.34	2.85	4.81	3.28	1.94	2,349	49,247	21,885	27,362	29.44	13.08	16.36
				SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-2 COUN. CASTELO			PERSONAL	-												
50	DIST.-3 COUN. KATE COSETENG		City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
				NO SPECIFICATION	1	9.34	2.85	4.39	3.28	2.13	2,349	6,156	2,997	3,159	3.68	1.79	1.89
	DIST.-3 COUN. DEFENSOR		City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
	DIST.-3 COUN. LAGUMBAY		City Hall Buildings	SPLIT TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-5 COUN. KARL CASTELO		City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
	DIST.-5 COUN. ALLAN FRANCISCO		City Hall Buildings	SPLIT TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
	DIST.-5 COUN. SHAILA LIBAN		City Hall Buildings	WINDOW TYPE	1	9.34	2.85	4.81	3.28	1.94	2,349	6,156	2,736	3,420	3.68	1.64	2.04
	DIST.-6 COUN. LALA SOTTO		City Hall Buildings	WINDOW TYPE	15	9.34	2.85	4.81	3.28	1.94	2,349	92,338	41,034	51,304	55.21	24.53	30.67
	DIST.-6 COUN. MARIVIC CO-PILAR		City Hall Buildings	WINDOW TYPE	2	9.34	2.85	4.81	3.28	1.94	2,349	12,312	5,471	6,841	7.36	3.27	4.09
	DIST.-6 COUN. DONATO MATIAS		City Hall Buildings	WINDOW TYPE	5	9.34	2.85	4.81	3.28	1.94	2,349	30,779	13,678	17,101	18.40	8.18	10.22
				FLOOR STANDING	1	9.34	2.85	4.07	3.28	2.29	2,349	6,156	3,233	2,923	3.68	1.93	1.75
				Total	1483												

Total	8,366,193	3,813,475	4,552,718	5,002	2,280	2,722
Average	5,641	2,571	3,070	3.4	1.5	1.8

Table 3-29 Calculation Results of Greenhouse Gas Reduction at Private Sector Facilities (Shopping Malls)

NO	Name	Shop Area (㎡)	HVAC Brand	HVAC System	Reference number of existing indoor units	Cooling Capacity (kW)	Reference COP	Project number of indoor units to be installed	Cooling Capacity (kW)	Project COP	Reference Electricity Consumption (kW)	Project Electricity Consumption (kW)	Reference Electricity Consumption（kWh）	Project Electricity Consumption（kWh）	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
1	GATEWAY MALL	100,000	York	Chiller	22	1650.00	5.00	15	2461.00	5.9	330.00	417.12	25,439,040	16,442,817	8,996,223	15,210.00	9,831.16	5378.84
2	U.P. TOWN CENTER	174,000	York	Chiller	38	1650.00	5.00	26	2461.00	5.9	330.00	417.12	43,940,160	28,500,883	15,439,277	26,271.82	17,040.68	9231.14
3	Fisher Mall	110,000	Trane	Chiller	24	1650.00	5.00	17	2461.00	5.9	330.00	417.12	27,751,680	18,635,193	9,116,487	16,592.73	11,141.98	5450.75
4	ALI MALL	62,000	York	Chiller	14	1650.00	5.00	10	2461.00	5.9	330.00	417.12	16,188,480	10,961,878	5,226,602	9,679.09	6,554.11	3124.99
5	ROBINSONS GALLERIA	216,000	York/DB	Chiller	48	1650.00	5.00	32	2461.00	5.9	330.00	417.12	55,503,360	35,078,009	20,425,351	33,185.46	20,973.14	12212.32
6	ROBINSONS MAGNOLIA	48,000	York	Chiller	11	1650.00	5.00	8	2461.00	5.9	330.00	417.12	12,719,520	8,769,502	3,950,018	7,605.00	5,243.29	2361.72
7	ROBINSONS NOVALICHES	55,893	York/Trane	Chiller	13	1650.00	5.00	9	2461.00	5.9	330.00	417.12	15,032,160	9,865,690	5,166,470	8,987.73	5,898.70	3089.03
8	ROBINSONS MAGNOLIA	48,000	York/Trane	Chiller	11	1650.00	5.00	8	2461.00	5.9	330.00	417.12	12,719,520	8,769,502	3,950,018	7,605.00	5,243.29	2361.72
9	SM City North EDSA	482,878	York/Trane	Chiller	106	1650.00	5.00	71	2461.00	5.9	330.00	417.12	122,569,920	77,829,334	44,740,586	73,284.56	46,534.16	26750.40
10	SM CITY STA. MESA	133,327	Trane/LG	Chiller	30	1650.00	5.00	20	2461.00	5.9	330.00	417.12	34,689,600	21,923,756	12,765,844	20,740.91	13,108.21	7632.70
11	SM CITY NOVALICHES	77,222	York/Trane	Chiller	17	1650.00	5.00	12	2461.00	5.9	330.00	417.12	19,657,440	13,154,254	6,503,186	11,753.18	7,864.93	3888.26
12	EASTWOOD MALL	47,000	York/Trane	Chiller	11	1650.00	5.00	7	2461.00	5.9	330.00	417.12	12,719,520	7,673,315	5,046,205	7,605.00	4,587.87	3017.13
13	AYALA MALLS VERTIS NORTH	106,040	Trane	Chiller	24	1650.00	5.00	16	2461.00	5.9	330.00	417.12	27,751,680	17,539,005	10,212,675	16,592.73	10,486.57	6106.16
14	AYALA MALLS CLOVERLEAF	110,000	Trane/York	Chiller	24	1650.00	5.00	17	2461.00	5.9	330.00	417.12	27,751,680	18,635,193	9,116,487	16,592.73	11,141.98	5450.75
15	Cubao Expo		Various	Split/Window Type														
16	TRINOMA (Triangle North of Manila)	195,000	Trane	Chiller	43	1650.00	5.00	29	2461.00	5.9	330.00	417.12	49,721,760	31,789,446	17,932,314	29,728.64	19,006.91	10721.73
17	FARMERS PLAZA	60,400	York	Chiller	14	1650.00	5.00	9	2461.00	5.9	330.00	417.12	16,188,480	9,865,690	6,322,790	9,679.09	5,898.70	3780.40
18	SM CITY FAIRVIEW	282,681	Trane/LG	Chiller	62	1650.00	5.00	42	2461.00	5.9	330.00	417.12	71,691,840	46,039,887	25,651,953	42,864.55	27,527.25	15337.30
19	SM CHERRY CONGRESSIONAL	13,469	Local Brand	PAC	3	1650.00	5.00	2	2461.00	5.9	330.00	417.12	3,468,960	2,192,376	1,276,584	2,074.09	1,310.82	763.27
20	FAIRVIEW TERRACES	114,000	LG	Chiller	25	1650.00	5.00	17	2461.00	5.9	330.00	417.12	28,908,000	18,635,193	10,272,807	17,284.09	11,141.98	6142.11
21	CENTRIS STATION	11,128	tba	PAC	3	1650.00	5.00	2	2461.00	5.9	330.00	417.12	3,468,960	2,192,376	1,276,584	2,074.09	1,310.82	763.27
22	HEMADY SQUARE	-	Various brand	Split-type														

Total	369

Total	627,881,760	404,493,297	223,388,463	375,411	241,847	133,564
Average	1,701,577	1,096,188	605,389	1,017	655	362

Table 3-30 Calculation Results of Greenhouse Gas Reduction at Private Sector Facilities (Hotels) (1/2)

No	Name	Address	No. of room	HVAC Brand	HVAC System	Reference number of existing indoor units	Reference Cooling Capacity (kW)	Project Cooling Capacity (kW)	Reference COP	Project COP	Reference Electricity Consumption (kW)	Project Electricity Consumption (kW)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
1	B Hotel Quezon City	14 Sct. Rallos St, Brgy, Quezon City, 1103 Metro Manila	111 rooms	AIRETECH	Chilled Water	136	5.79	5.20	3.03	4.81	1.91	1.08	682,431	386,387	296,044	408.03	231.02	177.00
2	Novotel Manila Araneta City Hotel	General Aguinaldo Ave, Araneta City, Quezon City, Metro Manila	401 rooms	Daikin	Chilled Water	492	5.79	5.20	3.03	4.81	1.91	1.08	2,468,796	1,397,812	1,070,984	1,476.09	835.75	640.34
3	Soleste Suites	193 Katipunan Avenue Blue Ridge, Quezon City		tba	tba													
4	Eastwood Richmonde Hotel	17 Orchard Road, Eastwood City, Bagumbayan,	138 rooms	Sanyo/Mitsubishi/Carrier	Chilled Water & Split-type	169	5.79	5.20	3.03	4.81	1.91	1.08	848,021	480,143	367,879	507.03	287.08	219.95
5	Luxent Hotel	51 Timog Ave, Diliman, Quezon City, 1103 Metro Manila	117 rooms	DAIKIN	Split-type	143	5.79	5.20	3.03	4.81	1.91	1.08	717,557	406,275	311,282	429.03	242.91	186.12
6	Microtel by Wyndham UP Technohub	Commonwealth Avenue, UP Ayala Land Technohub, Quezon City, Manila, 1121, Philippines	120 rooms	Samsung/daikin	Split-type	147	5.79	5.20	3.03	4.81	1.91	1.08	737,628	417,639	319,989	441.03	249.71	191.32
7	The Sulo Riviera	Matalino St, Diliman, Quezon City, 1100 Metro Manila	70 rooms	Various brands	Split-type	86	5.79	5.20	3.03	4.81	1.91	1.08	431,538	244,333	187,205	258.02	146.09	111.93
8	West Avenue Suites	West Ave, Quezon City	91 rooms	Daikin/Other Brand	Split-type	112	5.79	5.20	3.03	4.81	1.91	1.08	562,002	318,201	243,801	336.02	190.25	145.77
9	BRENTWOOD SUITES	6 Dr Garcia Sr., Diliman, Quezon City, Metro Manila	74 rooms	Hitachi	Chilled Water & Split-type	91	5.79	5.20	3.03	4.81	1.91	1.08	456,627	258,538	198,089	273.02	154.58	118.44
10	Meranti Hotel	82 Scout Castor St, Tomas Morato Ave, Quezon Cit	60 rooms	tba	tba	74	5.79	5.20	3.03	4.81	1.91	1.08	371,323	210,240	161,083	222.01	125.70	96.31
11	SEDA VERTIS NORTH	Sola corner Lux Drives, Vertis North Quezon City, 1105 Philippines	438 rooms	Trane	chilled water tapped from mall	537	5.79	5.20	3.03	4.81	1.91	1.08	2,694,601	1,525,661	1,168,940	1,611.10	912.19	698.91
12	Park Inn by Radisson North EDSA	North Avenue corner EDSA SM City North EDSA Complex, Quezon City, 1105 Metro Manila	238 rooms	tba	tba	292	5.79	5.20	3.03	4.81	1.91	1.08	1,465,221	829,596	635,625	876.06	496.02	380.04
13	Hotel Dream World Araneta Center	General Roxas Ave, Cubao, Quezon City		Panasonic	Window & Split-type													
14	SEQUOIA HOTEL	91-93 Mother Ignacia Avenue, corner Timog Ave, Quezon City	137 rooms	Various brands	Split-type	168	5.79	5.20	3.03	4.81	1.91	1.08	843,004	477,302	365,702	504.03	285.38	218.65
15	Camelot Hotel	35 Mother Ignacia Ave, Diliman, Quezon City		tba	tba													
16	The Grass Residence	Nueva Viscaya, Bago Bantay, Lungsod Quezon		tba	tba													
17	Great Eastern Hotel	1403 R-7, Quezon Ave, Diliman, Quezon City	287 rooms	tba	tba	352	5.79	5.20	3.03	4.81	1.91	1.08	1,766,293	1,000,061	766,233	1,056.07	597.94	458.13
18	Madison 101 Hotel + Tower	Aurora Blvd, corner Madison, New Manila, Quezon City	48 rooms	Daikin	Split-type	59	5.79	5.20	3.03	4.81	1.91	1.08	296,055	167,624	128,431	177.01	100.22	76.79
19	Cocoon Boutique Hotel	61 Scout Rallos St, cor Sct. Tobias St, Diliman, Quezon City, 1103 Metro Manila	39 rooms	tba	tba	48	5.79	5.20	3.03	4.81	1.91	1.08	240,858	136,372	104,486	144.01	81.54	62.47
20	Haeinsa Condotel	23 Makisig St, Diliman, Quezon City, 1100 Metro Manila		tba	Window-type													
21	Eurotel Vivaldi Araneta	629 EDSA Cubao, Quezon City	99 rooms	Panasonic	Window & Split-type	121	5.79	5.20	3.03	4.81	1.91	1.08	607,163	343,771	263,392	363.02	205.54	157.48
22	Microtel by Wyndham Acropolis	E. Rodriguez Jr. Ave., Brgy. Bagumbayan, Quezon City 110 Philippines	84 rooms	Panasonic	Split-type	91	5.87	5.20	2.96	4.81	1.98	1.08	474,256	258,538	215,718	283.56	154.58	128.98
22	Microtel by Wyndham Acropolis	E. Rodriguez Jr. Ave., Brgy. Bagumbayan, Quezon City 110 Philippines		Daikin	Split-type	12	5.20	5.20	3.59	4.81	1.45	1.08	45,679	34,093	11,586	27.31	20.38	6.93
23	Crowne Plaza Manila Galleria	Corner Asian Development Bank Ave, Ortigas Ave, Ortigas Center, Quezon City, 1100 Metro Manila	263 rooms	Trane / Daikin	Chilled Water & Split-type	322	5.79	5.20	3.03	4.81	1.91	1.08	1,615,757	914,828	700,929	966.06	546.98	419.09

Table 3-31 Calculation Results of Greenhouse Gas Reduction at Private Sector Facilities (Hotels) (2/2)

No	Name	Address	No. of room	HVAC Brand	HVAC System	Reference number of existing indoor units	Reference Cooling Capacity (kW)	Project Cooling Capacity (kW)	Reference COP	Project COP	Reference Electricity Consumption (kW)	Project Electricity Consumption (kW)	Reference Electricity Consumption (kWh)	Project Electricity Consumption (kWh)	Electricity Saving (kWh)	Reference Emissions (t-CO2)	Project Emissions (t-CO2)	CO2 Reduction (t-CO2)
24	Red Hotel Cubao	627 Epifanio de los Santos Ave, Cubao, Quezon City, 1111 Metro Manila	199 rooms	Samsung/Xtreme	Split-type	244	5.79	5.20	3.03	4.81	1.91	1.08	1,224,362	693,224	531,139	732.05	414.48	317.57
25	Stone House Hotel	1315 E Rodriguez Sr. Ave, New Manila, Quezon City	70 rooms	Kolin	Window & Split-type	86	5.79	5.20	3.03	4.81	1.91	1.08	431,538	244,333	187,205	258.02	146.09	111.93
26	Regal Residences	Lot Block 135, 13 Regalado Hwy, Novaliches, Quezon City		Haeir	Window & Split-type													
27	Prime Hotel	70 Sgt. Esguerra St. Quezon City Philippines 1103	39 rooms	LG	Split-type	48	5.79	5.20	3.03	4.81	1.91	1.08	240,858	136,372	104,486	144.01	81.54	62.47
28	Verjandel Hotel	70 Kalayaan Ave, Diliman, Quezon City	68 rooms	tba	tba	83	5.79	5.20	3.03	4.81	1.91	1.08	416,484	235,810	180,674	249.02	140.99	108.03
29	H Hotels - Metro North Uno	89 Rd 1, Brgy, Quezon City		Kolin	Window Type													
30	Red Planet Quezon Timog	100 Timog Ave, Diliman, Quezon City		Panasonic / Koppel	Window Type / Split-type													
31	The Cirque Serviced Residences	Bagumbayan, Quezon City	55 rooms	Samsung	Split-type	67	5.79	5.20	3.03	4.81	1.91	1.08	336,198	190,352	145,845	201.01	113.81	87.20
32	Icon Hotel - North Edsa	967 EDSA, corner West Ave, Quezon City		Panasonic	Window Type													
33	Fernandina 88 Suites Hotel	222 P. Tuazon Blvd, Cubao, Quezon City		Koppel & LG	Split-type													
34	Hotel 99	#8 Pinatubo St, Corner Matulin, Cubao, Quezon City		LG	Window Type													
35	MaxStays - Max Style @ One Eastwood Avenue	One Eastwood, One, 1800 Eastwood Ave, Bagumbayan, Quezon City		Panasonic	Split-type													
36	Hotel Dream World North Edsa	967 EDSA cor. West Avenue Barangay Philam, Quezon City	96 rooms	Panasonic	Window & Split-type	118	5.79	5.20	3.03	4.81	1.91	1.08	592,110	335,248	256,862	354.02	200.44	153.58
37	Hotel Rembrandt	26 Tomas Morato Ave. Diliman Quezon City	71 rooms	Daikin/Carrier/ Samsung	Chilled Water	87	5.79	5.20	3.03	4.81	1.91	1.08	436,555	247,174	189,381	261.02	147.79	113.23
38	Fersal Hotel	No. 245 P. Tuazon Boulevard Cubao, Quezon City, Manila, Philippines	68 rooms	Panasonic	Chilled Water & Split-type	83	5.79	5.20	3.03	4.81	1.91	1.08	416,484	235,810	180,674	249.02	140.99	108.03
39	Fersal Hotel Kalayaan	No. 130 Kalayaan Avenue Diliman, Quezon City, Manila, Philippines	49 rooms	Various brands	Window Type	60	5.79	5.20	3.03	4.81	1.91	1.08	301,073	170,465	130,608	180.01	101.92	78.09
40	Fersal Hotel Malakas	131 Malakas Street, Diliman, Quezon City, Manila, 1100, Philippines	49 rooms	Various brands	Window Type	60	5.79	5.20	3.03	4.81	1.91	1.08	301,073	170,465	130,608	180.01	101.92	78.09
41	Red Planet Aurora Boulevard - Quezon City	901 Stanford St., corner of Aurora Blvd, Cubao, Quezon City, 1109, Philippines	167 rooms	Koppel	Window Type / Split-type	205	5.79	5.20	3.03	4.81	1.91	1.08	1,028,665	582,422	446,243	615.04	348.23	266.81
					Total	4,593						Total	23,050,210	13,049,085	10,001,124	13,782	7,802	5,980
												Average	5,019	2,841	2,177	3.00	1.70	1.30

3.5 Future Vision and Plans

Efforts will be made to implement programs on a large scale in order to reduce greenhouse gas emissions in the cooling sector in Quezon City, based on the model project considered in Chapter 2. Furthermore, the implementation of a model project that applies JCM facility assistance will lead to the establishment of methodology, hence, enabling application of the JCM eco-lease system. For that purpose, suitable recovery/destruction of fluorocarbons, promotion of E-waste measures and effective utilization of the green labeling system will be considered in cooperation with the Department of Environment and Natural Resources to increase the effect of project implementation. For financing, it can be expected that the Japan Fund for the Joint Crediting Mechanism (JFJCM) of the Asia Development Bank can be used in addition to JCM facility assistance.

Furthermore, since only limited information on local private sector facilities could be obtained due to the impact of the coronavirus pandemic, a field survey needs to be conducted in the next fiscal year or later, too, in order to increase the accuracy of the energy savings effects brought about by the replacement of air conditioning systems.

Chapter 4 Review Concerning Fluorocarbon Processing Involved with Energy Saving Air Conditioning

4.1 Survey of Fluorocarbon Processing

4.1.1 Relationship of Air Conditioners and Fluorocarbons

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 eleven thousands 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.

In Japan, the “Act on the Rational Use and Proper Management of Fluorocarbons” has been enacted to stipulate comprehensive measures for the entire life cycle of commercial refrigerators and air conditioners from the production to the disposal of fluorocarbons, and the “Home Appliance Recycling Law” has been enacted for the recovery of fluorocarbons from household air conditioners. The “Act on the Rational Use and Proper Management of Fluorocarbons” obligates users of commercial refrigerators and air conditioners to turn them over to fluorocarbon recovery operators when they are disposed (to recover fluorocarbon refrigerant), and to make reports on the inspection and leakage volume when managing and using equipment utilizing fluorocarbons.

4.1.2 Efforts in Philippines Related to Fluorocarbons

(1) Formulation of National Law Regulating Fluorocarbons

The main law in the Philippines concerning fluorocarbons consists of a law enacted to support implementation of the “Fluorocarbon Reduction Plan” supported by a multilateral fund with the objective of reducing ODS etc. based on the “Ozone depleting substance (ODS) phase-out projects under the Montreal Protocol”. Administrative Order DAO2013-25 which regulates HCFCs prohibited the import of HCFC-141b and pre-blended polyols for the manufacturing of foam in January 2015, and prohibited the import of HCFC-22 for the manufacturing of freezers, refrigerators and air conditioners in January 2020, ending the manufacturing of air conditioners that use HCFC-22 in the country, and a shift to technology that uses HFC was effected.

Memorandum Circular No. 2005-03 for the "Act to Control Toxic Substances and Hazardous and Nuclear Waste" (RA6969) obligates importers of HFCs and other involved companies to submit a report to the Environmental Management Bureau every year, and stipulates penalties for violations. Importers of HFCs are required to obtain a Pre-shipment Importation Clearance (PSIC) before importing HFCs into the Philippines.

Since there is not a law that regulates the import of HFCs, the "Chemical Control Order for HFC Phase Down" is currently being drawn up in the Philippines. As of December 2020, the Kigali Amendment to phase down HFCs in the Philippines had not been ratified, but a conference of concerned organizations concerning laws regulating HFCs was held in September 2020 with the goal of ratifying the amendment by the end of 2021, and coordination activities and procedures are proceeding in order to obtain agreement.

Table 4-1 Regulatory Status Concerning Fluorocarbons in Philippines

Regulatory Content	Formulation Status
Fluorocarbon (CFC, HCFC) import regulations	O
Fluorocarbon (HFC) import regulations	Being formulated
Regulation for collection/recovery/destruction of fluorocarbons	X

(2) Formulation of Domestic Law Concerning Recovery and Destruction of Fluorocarbons

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.

The annual consumption volume of CFCs and HCFCs has decreased, 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.

Section 3 of DAO2013-25 specifies that "There should be limits / regulations for the disposal, storage and destruction of CFCs and HCFCs", but it does not describe the concrete fluorocarbon processing/destruction process. The Department of Environment and Natural Resources (DENR) is currently formulating a Memorandum Circular for DAO2013-25 to regulate storage and disposal of fluorocarbons and to enhance the effectiveness of DAO2013-25. This Memorandum Circular will require fluorocarbons be transported to recovery and destruction facilities from the users of equipment that contain fluorocarbons, and it is expected that Section 6 of the Memorandum Circular will stipulate a penalty. On the other hand, it is expected the burden of costs by users will not be stipulated.

(3) Formulation of Domestic Regulations for Users of Equipment Utilizing Fluorocarbons

In order to facilitate the sustainable recovery and destruction of fluorocarbons in a suitable manner, the country needs to establish regulations for recovery and destruction, and clarify the policy for the bearing of costs. Efforts are proceeding to destroy fluorocarbons with the Memorandum Circular for DAO2013-25, but the structure for the bearing of the cost is an issue that needs to be addressed. Laws similar to the "Act on the Rational Use and Proper Management of Fluorocarbons," "Home Appliance Recycling Law" and "Act on Recycling etc. of End-of-Life Vehicles" in Japan that clarify the user burden need to be enacted in order to recover fluorocarbons discharged from E-waste and scrapped vehicles. Due to the fact that there are not laws or regulations in the Philippines that require the recovery and destruction of fluorocarbons, and there is not a structure in the country for the recovery and destruction of fluorocarbons, there is not a framework for users to recover fluorocarbons.

(4) Domestic Regulations Concerning E-waste

There are not regulations in the Philippines concerning the comprehensive management of E-waste. A large volume of E-waste, including freezers, refrigerators and air conditioners that contain fluorocarbons are purchased by junk shops, repair shops and other such shops in the informal sector, and these shops retrieve the parts of value, but discard the remaining parts without disposing of them in a suitable manner. In general, it seems that fluorocarbons are not recovered and are discharged without being treated. E-waste from companies is processed by industrial waste disposal companies, but almost all fluorocarbons are not recovered or processed.

Formulation of the "Guidelines on the Environmentally Sound Management of Waste Electrical and Electronic Equipment (WEEE)" proceeded in 2015 to create a suitable management framework for E-waste, but the guidelines have not been enacted. The draft for these guidelines prohibits the storage, recycling, processing, treatment or disposal of E-waste at other than licensed TSD facilities. In addition, the draft stipulates that Material Recovery Facilities (MRF) operated by local governments should sort E-waste from households.

4.2 Survey Concerning Support for Capacity Building

(1) Role and Current Status of Quezon City related to Fluorocarbons

The basic policy outlined in the Waste Disposal Law in Japan requires that all local governments establish a four category recovery structure for household appliances being disposed that include air conditioners for which the retailer is not obligated to collect these items. Residents need to be notified of the suitable disposal methods for the four categories of household appliances on the website, newsletter, garbage calendar or other media published by the local government. In addition, activities by illegal unwanted item recovery operators and illegal scrapyard operators as well as illegal dumping are violations of the Waste Disposal Law, and local and prefectural governments are required to implement appropriate measures.

Under the Act on the Rational Use and Proper Management of Fluorocarbons, local and

prefectural governments are required to perform registration and on-the-spot inspections for fluorocarbon filling and recovery operators, and conduct training and on-the-spot inspections for fluorocarbon management and maintenance operators.

In the Philippines, there are not comprehensive regulations for the management of E-waste, and Quezon City is not taking the responsibility as a local government for the processing and management of E-waste. In the same manner, the country does not have regulations for the recovery and destruction of fluorocarbons, no system has been established, and local governments are not involved in the management of fluorocarbons.

(2) Status Concerning E-waste in Quezon 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 country is attempting to promote the sorting of E-waste by establishing recycling facilities (MRF) in areas managed by local governments to facilitate management of E-waste by local governments. Multiple MRFs have been established in Quezon City, while the program to establish MRFs has not proceeded in many local government jurisdictions. The MRFs that have currently been established are recovering, sorting and storing paper, bottles and recycled materials for composting. However, none of the MRF facilities established in Quezon City is suited to the collection and sorting of E-waste.

(3) Consideration of Support of Quezon City by Osaka City

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.

As progress is made in the Philippines in the future with the enactment of regulations, it is

envisioned that support for strengthening the practical capabilities of the staff in local government related to the recovery/destruction of fluorocarbons and management of E-waste will be provided by Osaka City as an integral part of the cooperation it provides under intercity cooperation projects. Furthermore, the experience of Osaka City can also be used for the education of the citizens of Quezon City and companies located in Quezon City who are the users.

(4) Information Provided Concerning Green Procurement by Osaka City

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.

When replacing air conditioners, Quezon City will consider whether or not to require the supplier to process the fluorocarbons in a suitable manner, using the green procurement policy of Osaka City (Appendix 4-1) as reference. Since the suitable processing of fluorocarbons is a requirement when applying JCM facility assistance, it will have an impact on the disbursement of subsidies. It is expected that environmental issues will be used as a reference when Quezon City replaces air conditioners in the future.

4.3 Survey Concerning Recovery and Destruction of Fluorocarbons

4.3.1 Fluorocarbon Recovery Operators

At this point in time, the only fluorocarbon recovery operating company in the Philippines that has been authorized by the Environmental Management Bureau is a company located in Metropolitan Manila, Delsa, which received financial support when the fluorocarbon reduction plan was implemented with multilateral support. Delsa only recovers fluorocarbons in Metropolitan Manila.

When fluorocarbons are recovered according to the fluorocarbon reduction plan, the air conditioning maintenance companies that have contracted with Delsa deliver the recovered fluorocarbons to Delsa, and purchase new fluorocarbon from Delsa that is used to fill air conditioners. Delsa itself was implementing fluorocarbon recovery from large commercial air conditioners. The cost required to recover fluorocarbon once from one location is 50USD.

Fluorocarbon recovery devices that are used to recover the old fluorocarbon by air conditioning maintenance companies have been widely used. It is said that Delsa restores the fluorocarbon that does not contain a high level of impurities with a regenerator, and sells it at 50-70% of the price of new refrigerant. However, it appears that the amount of fluorocarbons that can be recovered is not so large since this depends on the capacity of the technicians and the purity of the collected fluorocarbon.

Due to the fact that the fluorocarbon storage area and the number of cylinders capable of storing fluorocarbon are near their limit, Delsa suspended new collection of fluorocarbon last year. Fluorocarbons collected by air conditioning maintenance companies are not currently being delivered to Delsa.

Fluorocarbon Recovery Device

Fluorocarbon Type/Purity Detector

Fluorocarbon Regenerator

4.3.2 Requirements for Fluorocarbon Recovery Company Certification

In the Philippines, companies that perform fluorocarbon recovery need to register as a Treatment, Storage and Disposal (TSD) facility, and obtain a license from the Environmental Management Bureau. The fluorocarbon recovery company will be certified if it satisfies the requirements designated by the Environmental Management Bureau, but the environment for the collection of E-Waste, structure for the bearing of disposal costs, and requirements for fluorocarbon recovery and destruction as a business have not been developed. Consequently, no other companies have been certified as recovery operators since there is not an incentive to become a fluorocarbon recovery operator.

Fluorocarbon recovery operators are classified as a category F TSD facility, and are designated as a “Storage facility for the treatment, disposal and export of hazardous waste that is not generated by the relevant facility”.

4.3.3 Candidate Facilities for Introduction of Fluorocarbon Destruction Machines

Destruction of fluorocarbons is not being performed in the Philippines. The use of cement / lime rotary kiln mixing type cement kilns has been suggested as candidate facilities for the destruction of fluorocarbons in the Philippines. The Holcim Cement Plant and Republic Cement Plant are located in Northern Luzon. Cement kilns can operate at a temperature of 1450 degrees which is adequate to destroy fluorocarbons. A cement kiln of Holcim of the same size in Indonesia has succeeded in destroying 0.5 tons of fluorocarbon in one hour.

It is said that the only modification of a cement kiln needed to destroy fluorocarbons is the connection of pipes from the fluorocarbon cylinders to the kiln burner, with no special facilities being needed nor extensive costs required for the modifications. The initial cost of modifications of a cement kiln in Japan amounted to USD 25,000 excluding labor costs. In addition, past case studies in Japan indicate the cost required for destruction of 1 kg of CFC is 4 to 6USD. Holcim does not have a plan to modify its cement kiln to destroy fluorocarbons at this point in time, but

we understand that it is interested in fluorocarbon destruction service as a business if it can receive a suitable fee, including transportation costs.

Cement Kiln Burner

Fluorocarbon Injection (Example in Indonesia)

The other candidate for the fluorocarbon destruction method is installing of new dedicated fluorocarbon destruction machines at facilities of fluorocarbon recovery operators. However, due to the fact that the new introduction of a dedicated fluorocarbon destruction machine requires the purchase / transport / installation of new equipment and the training of technicians who operate the machine, it is expected that it will take more time and cost than modification of a cement kiln

4.3.4 Requirements for Certification of Fluorocarbon Destruction Operator

In the same manner as for recovery of fluorocarbons, operators that perform destruction need to be registered as a Treatment, Storage and Disposal (TSD) facility, and obtain a license from the Environmental Management Bureau. At this point in time, there are not any fluorocarbon destruction operators that have been licensed as a TSD facility. Fluorocarbon destruction operators are classified to category B. The required procedures for a category B TSD facility obtained in an interview of POD are compiled below.

Table 4-2 Registration of TSD Facility as Fluorocarbon Destruction Operator

Item	Procedure
Category B	Facility that commercially disposes hazardous industrial waste using combustion or non-combustion thermal technology. (B1: Plasma arc, thermal decomposition, gasification, rotary or fluidized bed incinerator, cement kiln or other combustion technology, B2: Autoclave, microwave, sterilization, hydroclave, irradiation or other non-combustion technology)
Required Documents	• Formal request letter to person in charge in region • Formal registration for hazardous waste disposal • Copy of Environmental Compliance Certificate (ECC) or Certificate of Non Correspondence (CNC) • Copy of solid resource operator license • Copy of wastewater discharge license • Copy of Initial Environmental Assessment Examination (IEE) or Environmental Impact Statement (EIS) • Detailed explanation of each disposal/recycle process specifying all by-products and residuals and process flow diagram • License certificate of person in charge of pollution prevention • Storage management plan for raw materials, residuals, by-products and end products • Long-term plan for recycled / processed / end products • Photos of treatment and storage facilities • Accountability declaration (officially effective)

	• Fiscal resource certificate • Registration fee per facility: 15,000 Philippine Pesos

Source: POD

4.4 Latest Trends Related to Fluorocarbons in the Philippines

4.4.1 Statistical Information Related to Fluorocarbons

Fluorocarbons are imported from overseas, and are not produced in the Philippines. Fluorocarbons can be imported to the Philippines by companies that have registered with the Department of Environment and Natural Resources (DENR). The DENR determines the annual fluorocarbon import allocation for each importer, and verifies the type and volume of fluorocarbons being imported. The Philippine Ozone Desk (POD) collects and manages monthly statistical data on the import volume of each type of fluorocarbon. However, it only ascertains the import volume for the type of fluorocarbon as the volume imported in a tank or other container as a chemical substance. The POD is not aware of the volume of imported fluorocarbons that are contained in air conditioners, vehicles and other completed products.

The consumption of CFCs and HCFCs is decreasing. The import volume of HFCs can be verified from statistics of 2007 and later, showing that consumption has increased in recent years.

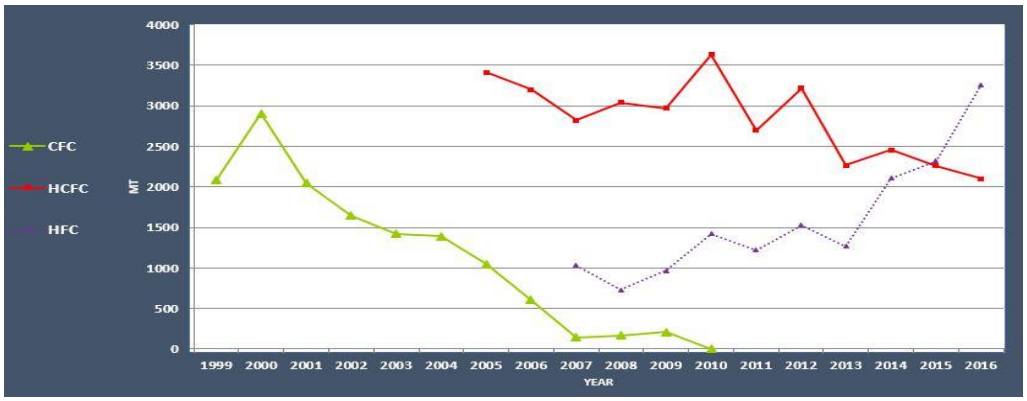


Figure 4-1 Change in Consumption of Fluorocarbons and Alternative Fluorocarbons in the Philippines (1999 – 2016)

Source: POD

The import volume of HCFCs that were imported into the Philippines as a chemical substance from 2013 to 2019 is shown in the table below. The import volume of HCFCs decreased after the commencement of import restrictions.

Table 4-3 HCFC Import Volume (Kg) (2013 – 2019)

	2014	2015	2016	2017	2018	2019
HCFC-141b	390,640.00	159,720.00	153,580.00	183,456.00	144,495.60	110,980.00
HCFC-22	1,860,032.40	1,837,425.60	1,685,118.80	1,653,691.00	1,615,380.25	1,643,243.40
HCFC-123	66,071.20	66,125.00	66,060.00	57,132.00	57,130.15	57,134.30
HCFC-142b	0.00	0.00	0.00	0.00	0.00	0.00
HCFC-225ca	420.00	1,520.00	210.00	307.00	14.95	381.70
HCFC-225cb	420.00	1,520.00	210.00	308.00	16.03	383.20
Additional Allocation	140,000.00	161,215.00	197,000.00	0.00	0.00	0.00
Total	2,457,583.60	2,227,525.60	2,102,178.80	1,894,894.00	1,817,036.97	1,814,141.70

Source: POD

The import volume of HFCs that were imported into the Philippines as a chemical substance from 2013 to 2019 is shown in the table below. The import volume of HFCs has increased in recent years due to the introduction of import restrictions for HCFCs. In the Philippines, HFCs are mainly used for air conditioners (including chillers and as refrigerant used for transport) and commercial freezers, refrigerators and other such equipment. One company in the Philippines that manufactures refrigerators has made a shift and started to use isobutene (R-600a), which may have resulted in the reduced import volume of HFC-134a in 2019. The import volume is high for R-134a (air conditioners, vehicle refrigerant), R-404a (freezers), R-410a (air conditioners) which have a high GWP value and high level of consumption.

Table 4-4 HFC Import Volume (Kg) (2013 – 2019)

	2014	2015	2016	2017	2018	2019
R-23	90.00	585.00	0.00	360.00	0.00	1,660.00
R-32	6,764.00	8,032.00	15,781.00	28,520.00	42,740.00	233,245.00
R-134a	1,347,813.36	1,291,421.46	1,677,772.78	1,637,346.76	1,992,752.83	1,673,001.10
R-404a	205,366.5	170,400	301,593.1	311,583.23	378,097.00	395,769.15
R-407c	41,115.00	27,172.00	51,730.50	52,143.20	102,288.50	64,352.60
R-410a	383,560.40	311,586.00	681,610.95	778,364.70	1,235,469.80	788,402.50
R-417a	0.00	0.00	204.3	737.00	226.00	1,359.50
R-507	39,847.90	29,712.70	53,505.50	57,849.70	93,168.50	101,504.00
R-508b	144.00	135.00	275.00	174.00	340.00	430.00
HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	1,615.70	3,590.35	1,406.78	19,480.04	4,554.13	14,939.18
HFC-236fa	54,200.00	23,700.00	6,298.00	44,400.00	138,100.00	98,100.00
HFC-245fa	12,386.4	0.00	0.00	13,205.00	31,000.00	32,000.00
HFC-43-10mee	875.00	0.00	0.00	0.00	0.00	0.00
Total	2,095,792.26	1,868,349.51	2,792,193.91	2,946,180.63	4,020,754.76	3,406,782.03

Source: POD

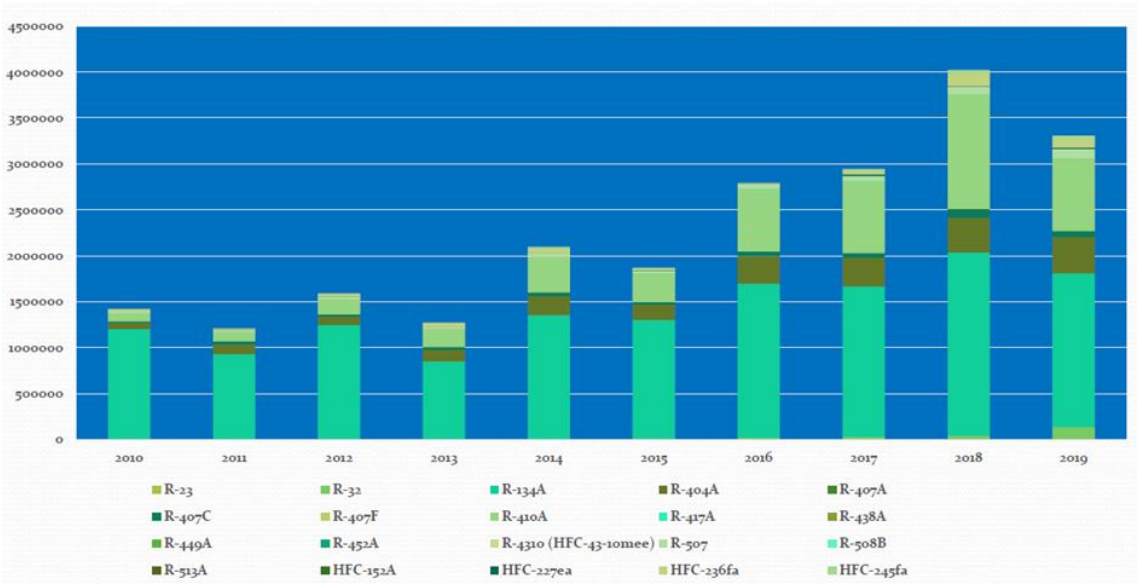


Figure 4-2 Change in HFC Consumption in the Philippines (2010 – 2019)

Source: POD

Chapter 5　Support for Quezon City Environmental Policies

5.1 Status of Intercity Cooperation

5.1.1 Background

In Quezon City, various environmental policies for waste, energy, transportation and other issues that have become evident have been driven by the rapid urbanization. These policies are designed to make it a highly livable, green, sustainable and resilient city. Based on the Quezon City Local Climate Change Action Plan 2017-2027, the city is implementing efforts to achieve the goals of Food Security, Water Sufficiency, Ecological and Environmental Stability, Human Security, Climate-Smart Industries and Services, Sustainable Energy and Knowledge and Capacity Development. Quezon City is an environmentally advanced city, and is the only city in the Philippines that has joined C40 (C40 Cities Climate Leadership Group). In 2020, it was one of 88 cities in the world that was given the highest A rating in the environmental measure level assessment implemented by the Carbon Disclosure Project (CDP).

A number of workshops have been held in the climate change response field, including the “Regional Workshop for Low-carbon Technology Development and Transfer” sponsored by the Ministry of the Environment and “JCM City-to-City Collaboration Workshop”. In the waste management field, Hitachi Zosen Corporation and EX Research Institute Ltd. implemented a feasibility study from fiscal 2015 to fiscal 2016 concerning a waste power generation project in Quezon City as the project was selected as a “Recycling Industry Overseas Development Promotion Project” promoted by the Ministry of the Environment of Japan. Osaka City supported efforts of this survey project and the improvement of waste management by Quezon City, by participating in a local workshop related to this project and by cooperating in offering training in Japan.

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 to Achieve a Low Carbon Society” sponsored by the Ministry of the Environment of Japan. 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 fiscal 2015.

5.1.2 Status of Support by Osaka City

While the relationship of cooperation between Quezon City and Osaka City is deepening through the city-to-city collaboration in the waste field and other areas, discussions were held between these cities in fiscal 2017 with the objective of establishing a mid to long term intercity relationship of cooperation to facilitate the creation of a low carbon city. At the “Regional 3R Forum in Asia and the Pacific” held in Indore, India in April 2018, both cities made a joint statement on the strengthening of cooperation between the cities. 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.

Signing of MOU (August 2018)

In this MOU, both cities agreed to formulate standards and systems that support low carbon policies of Quezon City, share expertise and knowledge to develop a low-carbon city, promote public-private partnership projects in the field of climate change and environmental conservation and proceed with capacity development as part of steady progress in implementing low-carbon policies, as well as agreed to continue to have a policy dialog at mayoral level once a year. After the MOU was signed, the first mayoral-level policy dialog was held, during which both sides exchanged opinions on the latest measures for climate change.

In May 2019, Mr. Tanaka, then Vice Osaka City Mayor, visited Quezon City and participated in the second mayoral-level policy dialog 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.

Second Mayoral-level Policy Dialog (May 2019)

5.1.3 Seminars / Workshops

(1) 11th “High-Level Seminar on Sustainable Cities”

After the “Environmentally Sustainable Cities” were selected for a priority activity field for environmental cooperation at the first East Asia Summit (EAS) Environment Ministers Meeting held in Vietnam in 2010, the “High-Level Seminars on Sustainable Cities” have been held once a year. The focus was placed on “Sustainable Cities” starting from the 9th seminar in consideration of the 2030 Agenda and the Paris Agreement, and plans called for the 11th seminar to be held in Manila in March 2020 (Appendix 5-1).

As the impact on the lives of people due to climate change is strengthening, the need is increasing to make efforts to address socioeconomic issues such as poverty, starvation and resilience. Therefore, “Localizing the SDGs: Enhancing synergies and coherence” was specified as the main theme in order to utilize the synergistic effects of measures to address climate change and development issues in order to avoid trade-offs. In addition, plans called for this seminar to be used as the opportunity to schedule a bilateral meeting between the Secretary of Environment and Natural Resources in the Philippines and the counterpart in Japan, at which time efforts related to fluorocarbons would be discussed.

However, the seminar was postponed due to the impact of the coronavirus pandemic, and was held online September 29 – 30, 2020, sponsored by the Ministry of the Environment of Japan, the Department of Environment and Natural Resources of the Philippines, the ASEAN Secretariat, and the ASEAN Working Group on Environmentally Sustainable Cities. Approximately 150 persons participated from the 15 countries in the East Asia Summit (EAST), from national and local governments, international organizations and private sector companies, to discuss on the main theme of creating sustainable and resilient society through localization of SDGs by cities. Quezon City made a presentation on its efforts to improve environmentally friendly sustainable clean transport, reduce disposable plastics, enhance flood control, facilitate conversion of open spaces, and improve the hygienic environment / waste management, with a focus on the synergistic effects of environmental management and coronavirus measures (Appendix 5-2). In addition, Osaka City introduced the status of a review of its global warming measure execution plan and the city’s advanced efforts to expand and promote the use of renewable energy, unused energy, new energy and next-generation vehicles (Appendix 5-3).

Table 5-1 11th "High-Level Seminar on Sustainable Cities" Program (1st Day)

DAY 1: Tuesday, 29 September 2020 Philippine Time: PHT (UTC+8) / Japan Standard Time: JST (UTC+9)	
Opening Session	
Moderator: Dr. K. Nagulendran Chair of ASEAN Working Group on Environmentally Sustainable Cities (AWGESC); Deputy Secretary General (Environment), Ministry of Environment and Water, Malaysia	
10:00 PHT 11:00 JST	**Opening Remarks** • **Mr. KONDO Tomohiro,** Vice Minister for Global Environmental Affairs, Ministry of the Environment, Japan • **Atty. Jonas R. Leones,** Undersecretary for Policy, Planning and International Affairs, Department of Environment and Natural Resources, the Philippines
10:15 PHT 11:15 JST	**Messages from Cities "Sustainable and Resilient Cities in New Normal"** • **Mr. KATAYAMA Kenya,** Mayor, Niseko Town, Hokkaido • **Mr. SHIMIZU Hayato,** Mayor, Saitama City (Video Message) • **Ms. Andrea Valentine A. Villaroman,** Head, Environmental Protection and Waste Management Department, Quezon City Government *The speech of Mr. Chansouk PHANDOLAK. Mayor, Luang Prabang, Lao PDR is cancelled According to circumstances.*
10:50 PHT 11:50 JST	**Presentations and Discussion** • **Mr. Curt Garrigan,** Chief, Sustainable Urban Development Section, Environment and Development Division, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) • **Mr. Saiful Adib bin Abdul Munaff,** Director of Sustainable Cities, Malaysian Green Technology Corporation, Malaysia • **Dr. Pornpimol Varathorn,** Director of Public Participatory Promotion Bureau, Department of Environmental Quality Promotion, Ministry of Natural Resources and Environment, Thailand
11:15 PHT 12:15 JST	Closure of the Session
Thematic Session	
Segment 1: Progress of the SDGs at Local Level	
Moderator: Dr. Premakumara Jagath Dickella GAMARALALAGE the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET)	
13:00 PHT 14:00 JST	• **Mr. Pak Sokharavuth,** Deputy Director General, General Directorate of Environmental Protection, Ministry of Environment, Cambodia • **Ms. MURAKAMI Emiko,** Director of Business Promotion Division, Asian Center for Low Carbon Society, City of Kitakyushu • **Mr. Novrizal Tahar,** Director of Solid Waste Management, Ministry of Environment and Forestry, Indonesia • **Mr. Nguyen Huy Hoang,** Director of Planning and Finance Department, Viet Nam Administration of Seas and Islands, Viet Nam • **Mr. IWASAKI Fusanori,** Executive Assistant to President, Economic Research Institute for ASEAN and East Asia (ERIA) • **Mr. Omar Siddique,** Economic Affairs Officer, Environment and Development Division UN ESCAP, and **Ms. Miho Hayashi,** Programme Manager, CCET/IGES • **Mr. Kanchit Manoonphol,** Deputy Mayor, Nakhon Si Thammarat City Municipality
14:00 PHT 15:00 JST	*Break (5 min.)*
Segment 2: Climate related Initiatives	
Moderator: Mr. Emani Kumar ICLEI Deputy Secretary General and Regional Director, ICLEI South Asia Secretariat	
14:05 PHT 15:05 JST	**Framing Presentation by Moderator** • **Mr. SHIBUYA Jun,** Deputy Director, Environmental Strategy Division, Environmental Policy Bureau, Ministry of the Environment, Japan • **Mr. Albert A. Magalang,** Chief, Climate Change Division, Environmental Management Bureau, Department of Natural Resources and Environment, the Philippines • **Mr. MICHIGAMI Ryutaro,** Deputy Director for International Cooperation Environment Bureau, Osaka City, Japan • **Ms. Erni Pelita Fitratunnisa,** Head of Environmental Management and Cleanliness of Environmental Management Agency - Jakarta City • **Dr. KANG Sang In,** Chief Research Fellow, Korea Environment Institute (KEI)
15:05 PHT 16:05 JST	Closure of the Session

Source: IGES

(2) “Seminar on City-to-City Collaboration to Develop Decarbonized Cities”

The main point of the new strategy concerning overseas infrastructure development (July 2020) of the Japanese Ministry of the Environment designates a basic policy of promoting “Support of infrastructure exports that induce decarbonization transition policies” which support the proposal of all types of selections that help reduce CO2 emissions and the formulation of policies to facilitate decarbonization, based on a deep understanding of the needs of the partner country.

In addition, the name of “City-to-City Collaboration Project to Achieve a Low Carbon Society” that was deployed from fiscal 2013 was changed to “City-to-City Collaboration Project for Decarbonized Society”, and is contributing to leapfrog type development of cities in developing countries through the transfer of decarbonization / low-carbon technologies and systems owned by Japanese cities. This practical seminar which has been implemented every year with the participation of involved persons from Japan and abroad as an opportunity to disseminate information on the City-to-City Collaboration Project was held this year in a complete online form on February 1, 2021 in consideration of the coronavirus pandemic. Approximately 400 persons from Japan and abroad registered for this seminar, indicating that it was considered more effective in spreading information than in normal times.

The on-demand distribution of a video introducing projects including this project (Appendix 5-4) was made, and panelists explaining overseas efforts during the pandemic appeared in the panel discussion in the off-record seminar, as well as knowledge was shared with parties involved in the City-to-City Collaboration Project to Achieve a Decarbonized Society (Appendix 5-5).

Table 5-2 “City-to-City Collaboration to Achieve a Decarbonized Society Seminar” Program

Time	Contents
14:00	**Opening remarks** Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, Global Environmental Bureau, Ministry of the Environment, Japan (MOEJ)
14:05	**Outline of the support menu for building a decarbonized society (50 min)** ・ Overview of Japan Platform for Redesign: Sustainable Infrastructure (JPRSI) and trends in projects adopted for the C2C collaboration programme Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, MOEJ ・ Trends related to JCM and the adoption of JCM Model Projects Kazuhisa Koakutsu Director of International Negotiations, Market Mechanisms Office, Climate Change Policy Division, MOEJ ・ Overview of JFJCM and trends of adopted projects Shintaro Fujii Environment and Climate Change Specialist, Climate Change and Disaster Risk Management Division, Sustainable Development and Climate Change Department, Asian Development Bank (ADB) Q & A
14:55	**[Panel discussion] How can we proceed projects in the corona era? (60 min)** ・ Panelists: - Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, MOEJ - Yuichi Arita Director, Kitakyushu Asian Center for Low Carbon Society, Environment Bureau, City of Kitakyushu - Masaru Ishikawa Acting General Manager, International Environment Dept., Nippon Koei Co., Ltd. - Masanori Fujii Oriental Consultants Co. Ltd. - HIS Co. Ltd. ・ Facilitator: - Shiko Hayashi Programme Director, Kitakyushu Urban Centre, IGES Q & A
15:55	**Closing remarks** Ryuzo Sugimoto Director, International Cooperation and Sustainable Infrastructure office, MOEJ

Source: IGES

(3) Director-Level Policy Dialog

Osaka City and Quezon City had a director-level dialog 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. In addition, Oriental Consultants made a report on the status of progress for this project during this fiscal year (Appendix 5-6). In fact, various efforts were introduced in relation with the Osaka Action Plan for City Global Warming Countermeasures (office project version) based on the track record of achieving an approximate 18% reduction in greenhouse gas emissions in fiscal 2018 compared to fiscal 2013, including efforts related to promotion of the introduction of LED lights, installation of sewage digestion gas power generator at sewage treatment plants, and anaerobic / aerobic activated sludge method (AO method) (Appendix 5-7). From the side of Quezon City, the head of the Environmental Protection and Waste Management Department, as well as city administrators from the Urban Planning, Engineering and Building Departments participated, and introduced priority climate change mitigation actions in the four fields of energy, buildings, transportation and waste that are being promoted under the C40 framework (Appendix 5-8). Appreciation was expressed for the Osaka City's support of their environmental policies and a request for continued city-to-city cooperation was made.

Table 5-3 Director Level Policy Dialog Program

14:00 PHT 15:00 JST	**<Opening Address>** **Mr. AONO Chikahiro,** Director General, Environment Bureau, Osaka City Government **Mr. Michael Victor N. Alimurung** City Administrator, Quezon City Government
14:10 PHT 15:10 JST	**<Quezon City: Presentation>** **Mr. Marvin Lagonera,** C40 City Advisor - Quezon City's Climate Action Planning and Results of the Greenhouse Gas Inventory
14:40 PHT 15:40 JST	**<Osaka City: Presentation>** **Mr. MICHIGAMI Ryutaro,** Assistant Manager for International Cooperation, Environment Bureau, Osaka City Government - Osaka City Action Plan for Global Warming Countermeasures (associated with Osaka City Government Operations)
15:10 PHT 16:10 JST	*Break (5 min.)*
15:15 PHT 16:15 JST	**<Oriental Consultants: Presentation>** **Mr. FUJII Masanori,** Team Leader, International Projects Division Oriental Consultants Co., Ltd. - City-to-city Collaboration Between Quezon City and Osaka City Current Progress and Proposed Way Forward
15:35 PHT 16:35 JST	**<Quezon City and Osaka City: Discussion>** - Climate Action Plan - Low-Carbon Projects - Overall Discussion
16:00 PHT 17:00 JST	Closure

Photo of Director Level Policy Dialog (February 2021)

(4) City-to-City Collaboration Workshop

When a city-to-city collaboration workshop was held in an online form on February 19, 2021 following the director level policy dialog, a total of approximately 30 people from the two cities' involved parties participated, including Director of the Environmental Protection and Waste Management Department of Quezon City and others from Infrastructure and City Planning / Development Department, Environmental Management Bureau of Philippine Department of Environment and Natural Resources, PPP Center, POD and other agencies. The objectives of this workshop are outlined below.

- Report on project progress in this fiscal year
- Review of cooperation with private sector companies in Japan and sharing of knowledge owned by Osaka City
- Review concerning JCM project application for next fiscal year

A discussion was held as outlined below, taking into consideration the activity for this fiscal year (Appendix 5-9) reported by Oriental Consultants at the opening.

- Method to proceed with replacement of 531 air conditioners at Quezon City Hall
- Issues for suitable disposal of fluorocarbons in relation with air conditioners replacement, introduction of proposals from Japan and exchange of opinions
- Progress of waste disposal operations proposed as one area of support for Quezon City environmental policies

Quezon City has a high level of interest in the Osaka City Action Plan for Global Warming Countermeasures and operations under the plan that have solved many environmental issues in the

past through public-private partnerships. Questions from Quezon City to Osaka City were made during the Director Level Policy Dialog and explanation was made using case studies related to the following two themes.

- New collection system for PET bottle recycling (Appendix 5-10)
- Sewage digestion power generation (Appendix 5-11)

In addition, a report was made by Quezon City concerning efforts that have been done since 2018 on the city's Climate Action Plan together with C40, as well as concerning the preparations ongoing to formulate the plan by March 2021 (Appendix 5-8).

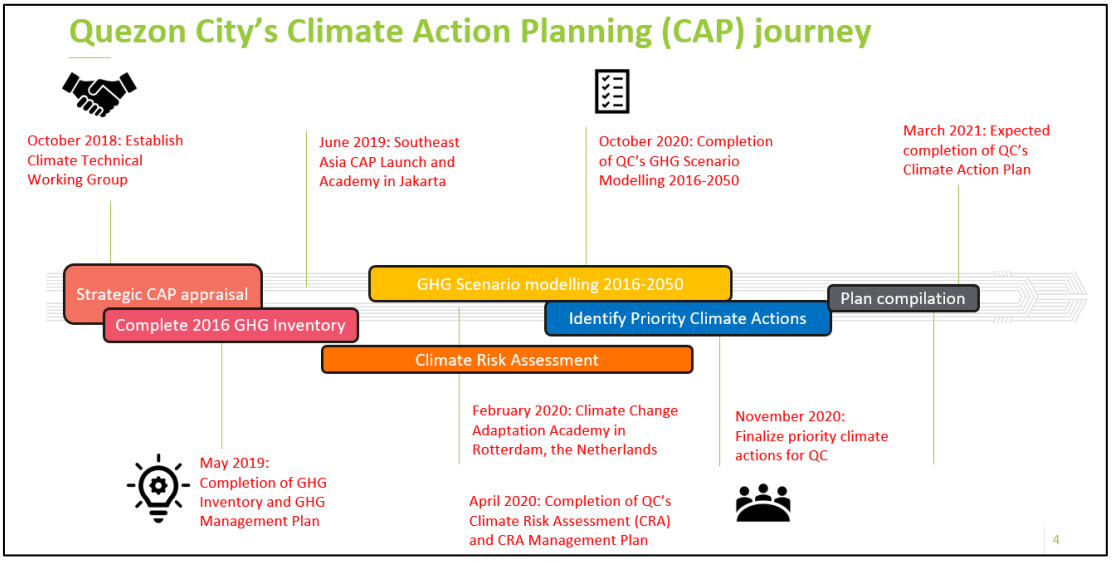


Figure 5-1 Journey for Formulation of Quezon City's Climate Action Plan

Source: Quezon City

As shown below, Quezon City has established a greenhouse gas emissions reduction goal of 30% by the year 2030 compared to yearly BAU.

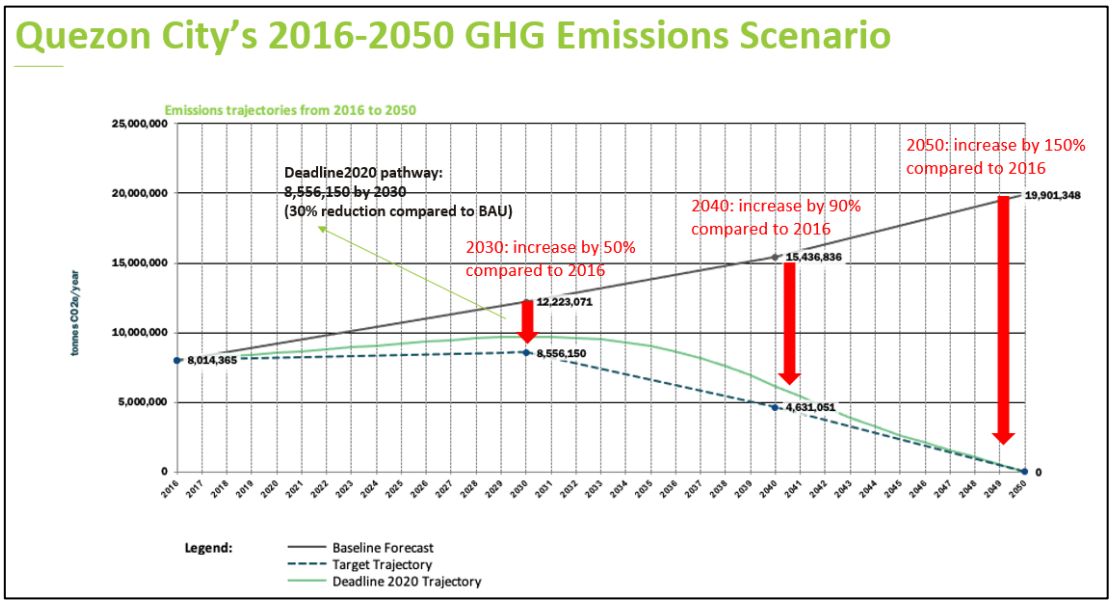


Figure 5-2 Quezon City's 2016-2050 GHG Emissions Reduction Scenario

Source: Quezon City

Therefore, explanation was made again on the policy for their efforts in the priority fields of energy, buildings, transportation and waste.

Table 5-4 Priority Fields for Quezon City Climate Change Mitigation Action

Energy	Secure clean renewable energy at a reasonable price for all people. 3. Install solar power generation at all city owned buildings and facilities by 2030 4. Provide incentive for introducing mid and large-scale renewable energy system at sectors and facilities that consume a large volume of energy
Buildings	Clean resilient buildings that have high energy efficiency 4. Amend and enact the green building code of the city, and strengthen the performance requirements for the energy efficiency of new and existing buildings in the commercial and manufacturing sectors 5. Implement energy efficiency measures in the housing sector or at household level 6. Reduce disaster risk in construction methods by establishing guidelines and standards for design and development
Transportation	Develop transportation infrastructure that provides comprehensive interconnection to facilitate mobility and mass transit of all people 5. Develop a bicycle network and foot walks that are comprehensive, climate friendly, fair and can be conveniently accessed 6. Develop integrated local bus high-speed transport system that is accessible, reliable and reasonably priced 7. Improve atmosphere with zero emissions government owned buses and vehicles, and develop atmosphere monitoring system 8. Support expansion of a mass transit railway system led by country with integrated transport connection complexes
Waste	Strive to achieve zero landfill through waste resource recovery strategy and reduction in wastewater volume 6. Strengthen strategy to collect, divide and reduce solid waste in entire city 7. Improve resource circulation of organic waste using anaerobic treatment facilities and resource recovery facilities in all 142 areas 8. Reduce waste at source it is generated (clean procurement plans, prohibit disposable plastic) 9. Support waste circulation model 10. Enhance functions of wastewater treatment systems and facilities to improve quality of wastewater and reduce wastewater volume

Source: Quezon City

In addition, regarding the JCM facility assistance project for replacement of air conditioners at Quezon City Hall that is currently under consideration, the policy to proceed with project

formulation utilizing private sector capital and private sector knowhow for development of a public-private partnership (PPP) by Quezon City, a private sector company and a leasing company (state bank) was reconfirmed. We obtained concrete advice from the person in charge at the PPP Center[1] concerning the way to proceed in this workshop. It was determined that, in preparation for the signing of a MOU for the formation of an international consortium to implement a JCM facility assistance project as a PPP project, a draft should be submitted to the PPP Center for verification. Through discussions made with the PPP Center, it is planned that Quezon City, Land Bank and the representative company from Japan will sign an MOU between the three parties by around March 2021 to establish a JCM facility assistance project for the next fiscal year.

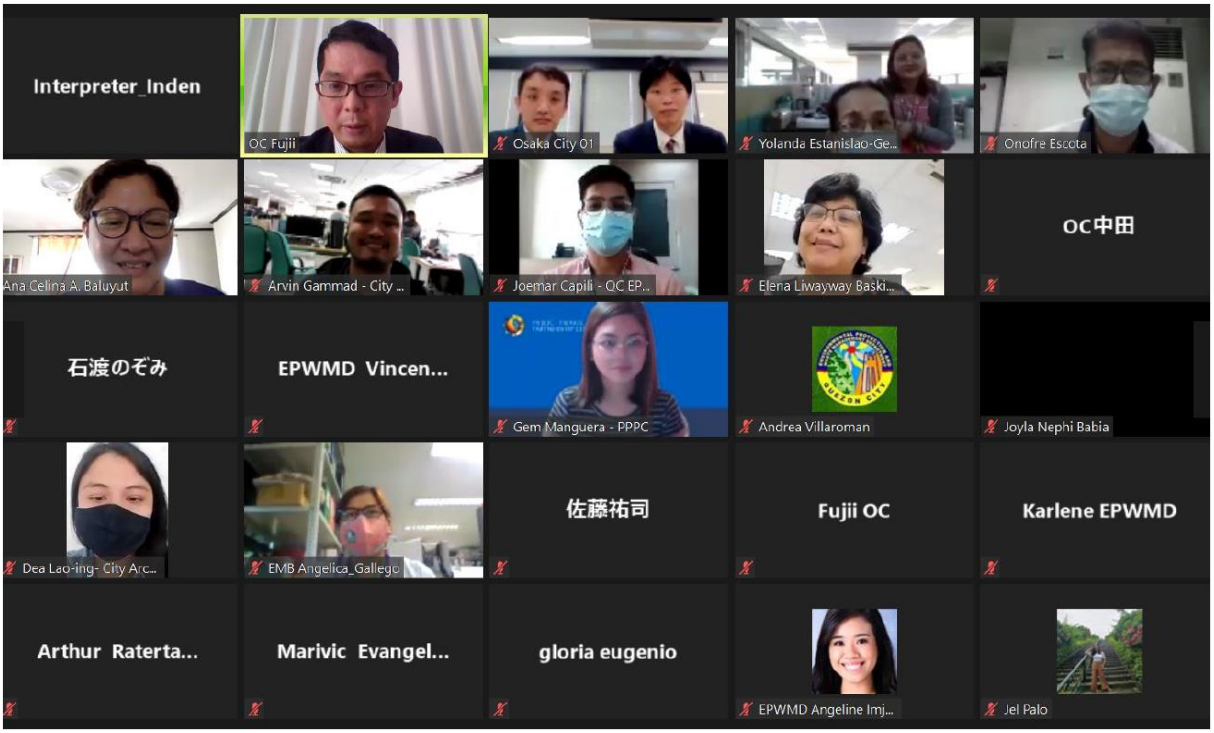
The POD made a report of the current status that the recovered fluorocarbons are not being stored in a suitable manner, and proposed a storage facility plan (Appendix 5-13). A report was made by the Japan side that through a discussion with the Ministry of the Environment it is known that a support cannot be provided for facility construction, but it can be provided as a JCM fluorocarbon destruction project if it is a fluorocarbon destruction project. The storage of collected fluorocarbons is a pressing issue for the POD, and it was determined that ongoing discussions will be conducted that include the Environmental Management Bureau, the Ministry of Environment and Natural Resources of the Philippines, concerning the ability to implement a fluorocarbon destruction pilot project, and whether or not suitable processing can be considered together for the fluorocarbons contained in the refrigerant for air conditioners to be disposed by the JCM facility assistance project to replace the air conditioners at Quezon City Hall.

In consideration of the fact that Metro Pacific Investments Corporation (MPIC) is currently reviewing a large scale project for biogas power generation from solid waste in Quezon City to be implemented as a private-sector proposed PPP, it was reported that duplication needs to be avoided, and the implementation of a pilot project in Cavite province that will introduce a small-scale facility to perform biogas power generation from food residue is being considered. Plans call for matching with companies in Japan and introduction of Japanese technology to be performed to consider the potential as a PPP project in order to respect the wishes of Quezon City and take the advantages of aerobic treatment described later into consideration, while continuing to receive advice from the PPP Center.

[1] Organization presiding over PPP system in the Philippines. Established in 2010 in accordance with Presidential decree No. 8. Provides support for bidding, F/S and other works, and promotes formation of PPP projects based on expertise.
https://www.env.go.jp/recycle/circul/venous_industry/pdf/env/h28/09_7.pdf

Table 5-5 City-to-City Collaboration Workshop Program

Opening Remarks	
09:30-09:40	**<Opening Remarks>** ◆ "Opening Remarks" by Environmental Protection and Waste Management Department (EPWMD), Quezon City ◆ "Ice Breaking (Introduction)" by Oriental Consultants (Guidance of this project and 3 years plan)
Session	
09:40-10:50	<**Presentations and Q & A>** • Update of the survey results by Oriental Consultants • Presentation of the approved projects and plans of EPWMD for 2021 with COVID-19 • Presentation on "experience" on renewal of air conditioner with proper management of fluorocarbons by Osaka City (Japan) • Presentation on the future plan for proceeding proper storage for the inventory on fluorocarbons (CFC/HCFC) and for collecting and destructing fluorocarbons (HFC) through E-waste Management, by Philippine Ozone Desk and Department of Environment and Natural Resources (DENR)
Short Break	
10:50-11:20	<Discussion> • Consideration of expected collaboration with private sector in Japan -Proper renewal of air conditioner (summary of next steps as PPP lease project) -Proper management of fluorocarbons -Effective utilization of bio-digester
11:20-11:25 11:25-11:30	<Closing Remarks and Photo Session> ◆ "Closing Remarks" by EPWMD and Osaka City Government ◆ Photo Session by zoom



Group Photo of City-to-City Collaboration Workshop (February 2021)

5.2 Quezon City Environmental Policies

5.2.1 Environmental Policies Being Considered by Quezon City

In the City-to-City Collaboration Workshop conducted in February of the previous fiscal year, Quezon City announced that it has been making the efforts outlined below in six main fields: (1) Climate change mitigation to reduce GHG emissions, (2) Renewable energy and higher energy efficiency, (3) Wastewater treatment, (4) Waterworks, (5) Waste treatment and (6) Environmental protection.

- Promotion of green energy: Experimentally introduce solar power generation units at 50 public schools
- Promotion of sustainable economy: Exhaust heat recovery at factories
- Promotion of environmentally friendly smart lifestyle: Introduce LED lights, solar water heaters
- Promotion of clean and smart transportation: Promote fuel efficient vehicles and electric vehicles

In addition, the development of a wastewater treatment facility in Quezon City and amendment of the Philippine Green Building Code published in 2015 which stipulates the efficiency of air conditioners and other such facilities were raised as future issues.

Furthermore, interest was expressed in the following fields when this project was proposed.

- Introduction of energy saving air conditioning for facilities owned by Quezon City, other facilities (schools, hospitals, etc.) and private sector facilities (shopping malls, hotels, etc.) and fluorocarbon disposal plans
- Introduction of organic waste treatment devices at Quezon City public markets
- Conversion of Quezon City vehicles to electric vehicles and installation of solar power charging stands
- Support for environmental policies that are now considered by Quezon City (Green Building Code, dispersed water treatment, etc.)

Interviews were conducted in Quezon City since support fields cover a diverse range, and the decision was made to consider project creation in the following two fields this fiscal year as the result of matching with companies in Japan interested in expanding to the Philippines into the said policy field, while narrowing down the conceivable themes where there are concrete needs.

(1) Introduction of organic waste treatment devices at Quezon City public markets
(2) Solar power generation project for public schools

Regarding wastewater treatment facilities, the use of rainwater and use of reclaimed water at city hall and other such facilities is being considered due to the water shortage problem.

Regarding amendment of the Green Building Code, the Primer on the Green Building Program

of Quezon City has been formulated based on the Green Building Ordinance of 2009, representing its attempt to promote 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 5-6 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

Quezon City implemented the "Verification Survey with the Private Sector for Disseminating Japanese Technologies for Low-Emission Public Transportation Systems Utilizing Electric Trikes" with the support of JICA in Japan. As of September 2020, the city had distributed a total of 276 E-Tricycles to Barangays, and is boosting the energy efficiency of the transportation sector and promoting clean technology. Review in preparation for expanded introduction will need to be performed in cooperation with various related persons, taking into consideration the knowledge obtained during the Verification Survey.

For the next fiscal year, efforts will be made to facilitate ongoing review of the concrete themes which were not taken up specifically during this fiscal year, and work will be done to create concrete projects while supporting the environmental policies of Quezon City.

5.2.2 Introduction of Organic Waste Treatment Devices at Quezon City Public Markets

(1) Current Status of Waste Management in Quezon City

1) Development of Laws and Regulations for Waste Treatment

In the Philippines, waste management is governed by the Republic Act 9003-Ecological Solid Waste Management Act 2000 which was enacted in 2000. This law serves as the framework for improving waste management from technical, organizational/system, educational and policy aspects. Fundamentally, LGUs manage and dispose of solid waste. In addition, the Act for Comprehensive Air Pollution Control Policy (RA 8749) has regulations concerning incineration.

2) Status of Organic Waste Treatment in Quezon City

The volume of waste in the Philippines is increasing every year due to its economic growth and an increase in population, and environmental pollution due to the improper disposal of waste is a serious problem. The daily amount of waste generated in Quezon City is 6,051 m^3, of which approximately 54% is organic waste (Figure 5-3,). The waste composition reflects the economic level of the country, with the ratio of organic waste increasing to a higher degree in low-income economies. According to JICA, the ratio of organic waste in Japan and other high income countries which have implemented measures to control the generation of 3R and other such garbage is predicted to be less than 30% in the year 2025, but organic waste in the Philippines and other low-income economies is expected to account for a half or more of the total volume.

Quezon City does not have an incinerator plant, and relies on landfill as the final disposal method. The Payatas Dump was closed due to a large-scale landslide in 2000 which resulted in many fatalities. The Rodriquez Landfill site (Figure 5-4) in Rizal Province is accepting the garbage from the 12 local autonomous communities in metropolitan Manila and other neighboring autonomous communities. The transportation costs, including cleaning, have doubled (Annual amount: Approx. 1.6 billion yen -> Approx. 3.5 billion yen).

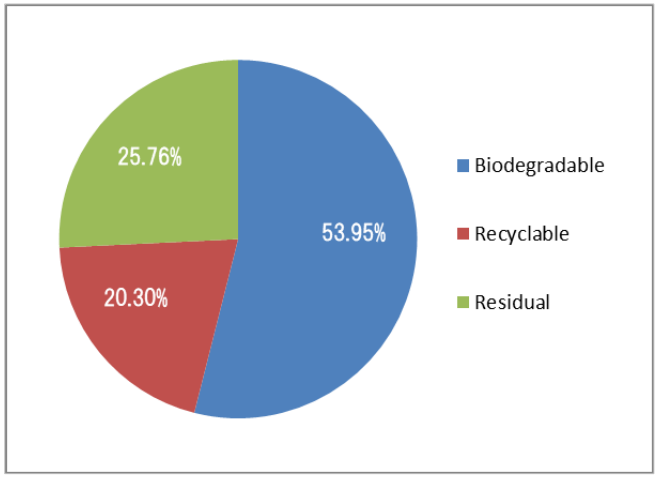


Figure 5-4 Quezon City Waste Composition

Source: Integrated Solid Waste Management Plan 2016

Figure 5-3 Location of Rizal Landfill

(2) Review of Introduction of Organic Waste Treatment Devices

1) Overview of Quezon City Public Markets

The Quezon City public markets are operated by the Market Development and Administration Department (MDAD). An overview of the eight public markets provided by Quezon City is described below. In addition to vegetables, fruit, meat and other perishables, daily necessities are also sold at the markets.

Table 5-7 Overview of Quezon City Public Markets

No.	Name	Location	Land Area	Estimated Volume of Biodegradable Waste per Day
1	San Jose Market	District I Mayon St., N.S. Amoranto	420 m2	100-250 kg.
2	Project 2 Market	District III Kubili St., Brgy. Quirino 2A	420 m2	400-500 kg
3	Roxas Market	District IV Hyacinth St., Brgy. Roxas	1,816 m2	500-750 kg
4	Project 4 Market	District III P. Tuazon, Brgy. Milagrosa	2,000 m2	500-1,000 kg
5	Murphy Market	District III 15th Ave., Brgy. San Roque	6,903 m2	750-1,000 kg
6	Kamuning Market	District IV K-5th, Brgy. Kamuning	7,024 m2	1,500 kg -
7	Frisco Market	District I Tolentino St., Brgy. Damayan	2,627 m2	1,500-2,000 kg
8	Galas Market	District IV Luzon Ave., Brgy. San Isidro	12,280 m2	2,500-3,000 kg

2) Review of Organic Waste Treatment Devices

Quezon City is considering the small-scale introduction of organic waste treatment devices at two of the above eight markets as a pilot project. The specifications that were initially proposed based on the composting devices that Quezon City plans to introduce are described below.

- 1,000 liter intermediate bulk (IBC) water tank with a 25kg/day processing capacity
- Ability to generate cooking gas for 1 – 2 hours
- Complete package that includes gas cooker and safety device
- One horsepower shredder that has 50 kg/hour processing capacity
- Operated with gasoline or electricity
- Includes setup, installation and training

The above information clarifies that anaerobic treatment biogas power generation facilities are the precondition. Therefore, an explanation was made that it is difficult for small biogas power generation facilities to be economically viable, and 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. Composting is not generally performed in the Philippines, but the treatment costs are significantly lower compared to anaerobic treatment, and this process has various other merits as shown in the table below.

Table 5-8Comparison of Aerobic Treatment and Anaerobic Treatment

	Composting (Aerobic)	Methane Fermentation (Anaerobic)
Treatment Cost*	Approx. ¥7,000/t	¥30,000 – ¥40,000/t
End Product	Compost, soil conditioner	Biogas, fermented mash
Features	Organic waste is decomposed until it does not harm the environment, and it can be used for soil reduction. There are many types of raw materials (waste) that can be used, helping to create a recycling society.	Biogas can be used for power generation, and fermented mash can be used as fluid fertilizer. Fluid fertilizer cannot be used depending upon the raw materials, as advanced treatment may be necessary.

* Treatment cost is reference value from Japan

Source: Kyowa Kako Co., Ltd.

The technology developed by Kyowa Kako Co., Ltd. mixes food waste, sludge, animal feces etc. with micro organic material (YM bacteria), keeps it in an aerobic condition at a high temperature, and hence, decomposing the organic matter (Appendix 5-13). An appeal was made to Quezon City on the potential of the Japanese technology to make a contribution from the standpoints described below, and the company directly explained the features of the devices it is proposing.

- Kyowa Kako Co., Ltd. has formed a partnership with Davao Thermo Biotech Corporation in the Philippines, and has operated a composting business since 2017
- "YM Himawari-kun" composting device is used for compact, hygienic composting.
- Hygienic risk in introduction area can be reduced
- Good quality fertilizer can be produced with organic waste
- Sustainable waste treatment in recycling economy can be promoted as a result
- Organic waste treatment methods complies with RA 9003
- It can serve as environmental education material at schools and other facilities

Features

- Features of Proposed Technology
  - Composting process is in high temperature range of 70℃ or higher
  - Composting period is about 14 days for food waste
  - Reduction ratio is approximately 80%
  - Sawdust, rice husks or other secondary material is not required
  - Safe and secure compost can be produced in which pathogenic microorganisms (O-157, Salmonella, etc.) and weed seed are extinct

- Features of Proposed Device
  - Spreading of odor can be minimized since it is sealed type
  - Low noise design for comparatively low noise and vibration levels
  - Simple outside body rotary structure for low energy load
  - Superior durability compared to wing rotary type that is easily corroded by raw material and compost, minimizing breakdowns
  - Wide lineup available that is suitable to installation location and treatment volume

Figure 5-5 Outside Rotary Type

Specifications

The composting devices of this company can be flexibly configured as a system according to the target type of organic waste, delivery method and usage of the compost to be produced. Companies that want to introduce the devices can be proposed with the facility configuration, device specifications and price in accordance with the installation environment, operator's skill level, and the extent of industrialization in the relevant country.

The specifications in the table below are for a case targeting at "food waste from businesses" which is one type of organic waste, and they show that the device can be installed in an area with limited space.

Table 5-9 Specifications for Proposed Devices

Treatment Capacity	Approximate Installation Dimensions		
	Width	Length	Height
200 – 1,000kg/day	2.3 – 3m	5 – 8.5m	3 – 3.5m

3) Decision on Introduction Candidate Site

After discussion was made with Quezon City from the standpoint of the required space for installation of the above composting device, the Kamuning Market and the Murphy Market were selected as the candidate sites for introduction. An overview of the two markets is described below.

Table 5-10 Overview of Introduction Candidate Sites

	Kamuning Market	Murphy Public Market
Location Proposed Device Can be Installed	Approx. 30m^2	Required space within 4,941m^2
Waste Treatment Cost	Approx. ¥6,000,000/year (including transportation charges, etc.)	Approx. ¥6,300,000/year (including transportation charges, etc.)

Figure 5-6 Location of Candidate Sites and Photos

4) Places where Compost Can be Utilized

In the Philippine National Standard PNS/BAFPS 40: 2013 concerning organic fertilizers that came into effect in 2013, it is prescribed that compost / soil conditioners “Supplied as a product to provide nutrition to plants in solid or liquid form that are derived from plants (excluding by-products from the petroleum industry) or animals shall contain a total volume of at least 2.5% but less than 5% of nitrogen, phosphorous and potassium” and, therefore, the ability to produce compost that complies with this standard needs to be verified.

It is expected that the compost can be used for the greening of facilities owned by the city, public parks and other such locations, and will be potentially sold as a product. The profitability needs to be reviewed in more detail in the future.

5) Review to Facilitate Introduction

Quezon City reached the conclusion that it will implement a biogas power generation project utilizing food residue in its 2021 fiscal year budget, but there are various approaches to reducing organic waste and achieving effective utilization. Introduction of technology by means of visiting the country and inviting persons to Japan should be performed by the JETRO “Operations to Promote Projects for Export of Infrastructure Systems” that is to be implemented by Kyowa Kako in order to promote the introduction of composting devices, and ongoing discussions will be held with Quezon City while making efforts to form a partnership with a local company.

5.2.3 Introduction of Solar Power Generation Facilities at Public Schools

(1) Status of Solar Power Generation Facility Introduction in Quezon City

1) Development Status of Laws for Introduction of Solar Power Generation Facilities

The National Renewable Energy Program (NREP) was formulated based on the Republic Act 9513 Promoting the Development, Utilization and Commercialization of Renewal Energy Resources that was enacted in 2008 in the Philippines. This program has set a goal of increasing the power supply volume of renewable energy to 15,304MW by the year 2030, which is approximately three times the volume in 2010, 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 promoting the expansion of solar power generation systems introduced at public facilities in order to help achieve the national goals. As of 2019, the system has been introduced for six buildings at Quezon City Hall, and it has been reported that the total power generation volume to date is 451.89kW.

In the fiscal 2018 City-to-City Collaboration Project, we considered the introduction of a solar power generation system for the Payatas Dump, but this did not result in the creation of a JCM facility assistance project due to the difficulty to secure the scale necessary to achieve profitability. Due to the fact that the Feed-In Tariff (FIT) system for solar power generation in the Philippines has already ended, it is difficult to achieve profitability with sales at market prices. Accordingly, in this fiscal year, the focus was placed on considering the introduction of on-site type facilities where the power is consumed by the facility itself for which there is a higher possibility of realization.

2) Status of Solar Power Generation Facility Introduction at Public Schools in Quezon City

Solar power generation systems have already been introduced at Commonwealth High School and Balara Elementary School as pilot projects in Quezon City. When the status of progress was checked with Quezon City, it was clarified that a feasibility study (FS) for the introduction of solar power generation facilities at public schools in the city is currently being performed with the support of C40 Cities Finance Facility (CFF). In addition, an interview was conducted on the survey content and other details to the German Corporation for International Cooperation GmbH (GIZ) which was introduced by Quezon City as the organization responsible for the survey.

Source: CFF

(2) Consideration of Solar Power Generation Facility Introduction at Public Schools

1) Overview of Existing Survey

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. At the Quezon City side, the planning and implementation of this survey is led by the Solar Technical Working Group (TWG), and CFF (GIZ) is providing the support described below.

- Placement of dedicated technical consultant within administration
- Provision of funds for technical FS to facility fund procurement
- Training of city staff who plan and design rooftop installed solar power generation facilities at public facilities
- Implementation of legal / system survey to enable development of bidding documents, fund procurement strategy and contract model necessary for a public-private partnership (PPP)

2) Consideration of JCM Project Formulation

After a discussion with Quezon City, the potential for the creation of a JCM facility assistance project was considered as an integral part of fund procurement support to facilitate achievement of this project. The cooperation was obtained from Looop Inc., a company that is involved in the sales of self-consumption type solar power generation systems in Japan and abroad. This company is considering the expansion of operations into the Philippines, and has shown interest in the solar power generation business in Quezon City.

The recovery of investment and approximate reduction in CO2 emissions are described in the table below, based on the information and prerequisites obtained from GIZ and Looop Inc.

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
Electric Cost = 10 PHP/kWh
USD = ¥107.65
PHP = ¥2.12

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

The results of the above calculations indicate that the required cost effectiveness condition of ¥3,000/tCO2 which is necessary when applying as an eco-lease project is narrowly unsatisfied.

The implementation system described below was considered in preparation for application as a JCM facility assistance project. An international consortium will be formed between a Japanese company and Special Purpose Vehicle (SPV), and the SPV will install the solar power generation facilities. The SPV concludes a power purchase contract with Quezon City, and concludes a power supply contract with Meralco, an electric power company. The net metering system has been adopted in the Philippines, enabling the offset of power supplied by the electric power company with the volume of power that is generated.

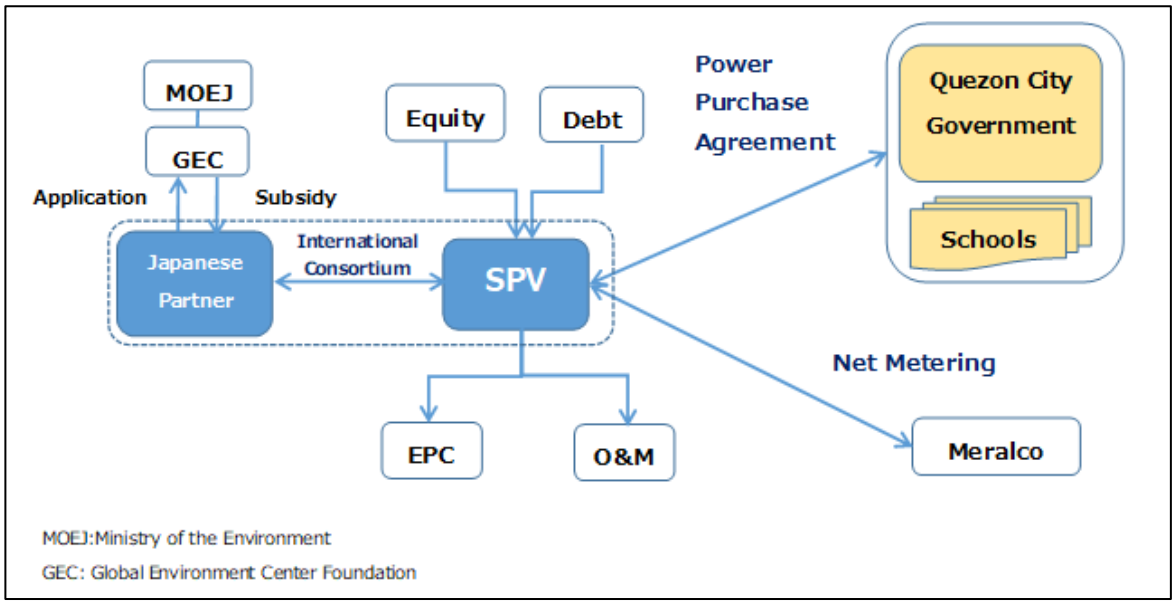


Figure 5-7 Draft Implementation Structure

In order to consider implementation of this project as a Solicited Proposal PPP project, Quezon City needs to select a PPP partner on the Quezon City side at the same time as the application procedure for a JCM facility assistance project is performed. However, since it is projected that the decision as to whether or not a JCM project will be implemented will not have been made during

the bidding process for a PPP project, discussions between involved parties including the Japan side need to be held to determine if the prerequisites for implementation with the JCM scheme can be incorporated in the bidding conditions.

Furthermore, schools were closed due to the impact of the coronavirus pandemic, and GIZ has substantially extended the survey period. In order to allow preparations to proceed for implementation of bidding around July 2021, sharing of information with GIZ will be continued, with the aim of formulating a JCM facility assistance project in the next fiscal year or later. In addition to taking measures to reduce the cost burden in the Philippines and hence to promote introduction, consideration should also be made on advantageous structures and systems for the Japan side, for example, about the possibility of an effective introduction leading to maintenance and management and monitoring of facility at multiple sites. The lessons learned in efforts to date will be reflected in project development efforts, while utilizing the knowledge and track record of Looop Inc. to implement self-consumption type solar power generation projects in not only Japan but also Malaysia, Thailand and other countries.