MOEJ

Final Report

City to City Collaboration for Zero-carbon Society in FY2022

Zero Carbon Development in Quezon City for the Realization of Carbon Neutral Society

March 2023

Oriental Consultants Co., Ltd.
Osaka City

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Tables and Figures

List of Abbreviations

Abbreviation	Meaning
ADB	Asian Development Bank
BEMS	Building Energy Management System
BRT	Bus Rapid Transit
C40	C40 Cities Climate Leadership Group
CAI	Climate Action Implementation Plan
CCESD	Climate Change and Environmental Sustainability Department
DENR	Department of Environment and Natural Resources
DOE	Department of Energy
EMS	Energy Management System
ETM	Energy Transition Mechanism
Enhanced QC-LCCAP	Enhanced Quezon City's Local Climate Change Action Plan
EV	Electric Vehicle
FEMS	Factory Energy Management System
GHG	Greenhouse Gas
IPP	Independent Power Producer
JCM	Joint Crediting Mechanism
NDC	Nationally Determined Contribution
NEDO	New Energy and Industrial Technology Development Organization

Chapter1　Project Overview

1.1 Project Objective

With the Glasgow Climate Pact adopted during the 2021 United Nations Climate Change Conference (COP26) held in November 2021, limiting the temperature increase to 1.5 degree above pre-industrial levels was confirmed as a new global goal. To achieve this goal, each country must accelerate their efforts at province, city, district and various other levels. In Japan, it has been declared that the country aims to achieve a decarbonized society with zero greenhouse gas emissions as a whole by 2050, and the number of municipalities declaring virtually zero carbon dioxide (CO2) emissions has rapidly increased to over 800 (as of January 31, 2023). Each municipality has created advanced measures and proceeded with their initiatives extending nationwide under the Regional Decarbonization Roadmap formulated in June 2021.

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

In addition, in the current situation of the spread of the COVID-19 infection, cities are under pressure to address issues related to the spread of infection and at the same time readjust and consider new measures to achieve sustainable development. It is extremely important to build a new method and a new city through cooperation between cities.

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

1.2 Project Overview

Entrusted Project Name:	City to City Collaboration for Zero-carbon Society in FY2022 Zero Carbon Development in Quezon City for the Implementation of Climate Change Mitigation Actions
Implementation Period:	July 8, 2022 to March 10, 2023
Ordering Party:	International Cooperation / Environmental Infrastructure Strategy Section, Global Environment Bureau, Ministry of the Environment
Consignee:	Oriental Consultants Co., Ltd.

1.3 Project Implementation Structure

Oriental Consultants Co., Ltd. became the main proposer for this project and the project proceeded in cooperation with Osaka City as the joint proposer, in cooperation with the Quezon City Government - Climate Change and Environmental Sustainability Department, the counterpart.

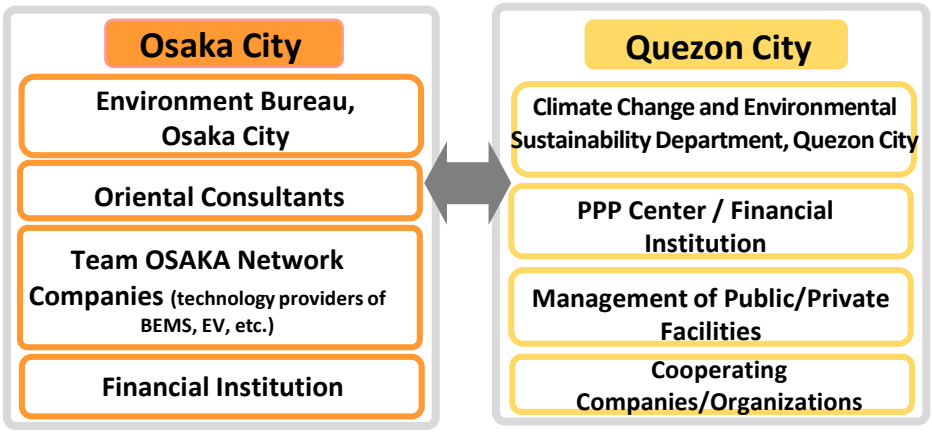


Figure 1-1 Implementation Structure

1.4 Study Content

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

Quezon City is an environmentally advanced city and is the only city in the Philippines that has joined C40 (C40 Cities Climate Leadership Group). Based on the "Memorandum of Understanding (MOU) between Quezon City and Osaka City for Cooperation in the Development of a Low/Zero Carbon City in Quezon City (hereinafter referred to as the "Quezon City-Osaka City MOU")," which was renewed in August 2021, Quezon City announced its new Climate Action Implementation (CAI) Plan in August 2022 to realize climate change mitigating actions of the city supported by UK AID and C40. The plan requires to introduce energy creation (renewable anergy), which is the main pillar of the plan, and promote cooperation in energy savings (revision of the Green Building Code). Accordingly, the project is also to investigate on energy management that optimize the demand-supply balance by introducing renewable energy including solar power generation which is a high priority energy in Quezon City.

Table 1-1 describes an overview of study for the first year in the three-year project.

Table 1-1 Overview of Study

Project item	Activities
①Study of the Construction Field (Promotion for Energy Management and Renewable Energy)	・Introduction of energy management system in buildings in Quezon City ・Installation of smart LED lighting ・Introduction of energy management system using renewable energy ・Promotion of zero carbon measures in the building and housing sector
② Study of the Transportation Field (Air Quality Management)	・Improvement in travel efficiency through traffic management using AI and IoT ・Introduction of electric vehicles (EVs) in Quezon City's bus system ・Survey on the current status of air quality management and examination of countermeasures
③ City to city and third country cooperation	・Consultations on the realization of the Carbon Neutral Society through workshops and policy dialogue with Osaka City

Table 1-2　Schedule of this fiscal year

Project Items	FY 2022									
	6	7	8	9	10	11	12	1	2	3
Meetings and reporting	▲	Kick-off		Progress report ▲				Mid term report ▲	Final report ▲	
(1)Study of the Construction Field (Promotion for Energy Management and Renewable Energy)										
・Introduction of energy management system in buildings in Quezon City		◄	―	―	―	―	―	►		
・Installation of smart LED lighting		◄	―	―	―	―	―	►		
・Introduction of energy management system using renewable energy		◄	―	―	―	―	―	►		
・Promotion of zero carbon measures in the building and housing sector						◄	―	―	►	
(2) Study of the Transportation Field (Air Quality Management)										
・Improvement in travel efficiency through traffic management using AI and IoT				◄	―	―	►			
・Introduction of electric vehicles (EVs) in Quezon City's bus system				◄	―	―	►			
・Survey on the current status of air quality management and examination of countermeasures					◄	―	―	―	►	
(2) City to city and third country cooperation										
・Consultations on the realization of the Carbon Neutral Society through workshops and policy dialogue with Osaka City			◄	►			◄	―	►	
Field survey		◄	―	―	―	―	―	―	►	
Workshop organization					▲		▲			
Meetings held by the Ministry of the Environment, policy dialogue (meetings designated by the MOE)					◄	┈	┈	┈	►	
Monthly report			▲	▲	▲	▲	▲	▲	▲	▲
Report preparation					◄	―	―	Draft report	―	Submit ▲

Chapter2　Current Status and initiatives of Climate Change Measures in Quezon City, the Philippines

2.1 Climate Change Measures in the Philippines

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

The following table shows the Nationally Determined Contribution (NDC) submitted by the Philippines to the UNFCCC in 2015. The NDC does not mention unconditional GHG reduction targets and presents its target of a "reduction of about 70% by 2030 relative to its BAU scenario" contingent on cooperation from developed and other countries being made available to the Philippines.

Table 2-1　Outline of the Philippines' NDC

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

Source: NDC of the Philippines[1]

Regarding the Philippine's budget for the climate action program, in January 2023, the French Development Agency agreed with the Department of Finance of the Philippines that the agency would finance 150M euros, and a 442.5M dollar joint loan with the Asia Development Bank (ADB) and a 250M

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

dollar loan from ADB alone have already been agreed upon. As a result, the government budget for climate actions accounts for 8.72% of the total budget in 2023.

2.1.1 Expansion of Renewable Energy Introduction in the Philippines

The Japanese government proposed the AETI (Asia Energy Transition Initiative) in the 26th United Nations Climate Change Conference to contribute to the prevention of global warming through the reduction of CO2 emissions from coal-fired power stations in the Philippines and Indonesia. Later, through the framework of the Energy Transition Mechanism (ETM) of the Asia Development Bank (ADB), financed by the Japanese government, sale of interests in coal-fired power stations in the Philippines owned by the private sector has also started.

In the Philippines, there is no plan to add or newly build coal-fired thermal power facilities. On the other hand, for renewable energy such as solar, hydraulic, geothermal and wind power, auctions have been conducted for business rights, and developers are being selected.

New power sources will be continuously sought after to meet electric power demand, and the new sources will be renewable energy (solar, geothermal, wind, etc.).

Figure 2-1 shows the concept of BtG (Brown to Green), meaning a transition from fossil fuel (Brown) to renewable energy (Green).

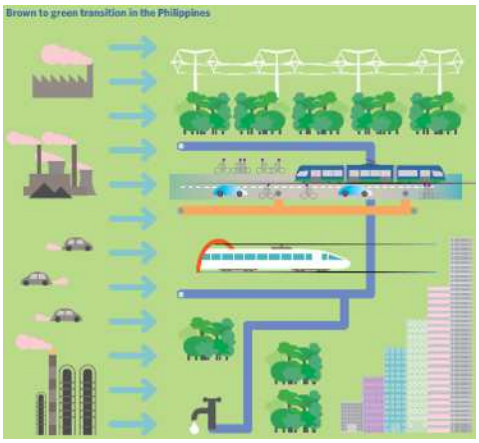


Figure 2-1 Transition from Brown (energy from fossil fuels) to Green (renewable energy)

Source: Quezon City Government

The Department of Energy (DOE) has issued the revised National Renewable Energy Plan (NERP) 2020-2024, setting a target to increase the rate of renewable energy generation to 35% by 2030 and 50% by 2040. According the NREP, the Philippine government hopes to satisfy the increasing electric power demand with cleaner energy resources, expand the use of renewable energy, use hybrid technologies, reduce CO2 emissions, and mitigate climate changes, through the achievement of this target. When President Marcos visited Japan, they explained about the energy mix consisting of fossil fuels and renewable energy and announced that 100% foreign owned companies would be allowed to participate in renewable energy projects.

To achieve the renewable energy target, the company has to add 102 GW power generation capacity, including 27 GW solar, 17 GW wind, 6 GW hydraulic, 2.5 GW geothermal, and 364 MW biomass energy. A

total of 901 MW renewable energy generation projects will be carried out from 2022 to 2027, of which 54% is solar power and 26% is hydraulic power generation (as of December 31, 2021). The NREP shows the intention to encourage private developers to develop new renewable energy technologies including hydrogen and ocean and tidal energy as well as solar, wind, geothermal and biomass energy to achieve the target.

2.1.2 Efforts in Quezon City and Request for Support

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

Quezon City has the largest area in Metropolitan Manila and various issues which include waste, energy, transportation, and urban greening have become more serious with the increase in population. Quezon City, which participates in C40, will participate in the Quezon City-Osaka City Bureau Director-level Policy Dialogue and Intercity Collaboration Workshop held in February 2021 in order to realize climate change mitigation actions as a representative environmentally advanced city in the Philippines. It shows the policy of efforts in the fields of 1) energy, 2) buildings, 3) transportation and 4) waste. After that, in the discussion on the activity policy of this year conducted with Quezon City, it is possible that the air conditioning replacement project of the City Hall, for which a plan and implementation system plan has already been formulated, will be feasible as a JCM project based on the results of the efforts up to the previous year. I have confirmed that it is expensive. The air conditioning replacement project enables early recovery of investment costs and is expected to be “Decarbonization Domino” by being expanded horizontally to public and private facilities. Furthermore, by supporting the recovery and destruction of CFCs with a high global warming coefficient that occur when air conditioning equipment is renewed, it is possible to enhance the GHG emission reduction effect in cooperation with the Fluorocarbon Initiative advocated by Japan.

2.1.3 Climate Change Measures in Quezon City

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

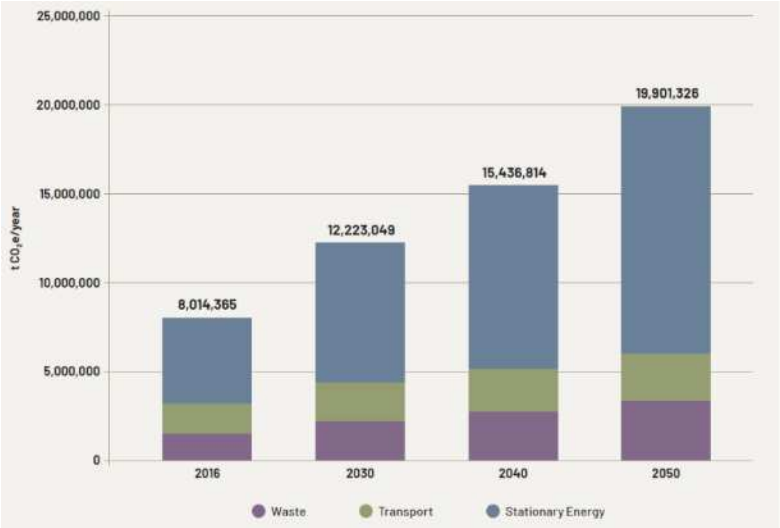


Figure 2-2 GHG Emissions Prediction in the Major Three Sectors in Quezon City by 2050

Source: Enhanced QC-LCCAP

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

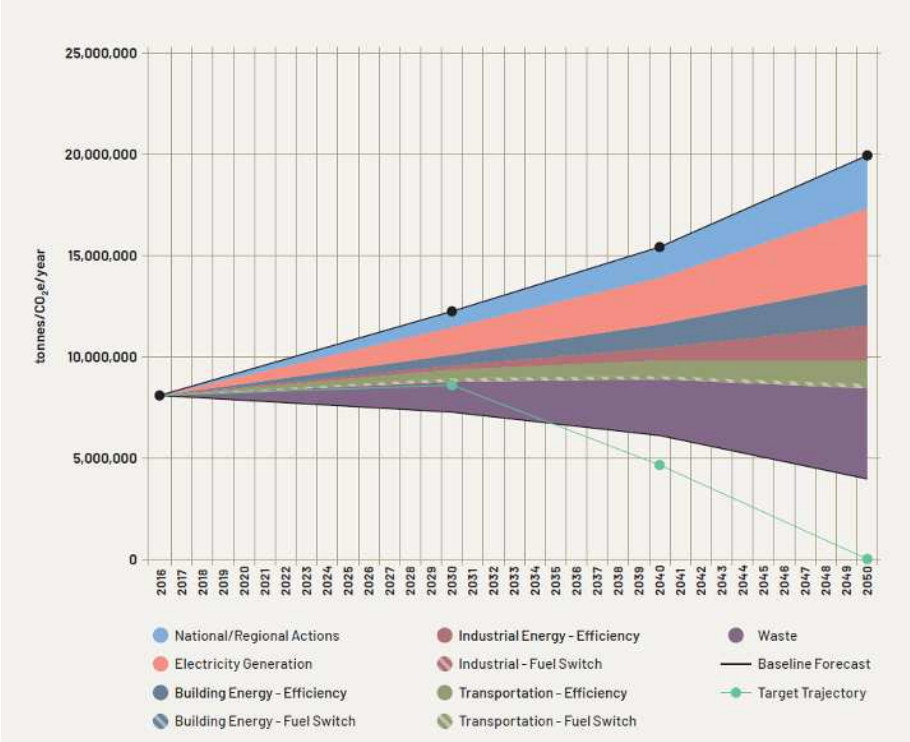


Figure 2-3 Emissions Reduction Targets of Quezon City by 2030 and 2050

Source: Enhanced QC-LCCAP

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

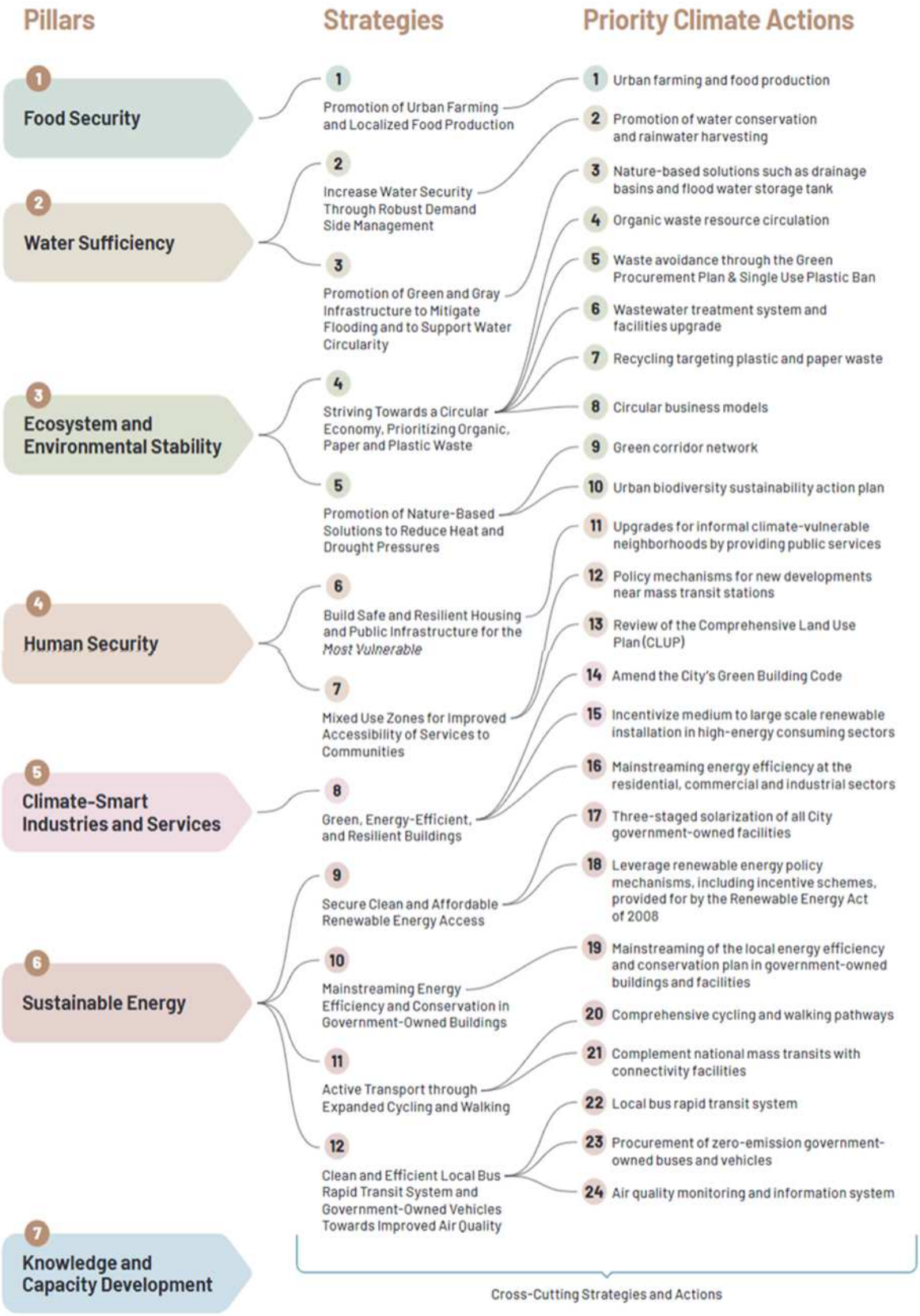
Table 2-2 Transformative Actions in Key Sectors

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

Source: Enhanced QC-LCCAP

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

Table 2-3 Enhanced Quezon City Local Climate Change Action Plan 2021-2050



Source: Enhanced QC-LCCAP

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

Table 2-4 Overview of Quezon City Local Climate Change Action Plan

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

Source: QC-LCCAP

2.1.4 Climate Action Implementation Plan (CAI)

The Climate Action Implementation Plan (CAI) is a plan for C40 cities, in cooperation with 15 other cities in Africa, Latin America and South East Asia, and through the Urban Climate Action Programme supported by the UK government, to take at least two effective actions of those suggested in the Climate Action Program (CAP) to continue monitoring and support progress of climate actions by incorporating a climate action plan into urban governance, planning and decision-making structures. The purpose of CAI is to expand substantial and effective implementation of CAP to the whole areas of the target cities, based on the transformation theory.

The CAI program announced by Quezon City in August 2022 declared that the city would address the following priority areas for the next three years: building code amendment as a measure to promote energy conservation and solarization of city-owned buildings as a measure to promote the use of renewable energy.

Figure 2-4 Major Pillars of the CAI Program

Source: Quezon City

Specifically, the program includes “Strategy 8: Green, Energy-Efficient, and Resilient Building”, and ”Strategy 9: Secure Clean and Affordable Renewable Energy Access”.

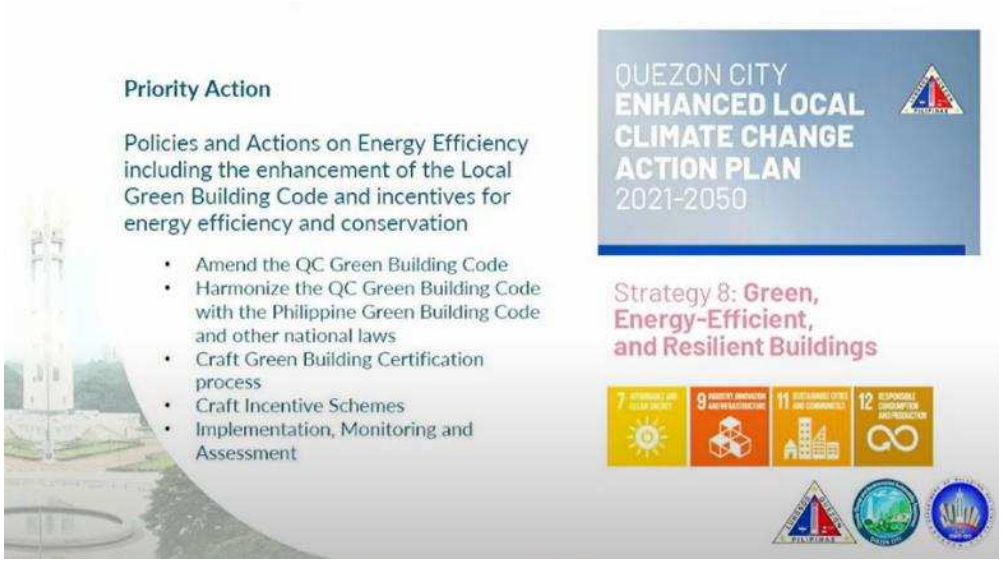


Figure 2-5 CAI Program Overview of Strategy 8

Source: Quezon City

Figure 2-6 CAI Program overview of Strategy 9

Source: Quezon City

Secure Clean and Affordable Renewable Energy Access

In September 2022, C40 Cities Climate Leadership Group Inc., based in New York, was appointed as an expert and has been carrying out baseline survey and analysis on the building conditions.

In the program's internal Technical Working Group (TWG) of Quezon City, the City Administrator Office plays an important role, with the City Administrator working as an advisor to the City Mayor, collecting ideas for the city's strategies and development projects, analyzing them, leading decision-making, and making proposals to the Mayor.

TWG's departments involved in the programme are as shown below.

Figure 2-7 UKAID CAI Program

Source: Quezon City

On the other hand, concerning the energy creation (renewable energy) mentioned earlier, the former Environment Protection & Waste Management Dept. (EPWMD), as described in the city's organization chart, currently called the Climate Change and Environmental Sustainability Dept. (CCESD), is mainly in charge of the acceleration of the introduction of solar power generation and serves as a contact for the city-to-city collaboration.

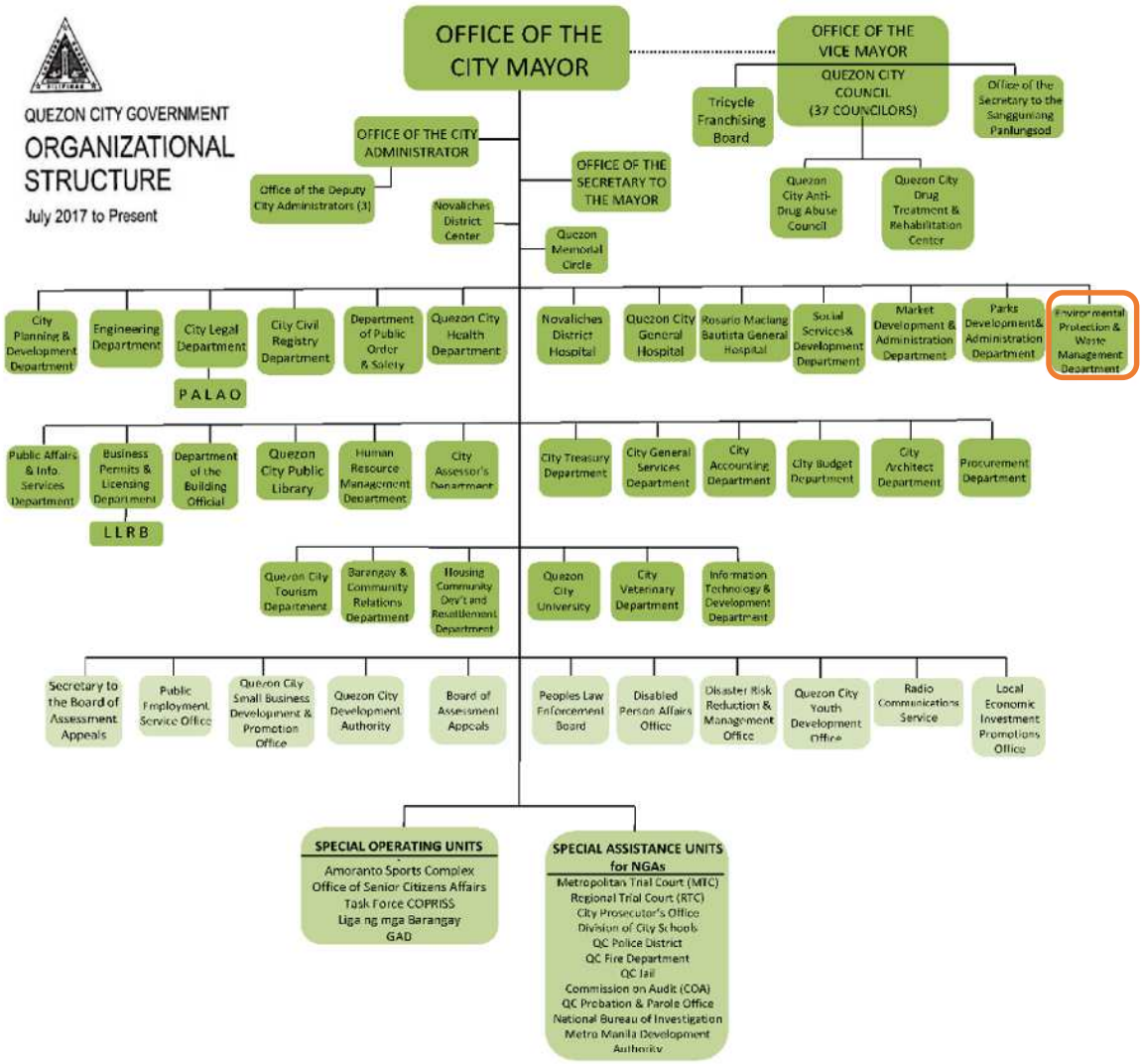


Figure 2-8 Quezon City Government Organization Chart

Source: Quezon City

2.1.5 Trends toward the Expansion of Renewable Energy in the Philippines

1) Aboitiz Power

In August 2021, Aboitiz Power, the largest renewable energy company in the Philippines, announced that it would invest about 190B PHP (420B yen) to expand the introduction of renewable energy in the next 10 years. The company aims to increase the rate of renewable energy in its power generation capacity from current rate of less than 30% (9,200 MW) to more than 50% (4,600 MW). As a way to increase renewable power generation capacity to 3,700 MW through the expansion of solar and wind power generation, they

have also established a plan to build 74 MW solar power generation facilities in Luzon Island in the northern region and start commercial operation. The country depends on import for liquid natural gas (LNG), of which supply is affected by the recent situation in Ukraine. Therefore, it is hoped that Aboitiz Power's efforts will bring good results.

Since the introduction of the Renewable Portfolio Standards (RPS) in the Philippines, many plans have been established for solar and other types of renewable energy facilities. The Aboitiz Group also plans to conduct development and investment in many renewable power generation plants in the next ten years.

2） San Miguel Corporation (SMC)

San Miguel Corporation (SMC) has announced that it plans to construct a 178,720 kW solar power plant in Mariveles City, the province of Bataanm, located in Luzon Island in the northern region, and complete it by the end of 2024.

The total capacity of SMC's secondary battery energy storage system (BESS) facilities being developed across the country will reach 530,000 kWh by the end of 2022, and 470,000 kWh storage capacity will be added when all 31 facilities are completed by the end of 2023.

3） ACEN

In November 2022, ACEN, a power generation company under the umbrella of Ayala Corporation, a major financial group in the Philippines, completed the sale of its wholly owned subsidiary, South Luzon Thermal Energy Corporation (SLTEC), which operates a coal-fired power plant (246,000 kW capacity) in the Province of Batangas to the south of Metro Manila. It was the world's first transaction case through the ETM. Under the ETM, it has been decided that the operation of the power plant will be discontinued by 2040 and 7.2B PHP (about 18.144B yen) transaction profit for ACEN will be reinvested in renewable energy. It is estimated that CO2 emissions will be reduced by up to 50M tons by cutting by half the operating time of the power plant, which was originally planned to be 50 years.

According to ACEN, SLTEC plans to allot share options to Insular Life Assurance, a local major insurance company, and ETM Philippines Holdings, and invest the profit from stock sales in new renewable energy projects so that they can withdraw from fossil fuel power generation and specialize in renewable energy.

4） Nickel Asia (NAC)

In July 2022, Nickel Asia (NAC), a leading resource development company in the Philippines, announced a collaboration with Shell UK in a renewable energy project, aiming to secure 1M kW solar power generation capacity by 2028. They intend to carry out development in Luzon in the northern region and Visayas in the central region with a view to development of onshore wind power generation facilities and energy storage facilities while focusing on large-scale solar power generation facilities.

Solar power generation facilities of 1M kW capacity may be enough to supply daytime electricity to more than 1.2M households every year in the Philippines. They aim to increase the generation capacity to 3M kW in the future.

Chapter3 Study of the Construction Field (Promotion for Energy Management and Renewable Energy)

3.1 Energy conservation sector trends

（1） Energy management trends

At the aforementioned AETI, there is a proposal to introduce renewable energy and energy management to contribute and cooperate with low-carbon and decarbonization efforts in Asian countries through a joint government and private sector effort. The Japanese government has also committed to funding efforts to reduce CO_2 emissions from coal-fired power plants in Asia. One of the visible initiatives and contribution proposals by Japan is a move to optimize the balance of supply and demand through energy management of renewable energy sources.

Accordingly, this underlines the need to promote the effective use of energy (energy management) by aiming to optimize the supply and demand balance through renewable energy generation, in line with the energy mix policy in the Philippines and the CAI program in Quezon City, in addition to reducing power consumption from fossil fuels such as coal-fired power generation.

（2） Energy management systems in Japan

EMS is a system that visualizes energy usage status and optimizes energy management by controlling how lighting, air-conditioning and other equipment operate. It is expected to contribute to environmental issues such as carbon neutrality and SDGs (sustainable development goals) as part of efforts to address climate change and resource depletion worldwide. Optimizing energy use can also help users save money. In fiscal year 2018, the market size of EMS and related equipment and services in Japan was approximately 883.4 billion yen. It exceeded one trillion yen in fiscal year 2019 and is predicted to reach 1.7 trillion yen by fiscal year 2030, with demand expected to continue increasing going forward.

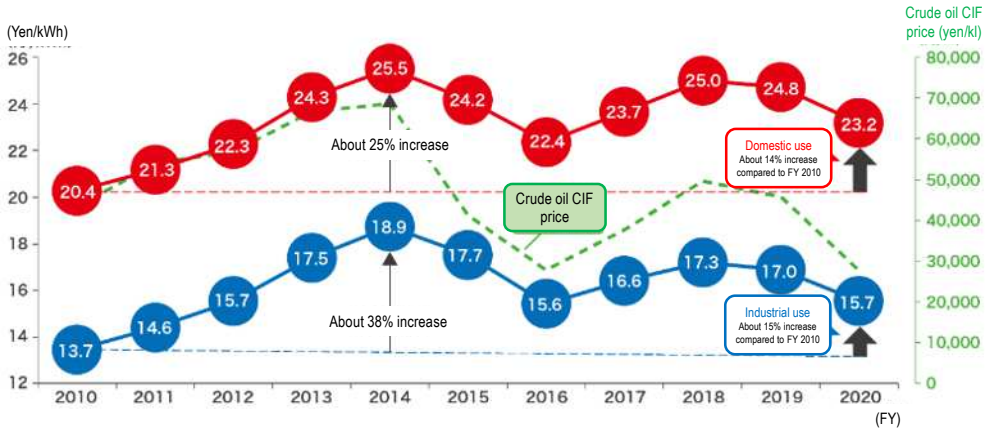


Figure 3-1 Changes in average electricity unit price

Source: Ministry of Economy, Trade and Industry

EMS systems are named differently depending on the object they manage. The main management targets include factories (FEMS), buildings (BEMS), homes (HEMS) and regions like small industrial parks (CEMS).

FEMS, which is targeted at factories, paves the way both to boost productivity and reduce energy costs by

linking energy management with production planning and the supply chain. These are being promoted as part of compliance with the Energy Conservation Law and as an element of ISO 50001 certification.

In offices and commercial buildings, BEMS can reduce wasteful energy consumption by visualizing the energy consumed and linking it to analysis and optimal energy supply planning. The three layers of BEMS, BAS (Building Automation System) and the local control layer can be linked to the BAS auto-control functions to effectively control peak shaving, heat sources, air-conditioning and certification and thereby optimize energy supply and demand. In the local control layer, there is also scope to conserve energy by interlocking with the BAS using lighting equipment equipped with an automatic control functions.

As well as collecting information from individual facilities and equipment, EMS also identifies equipment and operating conditions where energy consumption is sub-optimal by comparing and analyzing past data, which can then be used for maintenance purposes. Signs of aging or failure can also be detected, based on declining equipment operating efficiency and changes in power consumption.

（3） Example EMS implementation in Japan

1） EMS solutions for the semiconductor field

Given the vast amounts of energy consumed by producing semiconductor chips, it is believed that utilizing FEMS to optimize the use of electricity and heat and avoid energy supply risks would be effective. Fujitsu Electric Co., Ltd. produces power semiconductor chips, which are key devices for energy-saving and miniaturization, via the following initiatives:

① Improving air-conditioning energy by utilizing clean rooms in the factory, as well as external air cooling and heat exhaust utilization.

② Achieving a 100% power self-sufficiency rate and using waste heat through gas cogeneration (gas engines and fuel cells).

③ Smart factory utilizing FEMS.

Ultimately, this allowed Fujitsu Electric to achieve a 34% reduction in energy usage over five years and a power self-sufficiency rate of 100%, from zero in the past. In future, Fujitsu Electric plans to push forward with overall optimization efforts by utilizing IoT and AI technologies to implement functions like automatically analyzing the factors behind inefficiencies in each equipment and system and automatically tuning the operating parameters based on the analytical results in a move away from partial optimization.

Other initiatives by the company to optimize energy management and achieve energy efficiency include the “visualization,” “understanding,” and “optimization” steps shown in the figure below.

The “visualization” step involves collecting data on the usage fees for electricity, heating and cooling via sensors, while during the “understanding” step, accumulated data is analyzed from multiple perspectives using analytical software to uncover further energy waste and inefficiencies. Finally, in the “optimization” step, an AI engine predicts recent energy demand, plans an optimal operating pattern to minimize energy costs and achieves a reduction in energy usage.

2） Example energy conservation promotion by using an electricity demand forecasting system.

Fujitsu Electric Co., Ltd. opted to introduce the ZEBLA (Zero-Energy Building Logging and Analysis) system, which was improved for FEMS, to enable early-stage power suppression control. This system suppresses peak power demand and achieves power leveling while leaving production plans unaffected.

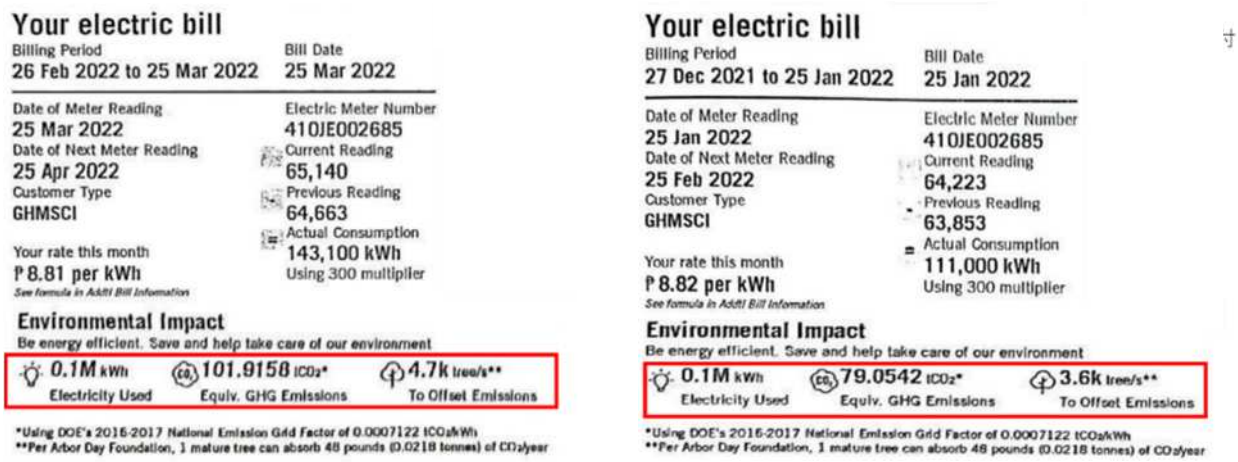
The FEMS-specific ZEBLA system includes a “TPO control” function that selects control targets at the optimal timing depending on the situation. This function is crucial for furnaces and processing machines requiring precise control in particular, given the potentially significant impact on product quality which momentary power outages or voltage fluctuations can cause. With this function, Fujitsu can disperse power demand peaks without compromising productivity and comfort.

This initiative was evaluated in the context of its contribution to reducing energy usage, by not only leveling power demand with ZEBLA but also promoting other energy-saving measures, such as converting large gas air-conditioners to electric power (clean energy conversion) without increasing the contract power. In 2018, they achieved an energy reduction of 1,167 kL (crude oil equivalent) per year, an electricity usage ratio of 83% and an energy unit (crude oil equivalent) reduction rate of -25.7% compared to 2015.

3.1.2 Study on the introduction of energy management in the Philippines

The Philippines has established PE2 (the Philippine Energy Efficiency Alliance), supported by DOE. This organization aims to achieve energy efficiency and conservation roadmap goals effectively by organizing collaboration between the private sector and market stakeholders in society, accelerating decarbonization, including economic activity, by promoting low-carbon energy, creating environmentally friendly employment and reducing CO_2 emissions. By lowering energy prices, saving cross-sectoral energy and reducing dependence on imported energy, it is expected that the Philippines will contribute to achieving the Paris Agreement goals.

Meralco, a major electricity supplier (distributor) in the Philippines, is also a member of PE2. It is striving to boost awareness of energy conservation and CO_2 reduction among its users by displaying the approximate CO_2 emissions calculated by DOE’s CO_2 emission coefficient for the amount of electricity consumed on the electricity bill issued monthly, as well as the number of trees needed to absorb the emissions. This effort aims to encourage energy conservation and CO_2 reduction among users who pay the electricity bill.



* The red-framed part section states that this electricity usage of 0.1 MWh results in a CO_2 emission of 101.9158 t and 4,700 trees are needed to absorb and offset it.

Figure 3-1 Quezon City General Hospital Electricity Bill

Meralco Energy Inc. (MServ), a subsidiary of Meralco, is engaged in the Energy Management System (EMS) business, which provides services to optimize electricity supply and demand as part of its energy conservation business. As shown in the table below, MServ already has a track record in Carrefour shopping malls, etc. and the software required for its EMS is manufactured by the Hitachi Group.

Table 3-1 Overview of Carrefour Shopping Center

Summary	Building management systems supplied and installed with POWERBAT software	
Feature	Managing energy of 832 facilities	
Outcome	27% reduction in electricity consumption	

Source: Oriental Consultants Co., Ltd.,

In this survey, MServ, a subsidiary of Meralco, which is engaged in the EMS business in Quezon City, is working on proposing the installation of Japanese-made super capacitors on air-conditioning outdoor units aimed at reducing CO_2 emissions through energy efficiency promotion. The product is intended to reduce the burden on outdoor units caused by the deterioration of condensers and compressors over time, as well as the full operation of air-conditioning due to climate change and is expected to have the effect of reducing power consumption and improving performance by installing it. In order to supply the product, the development and production of patented refrigerants are already underway in the Philippines and CO_2 reduction effects have been certified by the Department of Science & Technology (DoST).

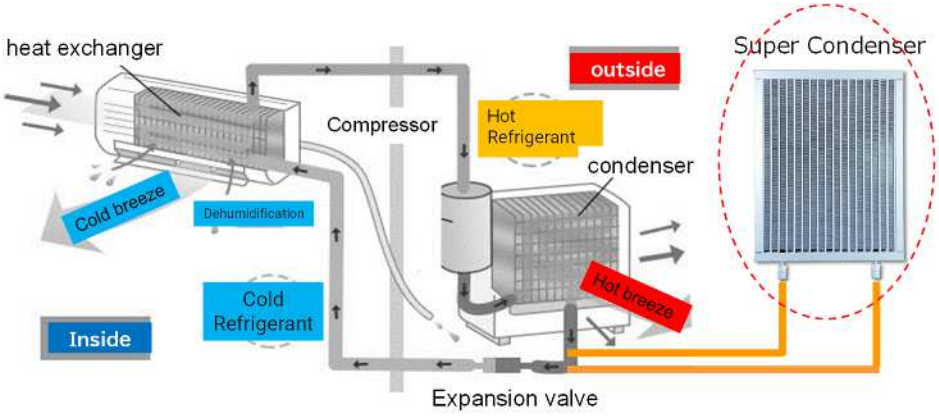


Figure 3-2 Overview of supercapacitor

Source: Green Earth Co., Ltd.

3.1.3 Consideration of Smart LED installation

In recent years, in Quezon City, as well as long-standing efforts to improve the environment, policies related to energy efficiency have been announced and efforts have been made to introduce LED lighting with technical support from the World Bank Institute (WBI).

The Department of Public Works and Highways (DPWH) is providing funding to install 2,046 LED streetlights on major roads in Quezon City which are not currently lit. Promoting LED lighting is expected to significantly improve the illumination of Quezon City streets, helping reduce crime and boosting nighttime tourism. The energy and cost savings resulting from LED lighting can also be allocated to other social issues.

As of October 2019, there were a total of 26,776 streetlights in Quezon City and the city is currently implementing the QC Integrated Energy Efficiency Streetlights Program 2020-2025 to introduce and replace them with LED lights.

Quezon City is planning to finance the purchase and installation of these 25,000 streetlights through internal revenue allotment from the Philippine government and revenue from business and real property taxes collected in Quezon City, as shown in the diagram below.

Figure 3-3 Work in progress by Mserv

Source: Meralco Energy Inc.

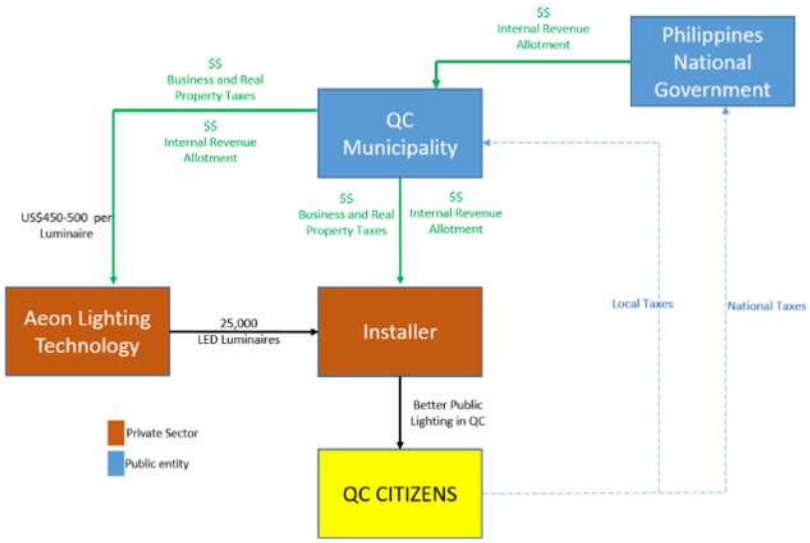


Figure 3-4　Funding recipient targets for street lighting retrofit in Quezon City

Source: Municipal Financing Delivery Model Quezon City, Philippines, Case Study

Japanese companies are considered likeliest to enter the LED lighting market in the area of architectural lighting in high-end residential areas, where there is scope to stand out from other Asian LED lighting companies by being more competitive. Going forward, it is expected to become easier for Japanese companies to enter the market for smart city development. In the case of the aforementioned LED streetlight project in Quezon City, Japanese companies are expected to stand out during the Phase 2 consideration of smart (IoT) lighting.

3.2 Trends in the energy creation (renewable energy) sector

3.2.1 DOE and Local Company Initiatives

（1） DOE’s Renewable Energy Initiatives

Efforts in the area of low carbon and decarbonization involve two approaches: introducing renewable energy to generate more energy and energy conservation. The Philippine government has already prohibited the construction of new coal-fired power plants and expanded its target for introducing renewable energy based on the energy mix. The government aims to increase the percentage of renewable energy to 35% of the total energy mix by 2030 and to 50% by 2040. During a visit to Japan in February 2023, President Marcos and his cabinet announced that this policy would be part of the government’s development plan for 2023-2028. The renewable energy sector is also moving toward allowing 100% foreign investment in business.

The ban on new coal-fired power plants has led to gas cost hikes being passed on to electricity and causing those prices to rise accordingly in the Philippines. Negotiations with Meralco, the electricity buyer, are ongoing to adjust prices. Going forward, the Philippine government’s energy mix policy is expected to accelerate the adoption of renewable energy.

The DOE has announced a green energy auction for project bidding to promote the adoption of renewable energy. Winners have already been announced in the solar, geothermal, small hydropower and wind power sectors. On Luzon Island, two hydropower projects with a total capacity of 80 MW, five solar power projects

with a total capacity of 1,070 MW and four wind power projects with a total capacity of 360 MW have been selected. In Visayas, there is one solar power project with a capacity of 300 MW and one wind power project with a capacity of 13 MW. On Mindanao Island, there are four hydropower projects with a total capacity of 19 MW, one biomass power plant with a capacity of 3.4 MW and one solar power plant with a capacity of 120 MW. However, the actual signing of financing-related contracts for each project must be monitored to ensure their implementation.

（2） Possibilities in Quezon City

Accordingly, it is important to target private companies in Quezon City to support the Enhanced QC-LCCAP and the investigative team has also explained how the JCM Model Project is used to the CEO of EEI.

According to EEI, there is an industrial park (5-Star Industrial Complex) in the Novariches area of Quezon City. Along with the CAI program of Quezon City, a feasibility study must be conducted on constructing a feed-in scheme utilizing the JCM Model Project, including the installation of rooftop solar power systems for self-generation or the introduction of renewable energy centered on solar power generation for factories in the area. In future, with the cooperation of Quezon City and the Quezon City Chamber of Commerce, consideration for promoting JCM utilization targeting factories in the surrounding areas of Quezon City as shown in the table below will be promoted.

Table 3-2　Factories located around of Quezon City

	Factory name	Industry type
1	Josefina Manufacturing, Inc.	Clothing wholesale and manufacturing
2	Blu Larimar Sales Resource Inc.	Plastic Packaging Products
3	Pacific Paint (BOYSEN®) Philippines, Inc.	Paint manufacturing
4	Salinas Corporation	Salt manufacturing, distribution and sales

Source: Oriental Consultants Co., Ltd.

（3） Local companies' efforts in renewable energy (Developer)

1） Ayala conglomerate

As previously mentioned, AC Energy (ACEN), the power generation company of Ayala Corporation, has successfully sold its existing coal-fired power assets and is focusing on becoming a specialized renewable energy provider. The company is actively expanding its renewable energy business, including battery storage, not only in the Philippines but also in other Asian countries and Australia. In July 2022, ACEN also agreed to invest in a joint venture company, Ingrid Power Holdings Inc (IPHI), which is pushing for a 150MW diesel-fired power plant project in Pili, Rizal. In addition to the existing ancillary service business with the National Grid Corporation of the Philippines (NGCP), ACEN is considering a new renewable energy introduction business. ACEN is currently in the process of arranging a technical presentation on how to integrate solar power generation, battery storage and an energy management system (EMS) as a Japanese technology.

2） Yuchenko conglomerate

The renewable energy developer of the Yuchenko conglomerate, Petro Energy Resources Corporation (PERC), is developing onshore wind power and considering cooperation for finance with the JCM Model Project. PERC is collaborating with Kyuden International (KI), a subsidiary of Kyushu Electric Power. In the microgrid business (an energy supply and consumption system that aggregates energy sources and consumption facilities for local production and consumption), in which KI invests, PERC supplies power via diesel generation in Palawan and Cebu islands, which are not connected to the main power transmission system. However, PERC plans to introduce solar power generation facilities and further development at other locations in future.

When PERC officials visited Japan in January 2023, they engaged in discussions with KI and our investigation team regarding the realization of the JCM Model Project for renewable energy generation, which is expected to be planned in future.

According to this passage, the investigation team discussed the possibility of implementing the JCM Model Project for the 27 MW solar power plant project of Petro Green Energy Corporation (PGEC), which is a subsidiary of PERC. However, they decided not to pursue the project due to difficulties in finding a Japanese representative company to apply for the JCM subsidy before the application deadline.

The Yuchenko Group is known for its pro-Japanese stance, with a record of producing ambassadors to Japan for the Philippines and having the CEO of its major construction firm, EEI, serve as representative secretary of the Japan-Philippines Economic Committee. EEI is based in Quezon City and has installed 197.6 Wp solar panels at its own headquarters there, as shown in the diagram below, which have been in operation since 2020.

Figure 3-5 Rooftop solar panels at EEI headquarters

Source: EEI

EEI also visited Sumitomo Electric Industries (at the Osaka head office) concentrating photovoltaic (CPV) and redox flow battery demonstration facilities and the company has been very proactive in introducing renewable energy. They have also acquired shares in BioTech's Philippine subsidiary (BioTechJP) in Niigata Prefecture and installed rooftop solar power generation facilities at the BioTechJP facility. Additionally, EEI has also won the contract for the solar carport facility at Tarlac Hospital.

Figure 3-6　BioTechJP's rooftop solar power generation system (left) and Tarlac Hospital's solar carport (right)

Source: EEI

（4） Future direction

More and more renewable energy projects, especially involving solar power, are expected in the Philippines in future. However, in the JCM Model Project, the subsidy rate is currently set at 40% based on the number of current solar projects and it is expected that the subsidy rate will decrease in the future as in Thailand. Therefore, it is necessary for the developer to propose a more advantageous solution by combining a battery with a solar power plant to achieve a higher subsidy rate of 50%, rather than a standalone solar power plant. In the fields of wind power, small hydropower, geothermal power, etc., it is also possible to consider ways to obtain higher subsidy rates, but since it will be a power selling business, collaboration with local developers will be essential.

As aforementioned, collaboration between local developers and Japanese companies on renewable energy projects, such as Marubeni Group and Kyushu Electric Power, are also progressing, so the use of the JCM Model Project is also expected to be promoted in future.

3.2.2 Low-carbon and Decarbonization Renewable Energy Projects

（1） Renewable energy projects based on the JCM Model Project

In the Philippines, JCM Model Projects implemented by Japanese companies include solar power generation (including rooftop solar), small hydropower and geothermal power generation. However, the power generation sector in the Philippines is mainly in the form of IPP (electricity sales) projects and the use of JCM Model Projects is primarily for power sales businesses by trading companies and others, rather than for self-generation of electricity for Japanese company factories.

The JCM Model Project implemented by Toyota Motor Philippines in 2017 involved installing a 1.1 MW solar power generation system on the roof of its automotive manufacturing plant located in southern Manila, in partnership with Meralco subsidiary SPECTRUM. The electricity generated is consumed for in-house use, reducing CO_2 emissions by replacing the amount of electricity consumed from the grid. The project is expected to result in an annual GHG emission reduction of 731 tCO_2/year.

Figure 3-7　Additional solar power generation facilities for factory self-use

Source: SPECTRUM

SPECTRUM, a Meralco subsidiary, has also installed a 1 MW solar power generation system at the Ajinomoto factory, further strengthening the ties between Japanese companies and Meralco.

Figure 3-8　1MW solar power generation facility installed in Ajinomoto Philippines Flavor Food Inc.

Source: SPECTRUM

SPECTRUM, a Meralco subsidiary, also handled the installation of over 1MW of solar power facilities at Maynilad Water Services Inc. (Maynilad), the largest private water utility in the Philippines, which also covers Quezon City. Although the JCM Model Project was not utilized by Maynilad, SPECTRUM is working to roll out more than 1MW of solar power facilities at Maynilad's La Mesa Compound (Sewage Treatment Facility/Pumping Station) between 2021 and 2022. Maynilad is advancing its efforts toward low-carbon emissions, taking the CO_2 emissions associated with the operation of pumps and motors at sewage treatment plants into account and is considering the procurement of renewable energy sources (electricity) in future.

Figure 3-9　Solar power plant inside La Mesa Compound in Quezon City

Source: Maynilad

Some Japanese companies are implementing initiatives to use renewable energy by utilizing roof-mounted solar power for their own factories in the Philippines without utilizing the JCM Model Project. Philippine Manufacturing Co. of Murata, Inc., a production subsidiary of Murata Manufacturing Co., Ltd., has met all its power needs through renewable energy since January 2022. To promote the use of renewable energy, the company started installing solar panels on the roof of its production building from May 2021. In the Philippines factory, which is the first overseas base to convert to 100% renewable energy, 6,768 solar panels were installed in May 2021 and it is expected to reduce CO_2 emissions by approximately 2,947 tons. The company's solar panels are supplied by Sharp.

Table 3-3 Solar panel overview

Working day	May 2021
Usage of generated power	In-house use
No. of units installed	6,768
Photovoltaic system capacity	2,978 kW
Annual electrical power generated	4.22 million kWh
Annual CO_2 reduction	2,947t

Source: Murata Manufacturing Co., Ltd.

Figure 3-10 Roof-mounted solar panels

Source: Murata Manufacturing Co., Ltd

Conversely, as part of an initiative that has already seem roof-mounted solar power generation units installed and started monitoring CO_2 emissions, Sharp Energy Solutions Corporation (SESJ) has installed a DC (Direct Current) 4MW solar power generation system on the roof of a production factory operated by a Yokohama Rubber Corporation subsidiary that produces and sells tires in Pampanga Province, the Philippines, under the JCM Model Project. The electricity generated is used in the tire factory to reduce the amount of power purchased from the grid. The estimated annual power generation capacity of the factory, which is about 5,363 MWh, is equivalent to a reduction of approximately 2,858 tCO_2 in greenhouse gas emissions per year. This project is being implemented as a JCM Model Project supported by the Ministry of the Environment and monitoring of CO_2 emissions has been underway for nine years.

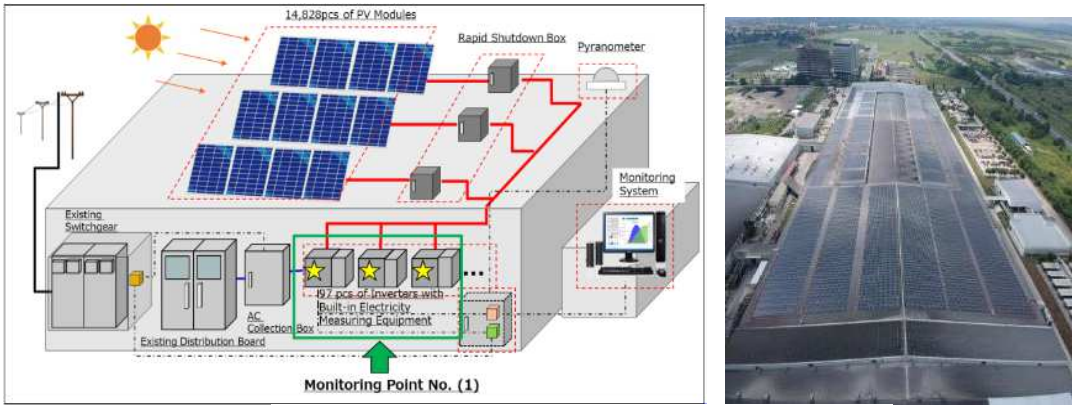


Figure 3-11 Solar power generation system

Source: Sharp Corporation

The JCM Model Project for fiscal year 2022 also encompasses a renewable energy project for the Philippines, which is an investment project for rooftop solar power generation at ceramic and cement factories by Marubeni Corporation. It involves the introduction of a total of 9 MW of solar power generation systems for each factory in the ceramic and cement manufacturing industry, with a joint venture partner (TeaM Energy Corporation) responsible for the installation, operation and maintenance of the facilities and supplying electricity to the companies that own each factory. By substituting renewable energy for a part of the power from fossil fuel-derived grids, it is expected to reduce GHG emissions by 5,957 tCO_2 annually.

The Marubeni Group is considering utilizing the JCM Model Project for similar development projects going forward and exploring the idea of collaboration with companies that are actively engaged in the Philippine market, like the group itself, to promote the formation of JCM Model Project initiatives.

3.2.3 Efforts to form a case for the JCM Model Project

As part of a feasibility study on solar power generation, they are considering specific project formation by exchanging information with solar panel manufacturers who have a track record of rooftop solar power generation JCM Model Project in Meralco and the Philippines.

During the survey, a meeting with SPECTRUM executives who visited Japan in December 2022 was held. It was confirmed that the idea of introducing solar power generation facilities to facilities owned by Quezon City is being considered by way of a Power Purchase Agreement (PPA) between the city and the business operator. We will continue to monitor the situation in Quezon City and share information with Japanese companies with a track record of being selected for JCM Model Project's electricity sales business, while working with related companies to push forward with JCM Model Project initiatives, as envisioned in the organizational chart below.

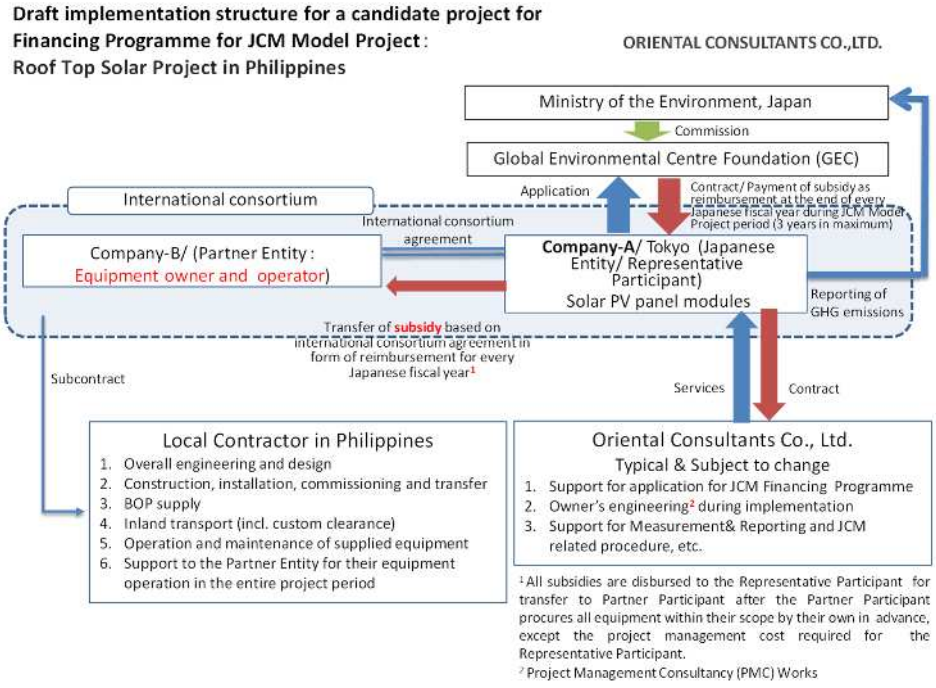


Figure 3-12 Project implementation plan

Source: Oriental Consultants Co., Ltd.,

The scope of this study also included explaining the outline of the JCM Model Project to Meralco, the distribution company that supplies electricity to Quezon City, via online meetings to promote project development. Meralco established a new department called the Sustainability Office in 2020 and under the CEO's leadership, started an initiative to generate 15% of their own electricity consumption by using renewable energy (rooftop solar power generation). In 2021, they completed the installation of 145 kWp of solar panels at three facilities at the Meralco Ortigas Compound (MOC) in the Ortigas district. Plans for further installations as shown in the table below were also confirmed with Meralco.

Table 3-4 Installation plan for future solar power generation in MOC

2023-2025（Phase 1）		
Building/Location	Total Capacity（kWp）	Year of Implementation
Lopez Building	27	2023
Technical Services Building	209	2023
Security Building	14	2023
Emergency Operations Center	23	2024
Fire Station	34	2025
Total	**308**	
2026-2030（Phase 2）		
Emergency Response Facility	55	2026
Transportation Building	175	2027
Meter Storage Facility	204	2027
Meralco Orange Fit Center	539	2028
Covered Tennis Court	167	2028
Business Solution Center	75	2028
B&G Building	87	2029
Materials Recovery Facility	95	2029
New Operations Building	427	2029
Parking Area	339	2030
Total	**2,163**	

Source: Meralco

In line with the above plan, the research team engaged in discussion with Sharp Energy Solutions (Osaka), which has a track record in roof-mounted solar power generation JCM Model Project in the Philippines and held an online meeting with three companies, including SPECTRUM and the research team.

As the scale of Phase 1's 308 kWp is insufficient for a JCM Model Project, there are plans to proceed with normal trade business negotiations. Conversely, to consider JCM Model Projects for future Phase 2 of 2,163

MWp and other projects on which Meralco is working, the three companies will start by selecting and designing solar panels for Phase 1 through technical discussions. SPECTRUM has introduced information on Sharp's 550W (Module Efficiency 21.29%) solar panels to Meralco, as shown in the figure below.

Figure 3-13 Monocrystalline PERC Half Solar Cell Module

Source: Sharp Corporation

3.3 Green Building

3.3.1 Quezon City Building Code

As part of moves to promote low-carbon and decarbonization in Quezon City, a Green Building Ordinance was passed in 2009, mandating "the design, construction, or alteration of buildings, other structures and chattels to meet minimum standards for green infrastructure." Specifically, the following actions are required: Buildings constructed after 2011 must comply with this Green Building Ordinance, which includes operation and maintenance.

Table 3-5 Details of Green Building Ordinance

Green Building Ordinance Details
・ Use renewable building materials.
・ Install and use insulation, energy reduction and efficiency mechanisms.
・ Use solid waste and wastewater treatment schemes.
・ Incorporate green architecture.
・ Reduce greenhouse gases and other volatile organic compounds.

Source: QCG Building Code

Buildings that comply with the Green Building Ordinance are eligible for tax incentives. The ordinance requires buildings, other structures and movables to be designed, constructed, or renovated in compliance with the minimum standards for green infrastructure. This includes schools, office buildings, hospitals and warehouses. The ordinance also emphasizes the conservation and sustainable planning of land, water conservation and efficiency, energy efficiency and renewable energy, materials and resource conservation,

indoor environmental quality and human health.

Building owners can obtain “green” certification for their buildings and must submit technical requirements to obtain both the Preliminary Certification (PC) and Final Certification (FC) certificates. To obtain the PC, requirements such as construction activity management and pollution prevention systems, energy efficiency plans, water reduction systems including water-saving equipment, waste management plans, designated smoking area layouts and sewage treatment plans must be submitted. Building owners can earn up to 100 points for new construction projects or building renovations, with equivalent tax deductions issued by the city treasurer and city assessor through the PC. Buildings that earn 70-89 points (Gold) receive a 20% tax deduction incentive, while those earning 50-69 points (Silver) receive a 15% deduction. Buildings with fewer than 50 points (certified green buildings) are not eligible for tax deductions. Popular green buildings in the area include the Laguna Lake Development Authority Building, Seda Vertis North, Vivaldi Residences and Ilan Lane Townhouse.

Quezon City announced its CAI program in August 2022, supported by UK AID, which focuses on the utilization of renewable energy generation centered on the introduction of solar power generation as an alternative to fossil fuel power sources. In addition to the introduction of renewable energy, the revision of the Building Code is also a priority. They aim to pursue efficiency by harmonizing and unifying the Building Code of the Philippine government and the Building Code of Quezon City. Moreover, C40 is promoting Clean Construction in Quezon City. ().

Figure 3-14 Quezon City key Action

Source: Making the Case for Clean Construction QUEZON CITY

Quezon City has already been working with CASBEE Osaka Mirai and we plan to continue discussions with the city to identify projects that could lead to a specific JCM (Model Project).

3.3.2 Osaka City Comprehensive Assessment System for Built Environment

To promote environmental consideration in buildings, the city of Osaka implemented the “Osaka City Building Environmental Consideration Ordinance” (enforced in April 2012), which requires the submission of a plan giving details of the environmental quality, performance and reduction of environmental impact for buildings above a certain size and summarizes the plan on its website and other platforms through the “CASBEE Osaka Mirai” system. This system aims to encourage the development of comfortable and environmentally friendly buildings, as well as promote labeling systems that indicate the environmental performance in advertisements for condominiums and rental offices and award excellent buildings to further promote and raise awareness of the system.

When newly constructing, expanding and renovating buildings with a total floor area of 2,000 square meters or more, the building owner must conduct a comprehensive environmental evaluation of the building based on the standards established by the city of Osaka and report the results in a “Building Environmental Plan” to the city of Osaka. For existing buildings with a total floor area of 300 square meters or more, or new construction, expansion and renovation of buildings with a total floor area of less than 2,000 square meters, voluntary reports can be submitted and the environmental performance of the building can be displayed in advertisements through labeling.

The following table shows the types of buildings covered by this system:

Table 3-6　Buildings subject to CASBEE Osaka Mirai

1.	Buildings for which a building environmental plan must be submitted (specified environmentally conscious buildings)
2.	- New buildings, extensions and renovations with a total floor area of 2,000 m^2 or more
3.	Buildings that can be notified voluntarily (quasi-specified environmentally friendly buildings)
·	New buildings, additions and renovations with a total floor area of 300 m^2 or more but less than 2,000 m^2
·	Existing buildings with a total floor area of 300 m^2 or more
4.	Energy-saving renovation, etc. of existing buildings with a total floor area of 300 m^2 or more

Source: Osaka City

（1） Building Environment and Efficiency Rating System (CASBEE)

CASBEE stands for “Comprehensive Assessment System for Building Environmental Efficiency,” and is a method for evaluating and rating the environmental performance of buildings. It was developed through a joint effort of industry, government and academia under the leadership of Japan’s Ministry of Land, Infrastructure, Transport and Tourism. Building owners and designers can use the system to evaluate a building’s comprehensive environmental performance, including energy efficiency, resource conservation, recycling performance, indoor environmental comfort, durability and consideration for the surrounding landscape.

（2） Evaluation contents of CASBEE Osaka Mirai

Regarding the evaluation of CASBEE Osaka Mirai, it is based on CASBEE (Building Environmental Efficiency Rating System) and evaluated based on the “Building Comprehensive Environmental Evaluation Criteria (enacted on April 1, 2015)” formulated taking into account the regional characteristics of Osaka City. The evaluation items are divided into the following two categories:

Table 3-7　CASBEE Osaka Mirai Evaluation Items

Evaluation items
Q: Environmental quality and performance inside the building and on the site (Quality) Quality concerns aspects of the indoor environment such as room temperature and ventilation, functionality, earthquake resistance of buildings, greening and so on.
L: Environmental Load from Buildings, including Energy Consumption Items related to energy efficiency, resource conservation and heat island countermeasures.

Source: Osaka City, Osaka City Building Environmental Consideration System

The overall evaluation is carried out using a numerical value called Building Environmental Efficiency (BEE), which integrates the two areas mentioned above. Furthermore, the environmental evaluation of the building is graded into five levels based on the BEE value and the evaluation results are shown in figures and graphs, among others. This numerical value increases when the quality and performance (Q) of the

environment are improved or when the external environmental load (L) is reduced.

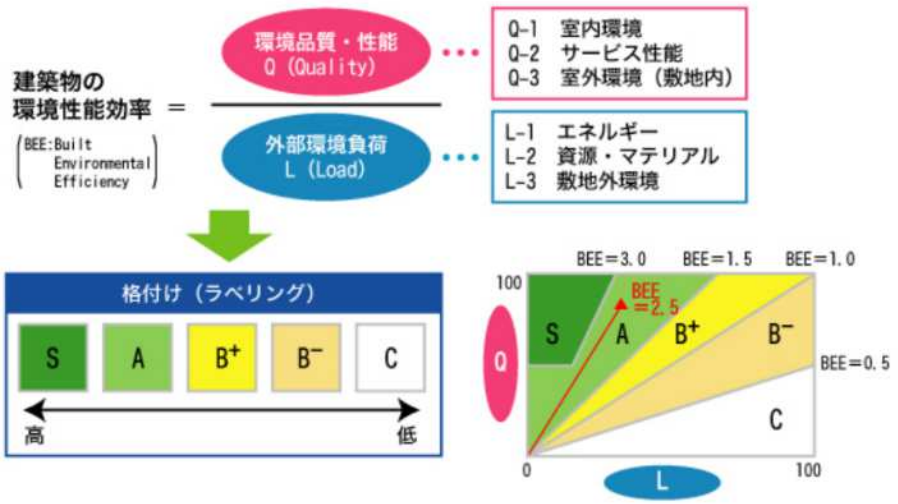


Figure 3-15 Building Eco-Efficiency (BEE) and rating (labeling)

Source: Osaka City

Going forward, there will be a need to compare and analyze the case of the Building Code revision (including the previous Philippines National Building Code/Quezon City Building Code) announced by Quezon City under the CAI program and the case of CASBEE Osaka Mirai and consider contributing measures.

Chapter4　Study of the Transportation Field (Air Quality Management)

4.1 Current Status and Measures to be Studied for Traffic Flow Improvement in Quezon City

The population of Quezon City was 3 million in 2016. It increased annually by 1.17 percent from 2010 to 2015 and it is projected to reach 4 million between 2025 and 2030. The increase is due to the natural increase and relocation from neighboring cities and securing labor force, strengthening the competitive edge and further development of economic activities are expected. In order to maintain continuous growth with the population increase, urban and transportation infrastructure development needs to be promoted. However, the amount of GHG emissions of the transportation sector, caused by jeepneys and autorickshaws and private cars account for approx. 21 percent all total emissions. Measures for automobile traffic in the transportation sector is likely to have a major impact on the emissions reduction.

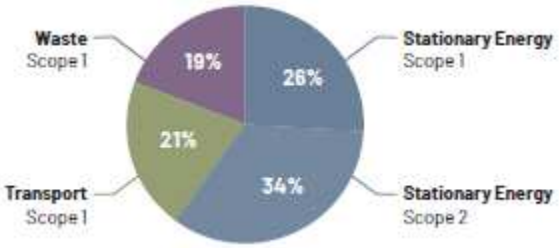


Figure 4-1　GHG Emissions by Sector in Quezon

Source: Enhanced QC-LCCAP

In the Enhanced Quezon City Local Climate Change Action Plan 2021-2050 (Enhanced QC-LCCAP), transformative actions concerning motor traffic include mode shift to walking and biking and mass public transport and shift to public utility vehicles and private cars, all of which cause less environmental burden. Measures to materialize the vision are analysis of means of transportation, revision of the plan of intermodal transportation that combines means of transportation to reduce the environmental burden as the entire transportation system and improvement of transport nodes in the city to expand and increase the access points and improve the convenience. It also intends to reduce GHG emissions and improve air quality by monitoring the air in the city and provide data necessary for planning concurrently with the development of a green transportation system that includes the introduction of BRT (bus rapid transit) and shift to electric buses.

In this chapter, the current status of the road traffic in Quezon is organized in order and examine the technology of transportation infrastructure for continuous economic development that is also expected to be introduced to enable GHG emissions reduction.

Table 4-1　Transformative Actions in Transportation Sector

Sector	Transformative Action
Transportation	• Shift to walking and biking. • Shift to mass public transport. • Modernization of public utility vehicles (PUVs) and private cars

Source: Enhanced QC-LCCAP

Table 4-2　Overview of Enhanced Quezon City Local Climate Change Action Plan 2021-2050 of Quezon City (Enhanced QC-LCCAP 2021-2050) (an excerpt)

Pillar	Strategy	Priority Climate Action
4. Human security	⑥ Build safe and resilient housing and public infrastructure for the most vulnerable	(11) Provide public services to climate-vulnerable communities.
	⑦ Mixed use zones for improved accessibility of services to communities	(12) Policy mechanism for new development near mass transit stations (13) Review of comprehensive land use plan (CLUP)
5. Sustainable energy	⑪ Active transport through expanded cycling and waling	(20) Comprehensive cycling and walking pathways (21) Connectivity facilities that complement national mass transit
	⑫ Clean and efficient local bus rapid transit system and government-owned vehicles towards improved air quality	(22) Local bus rapid transit system (23) Procurement of zero-emission government-owned buses and vehicles (24) Air quality monitoring and information system

Source: Enhanced QC-LCCAP

4.1.1 Current Status and Challenges concerning Road Traffic in Quezon City

（1） Road and Traffic Conditions

1） Road network

As shown in エラー! 参照元が見つかりません。, the road network of Metro Manila mainly consists of five loop lines and 10 radial roads connecting central business districts, commercial districts and residential districts. In Metro Manila, there are three expressways, NLEX, Skyway and SLEX, and they access to regions III and IV-A. Some of the five loop lines and 10 radial roads run through Quezon City. They have at least 6 lanes. Although major roads are sufficiently maintained, traffic concentrates there.

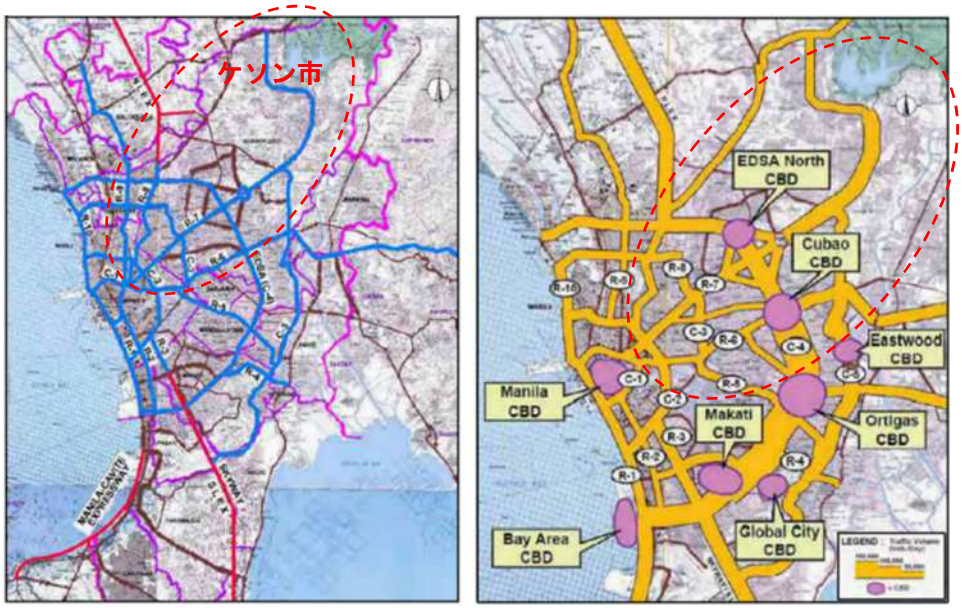


Figure 4-2　Road Network (left) and Traffic Volume (right) in Metro Manila

Source: Final report on the project to enhance high-standard highways by ITS in Mega Manila in the Philippines (JICA)

Major road projects in Metro Manila include three expressways, five interchanges and two bridge development. The future road network is provided in エラー! 参照元が見つかりません。. The road network to be completed by 2030 is based on the Master Plan on High Standard Highway Network Development in the Republic of the Philippines, JICA (2010).

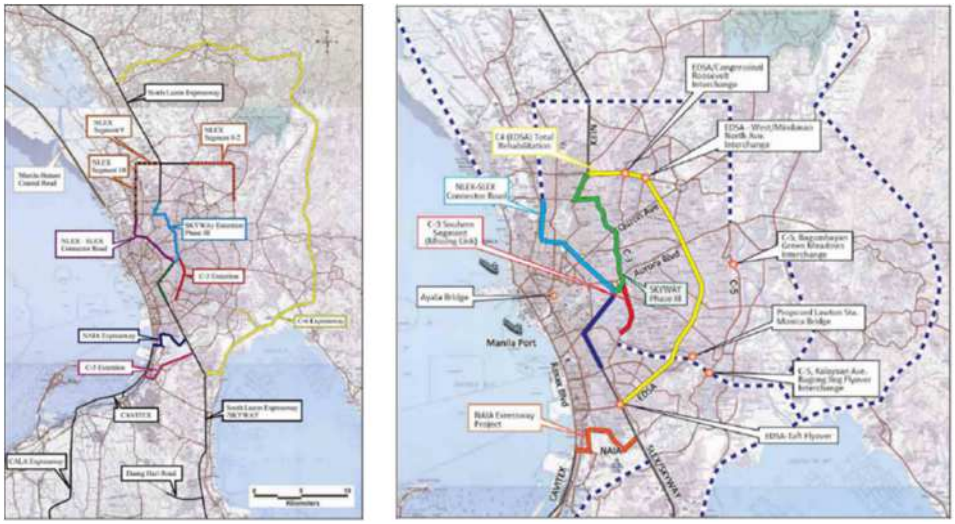


Figure 4-3 Location of Road Projects (left) and Future Road Network (right) in Metro Manila

Source: Final report on the project to enhance high-standard highways by ITS in Mega Manila in the Philippines (JICA)

2） Registered vehicles

In the transportation system in Metro Manila, rail transit has become common. However, because of the absolute shortage of the capacity, dependence on road transportation continues to be high. The number of registered vehicles in 2009 was 6.22 million in the Philippines and Metro Manila accounts for 28.8% or 1.77 million of the total. In addition, 0.84 million vehicles registered with Central Luzon in Region III and vehicles registered with Calabarzon in Region IV are said to be running in Metro Manila during the day. Although the sales of new cars in the Philippines peaked in 2017 at 474, 000 and reduced to 402,000 in 2018, it is still high. This has continued with stable economic growth and the traffic volume is likely to continue increasing in Quezon and its surrounding areas.

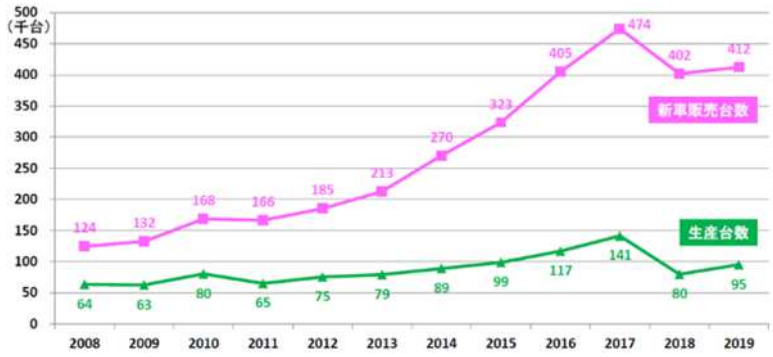


Figure 4-4 Sales and Production Volume of New Cars in the Philippines

Source: JETRO

3） Traffic congestion

Traffic congestion survey data of Asian cities with a population of 5 million or more, conducted by Asian Development Bank (ADB) is shown in エラー! 参照元が見つかりません。. The data of the degree of congestion is comparison with the average of the samples. When the value is 1.0 or higher, it means that the relative congestion of the city is higher than the sample average. In the data, the value of Metro Manila is approx. 1.5 and it is the highest. In ADB's ASIAN DEVELOPMENTOUTLOOK 2019, the traffic congestion in Metro Manila is caused by the absolute shortage of efficient and economical public transportation and public transportation cannot be used in 25% of human travel. It is said to take three times longer to travel by public transportation than to travel by car in Metro Manila and traffic congestion is a serious problem in Metro Manila including Quezon.

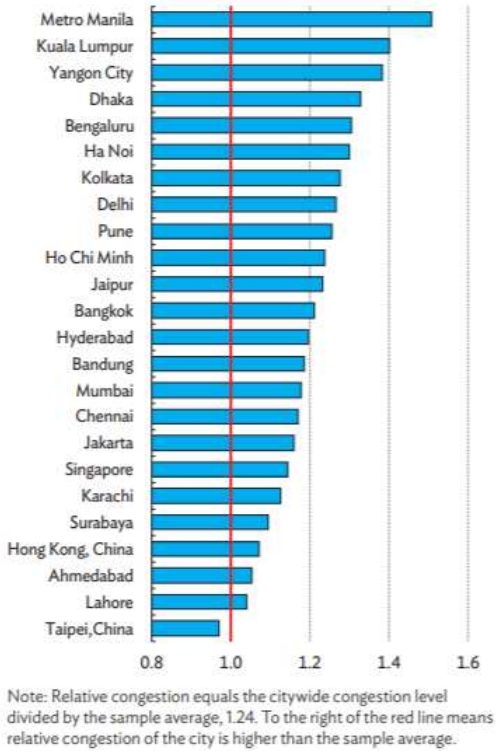


Figure 4-5 Road Congestion in Asian Cities with Population of 5 Million or More

Source: ADB estimates using nighttime lights images from the National Ocean and Atmospheric Administration (Accessed 1 April 2017 and 10 August 2018), grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 Aufast2018) and trip routes from Google Maps (Accessed 19 March 2019)

4） Current status of public transportation

Quezon City faces serious traffic congestion, whereas in Metro Manila, bus, jeepney (US military jeep converted into minibus), tricycle (motorbike taxi equipped with sidecar), pedicab (bicycle taxi) UV Express (UV transportation service) and P2P (high standard direct bus service that connects places within the area operated by private companies) are available as means of public transportation. In Quezon, city bus is also operated as a means of public transportation. As shown in エラー! 参照元が見つかりません。, there are 8 routes that connect city center and suburbs.

Figure 4-6 Quezon City Bus

Source: Quezon City

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

Figure 4-7 Quezon City Bus Routes

Source: Quezon City

Quezon City has formulated a city bus enhancement program to utilize the city bus to ease traffic congestion. The program aims to use limited road space more efficiently to utilize means of transportation. It includes provision of an options of means of transportations to commuters and introduction of a system where buses stop only at designated platforms as buses stop at places passengers designate and it is one of the causes of traffic congestion.

Figure 4-8 Official Logo of Free Bus Program in Quezon City (left) and PUV Operators and Drivers (right)

Source: INQUIRER.net

Also in March 2017, the World Bank approved a loan of 64,60 million dollars for the bus rapid transit (BRT) project in Metro Manila. The target area is the BRT Lane 1 (Espana Boulevard – Quezon Avenue) that connects Metro Manila and Quezon . Of the total project cost of 194.0 million dollars for the BRT Lane 1, the World Bank and the Clean Technology Fund (CTF) within the WB that supports developing countries for climate actions extends loans of 40.70 million dollars and 23.90 million dollars, respectively, and the remaining 44.80 million dollars is borne by the Government of the Philippines. The project includes the bus terminal and median construction in addition to the BRT lane. The completion of the BRT Lane 1 is 2020 and 300,000 users are projected daily. There is also an idea of introducing E-Bus (Green Bus) by replacing the current BRT bus that runs with the diesel oil that is fossil fuel with EV in the future.

Figure 4-9 Quezon City BRT Vehicles

Source: Quezon City

In Metro Manila, the subway construction that connects Valenzuela in the north and Paranaque in the south where Ninoy Aquino International Airport is situated is underway, which is the first subway construction in the Philippines. The project cost is the largest in the 75 Build, Build, Build infrastructure development projects under the Duterte administration. The total length is 36 kilometers with 15 stations and it will partially open in 2025 and is to be completed around 2028. The ADB and Japanese Government (JICA) are donors, the amount of the loan is one of the biggest, and the group companies are playing the leading role in supporting the bidding and in charge of consultation of construction and supervision.

Opening of the route is expected to shorten the travel time from Quezon City to NAIT from 70 minutes to 35 minutes. The route is also designed to be connected to other public transportation to enable transit to LRT

1, MRT 3, MRT 7 (under construction) and existing LRT 2, RNP Metro Commuter, and currently planned Makati city subway, MRT 4 and MRT 8. Opening of the route is expected to accommodate the increasing transport demand and contribute to local economic growth and improvement of urban environment by easing traffic congestion and traffic pollution.

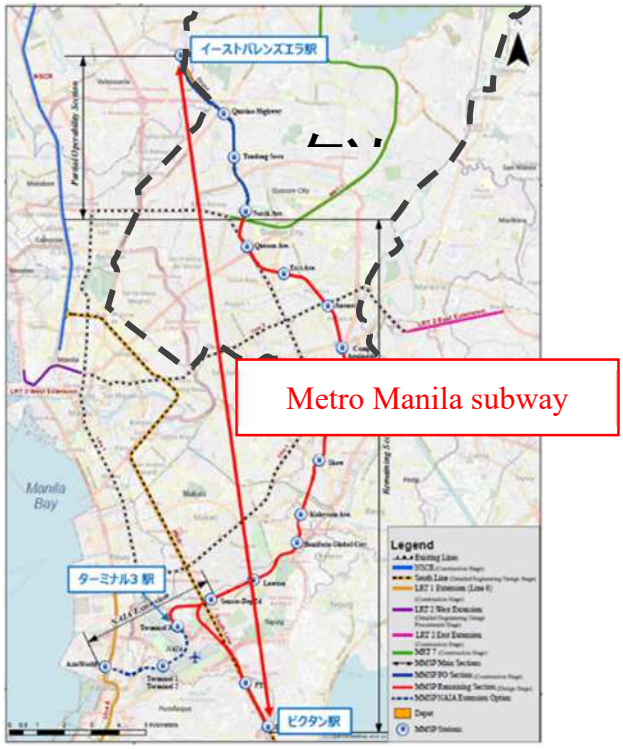


Figure 4-10　Manila Subway Route Map

Source: Mitsubishi Corp. press release (https://www.mitsubishicorp.com/jp/ja/pr/archive/2022/html/0000048677.html)

4.1.2 Introduction of Energy-Efficient Electric Vehicles and Solar-Powered Electricity Charging

Although the involvement of Japanese companies in the replacement with the EV bus may be limited to conversion of diesel buses and parts supply, introduction of large EV buses requires installation of rapid chargers and accommodation of power grid source to rapid charging (use of solar panels as power source will also require repeated substantiative experiments) and it is be a future issue to be examined. As Assemblepoint Co., Ltd., a venture company based on Yokohama, delivered small 10-seat smart bus for pilot trial to the Philippines in 2022, attention should be paid to the route and charging facility. The company is also considering the production in the Philippines in the future.

According to media report of the EV summit in October 2022, the DOE will announce a roadmap for the EV introduction in 2023. Preferential treatment to levy no tariff on imported EVs has been discussed and below movements are also in progress and thus attention needs to be paid to future actions regarding promotion of EVs.

- Meralco : R&D on the use of used EV battery with a Korean company, collaboration for charging station construction and solar panel installation with a major real estate developer
- Ayala Corp. : Plan to sell EVs manufactured by a Korean automaker and set up 20 charging

stations on Luzon Island

・SM Group : Launch free charging service at 4 commercial facilities in Metro Manila (accommodate vehicles of German Audi, BMW, Mercedes-Benz, Porche, Volkswagen (VW), Ford (US), Hyundai (Korean), etc.)

Figure 4-11 E-Vehicle Charging Station

Source: SM Mall of Asia

In the Philippines, DOE has procured E-Trike with an ADB loan to improve the environment by converting approx. 3.5 million gasoline-fueled tricycles into EVs. As a result, BEMAC Electric Transportation Philippines Inc. (BEMAC), a Filipino subsidiary of Uzushio Electric (based in Japan), delivered 3,000 E-Trikes to 37 local governments and national authorities across the Philippines and 300 of them were delivered to Quezon mainly in Metro Manila.

Table 4-3 Specifications of BEMAC 69VM DOE Model

Dimensions	Length: 3,300mm, width: 1,470mm, Height: 1,885mm
Capacity	5 passengers and 1 driver
Maximum speed	50km/h
Driving distance	40km ※ at 20km/h
Motor	Rated capacity: 5kW
Battery	Capacity: 3.3kWh , lithium-ion battery

Source: BEMAC

Figure 4-12 BEMAC 69VM DOE Model

Source: BEMAC

Table 4-4　Regions where E-Trike is Introduced

* Figures in the parenthesis are the number of vehicles.

Metro Manila	Quezon City (300), Valenzuela City (250), Pasig City (200), Malabon City (175), Mandaluyong City (170), Muntinlupa City (150), Pasay City (101), Manila City (100), Las Piñas (100), Armed Forces of the Philippines (50), DOST (20), DOE (2)
Region 1	Ilocos Norte (20)
Region 2	Echague, Isabela (120)
Region 3	Malolos, Bulacan (100), Angat, Bulacan (20), Hagonoy, Bulacan (20), Balagtas, Bulacan (20), San Jose Del Monte, Bulacan (2)

Source: BEMAC

For promoting the efforts to introduce clean means of transportation, Quezon City manufactured three charging stations for E-Trikes and set up them at Batasan Hills TODA Terminal, Barangay Payatas Motorpool, and AmoraMeralco in the city in collaboration with Meralco. Each charging station is equipped with coin-type charging pods and net metering service[2] that accommodates 8 E-Trikes concurrently as well as 2kW solar panels.

Figure 4-13　Charging Station for E-Trike

Source: Quezon City

Quezon City aims to be a green city based on the currently implemented economic development investment plan (to 2025). The introduction of E-Trike and road development for the vehicle is one of the 14 agenda items and is a priority issue as green transportation. As the plan progresses, charging station construction and solar power generation for charging (solar panel installation at charging stations) will accelerate as the power source in line with the introduction of E-Trike.

Meralco that supply power to Quezon City is actively working on the EV project for the city. It has donated 2 e-Jeep to then Quezon EPWMD and the relationship between the two parties has strengthened toward low- and zero-carbon society through provision of electric vehicles and ancillary solar panels and charging facility. In 2020, it also donated new e-Jeep (A1E-Jeep) to the city.

[2] When power consumers generate power and supply it to a power company, the supplied power and power purchased by the power company is offset. For consumers, it is the same as the power company buying the power at retail price and it becomes incentive for power generation.

Figure 4-14　Donated A1E-Jeep

Source: MServ

As Meralco has introduced a solar panel power generation system on the roof of a McDonald's building on a trial basis (see below figure), it is likely to also replace the power source of E-Bike charging station at McDonald's (see below figure) with solar power.

Figure 4-15　Rooftop Power Generation Facility (left) at McDonald's in Quezon City and an Official Poster (right)

Source: ABS-CBN news (left), Philippines Graphic (right)

4.1.3 Example Cases of Measures to Ease Traffic Congestion in Japan

（1） Osaka's Efforts

Osaka City formulated the Osaka Urban Development Mid-term Plan in FY2011and is working on urban infrastructure development. Osaka Prefecture's Urban Development Mid-term Plan promotes the enhancement of distribution and transportation network, elimination of traffic congestion and efforts for traffic safety.

To ease chronic traffic congestion, it promotes finely-tuned measures that meet local conditions, including development of urgently needed bypass roads, grade separation of railway and road and crossings with immediate effects.

① Bypass road development

Bypass road development for traffic volume reduction.

Figure 4-16　Before and After Bypass Road Development

Source: Osaka Prefecture's Transportation Road Master Plan:　Implementation

②　Grade separation project promotion

Grade separation of railway and road to eliminate congestion at the bottleneck of railway and road crossings.

Figure 4-17　Before and After Grade Separation Project

Source: Osaka Prefecture's Transportation Road Master Plan:　Implementation

③　Easy-to-pass crossings

Project to provide right-turn lane and extend the road at crossings and adjust traffic light indication duration.

Figure 4-18　Easy-to-Pass Crossing Project

Source: Osaka Prefecture's Transportation Road Master Plan:　Implementation

（2）　Substantiative experiment of traffic light control using AI congestion projection: Okayama City in Okayama Prefecture

One of the measures conducted at crossings in Osaka City is to adjust the traffic light indication duration. In Japan, substantiative experiments of AI-assisted traffic light control to adjust it has been conducted. The system is expected to be introduced to Quezon City in the future.

The system is developed and the experiment is conducted with cooperation from the Okayama Prefectural

Police by UTMS Society of Japan and Sumitomo Electric Industries Ltd. as part of NEDO's realization of smart community by using AI technology[3].

Currently, the optimal green light duration of many traffic lights in Japan is controlled by each traffic control center based on the traffic volume and length of congestion measured by vehicle detection sensors on the road. In particular, vehicle detection sensors for congestion measurement need to be installed in every several hundred meters along the road before entering the intersection to measure the length of the congestion, and the high operation cost is a problem. In recent years, although vehicle swept path information (probe information) directly collected from vehicles as a new traffic information source instead of the vehicle detection sensor has drawn attention, it has some drawbacks that include the time zone when data cannot be collected as the target vehicles are limited and delay for the traffic control center to collect probe information due to the information transmission cycle and the time required for processing the information at the collection center. To solve the problems, in the substantiative experiment, AI traffic congestion projection was used to control traffic lights. It was conducted as the following: 1) Have the system introduced to the Okayama Prefectural Police Headquarters' traffic control center learn the correlation between spatiotemporal information of traffic volume and surrounding information and travel time (congestion) obtained from the probe information in the past and 2) have the system estimate the length of congestion from the traffic volume obtained by the vehicle detection sensor for traffic volume measurement from AI analysis. This showed that it has the performance equivalent to the traffic light control that uses the measurement results of the conventional vehicle detection sensor for congestion measurement.

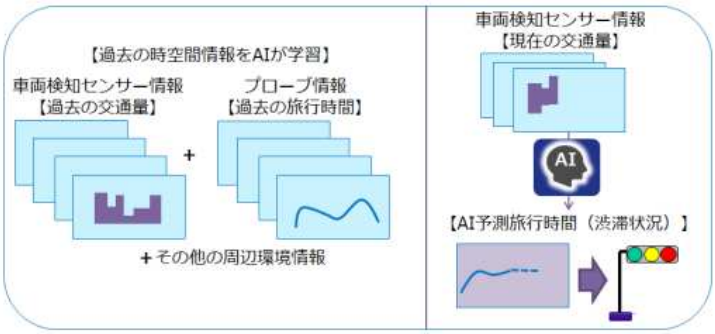


Figure 4-19 Congestion Projection by AI

Source: Sumitomo Electric Industries Ltd.

The results of the substantiative experiment showed that keeping only the vehicle detection sensor for traffic volume measurement necessary for AI congestion projection and reducing the existing vehicle detection sensor by half does not change the congestion and the traffic light control performance can be maintained. The introduction of the system is expected to lead to the reduction of the vehicle detection sensor and thus lower the infrastructure cost and reduce the traffic congestion at intersections as it enables proper traffic light control at intersections with few vehicle detection sensors for congestion measurement.

[3] R&D and substantiative experiments are conducted to realize smart community by combining cyber physical space using sensor technology and R&D infrastructure to obtain AI modules and data that have been studied, developed and introduced.

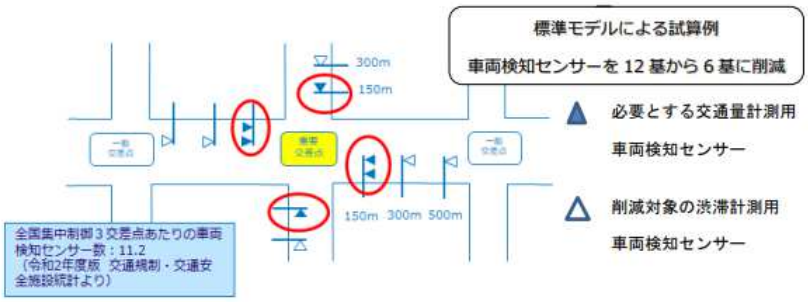


Figure 4-20　An Image of Impact of Vehicle Detection Sensor Reduction

Source: Sumitomo Electric Industries Ltd.

（3） Substantiative Experiment of Traffic Light Control Using Probe Information: Bangkok, Thailand

Ordinary traffic control systems gather and measure information of congestion length necessary for traffic light control using the sensor mainly installed on the road. Partly because this requires cost and time for the installation and maintenance of the sensors, it is one of the causes of hindering the spread of the traffic control system in developing countries. As a means of solving the problem, use of probe information obtained by gathering data of vehicle travel locations and driving speed is better and more effective in terms of price and the scope of information gathering than sensor information. A substantiative experiment of the traffic light control using the probe information was carried out in Bangkok. It was one of the experiments conducted in the project to promote traffic control system maintenance and management technology for improving the traffic congestion in Bangkok, Thailand, JICA has been implementing since 2015 and it was conducted for about one month from February 2022. The experiment was to gather such data as traffic volume from the vehicle detectors on the road and control the traffic light real time based on the data to reduce congestion and optimize the traffic flow. As a result of the optimization of the traffic flow, congestion is expected to be reduced and eased and CO2 emissions are expected to be reduced.

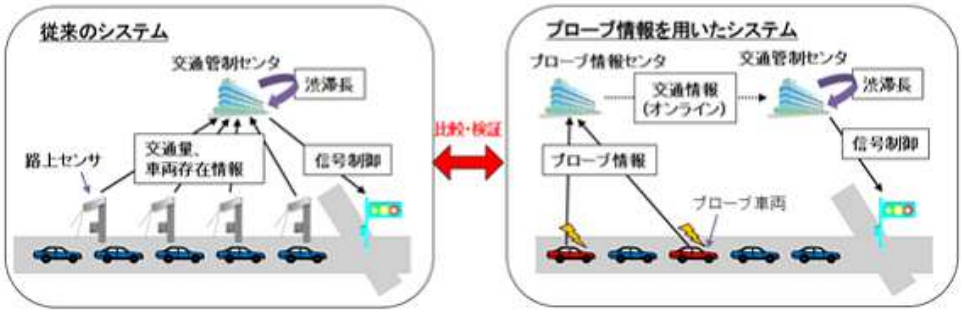


Figure 4-21　Substantiative Experiment Using Probe Information (an image)

Source: Sumitomo Electric Industries Ltd.

（4） Promotion of Use of Public Transportation（Osaka Metro’s Efforts）

An effective measure to reduce vehicle traffic volume and eliminate congestion is the management of the means of transportation, which includes encouraging the shift of means of transportation from the automobile to such public transportation as bus and train and reducing the total number of automobiles and the volume during the peak hours.

Osaka Metro Co., Ltd. (Osaka Metro) that operates subways, etc., in and around Osaka City is implementing the 5-layered urban Mobility as a Service (MaaS) project consisting of improvement and advancement of existing transportation, integration of traveling means, expansion of living-related services, and provision of web services and promotion of digital transformation (DX) necessary for all efforts to tackle the challenge of widening supply-demand gap where transportation capacity is insufficient in the city center whereas it is excessive in the surrounding area.

As shown in Figure 4-2 エラー! 参照元が見つかりません。, the urban MaaS project promotes transportation and traveling services in 4 categories from layers 1 to 4 in collaboration with various companies and organizations.

Since the launch of street car operation in 1903, Osaka Metro has operated the subway and local bus system in line with the changing times as a section of the Osaka City Government in the second biggest city in Japan and since its privatization in 2018, it has continued to be a railway operator that supports the transportation of the citizens in Osaka City.

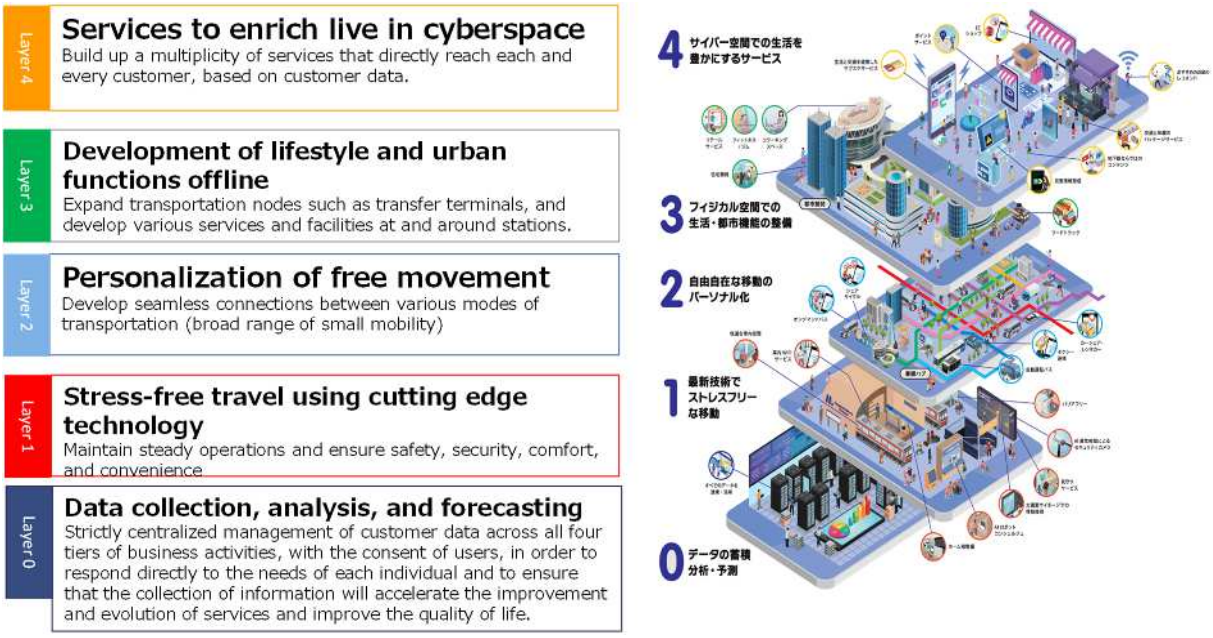


Figure 4-22　Overview of Urban MaaS Project

Source: Osaka Metro

Example efforts to realize the vision are as shown in エラー! 参照元が見つかりません。.

In layer 2, particularly, in addition to such basic public transportation as railway and local bus, seamless provision of such edge transport services (first one mile / last one mile) as on-demand bus and short-distance mobility helps convenient door-to-door travel and encourage use of public transportation. Introduction of electric buses for the bus services indicates consideration given to the carbon neutrality and decarbonization and global environment.

These efforts are not limited to the transport services but the smartphone app., Osaka MaaS, connects various mobility with lifestyle services and contributes to the development of an attractive city.

Table 4-5　Efforts to Realize Urban MaaS

Category	Contents	Example Effort
Layer 1 Stress-free travel using cutting-edge technology 【Advanced transportation】	Steady railway and local bus operation, us of cutting-edge technology to further improve safety, security and comfortability and convenience	・Movable platform fence ・Installation of face authentication entrance gate ・Substantiative experiment of detection system for white cane (visually impaired) and wheelchairs using AI automated detection technology
Layer 2 Personalization of free movement 【Integration of means of traveling】	In addition to railway and local bus, connecting a variety of means of transportation seamlessly using app payment for overwhelming improvement of transport convenience	・On-demand bus operation ・Substantiative experiment of short-distance mobility (next-generation electric wheelchair) ・Collaboration with taxi app ・Substantiative experiment of next-generation urban transportation system with automated driving vehicle in its core
Layer 3 Development of lifestyle and urban functions offline 【Development of lifestyle services and urban functions】	Aiming to diversify services to add values of railway and local bus, conduct urban development and marketing particularly to improve convenience of stations and its vicinity.	・Food truck at bus terminal at transit ・Installation of pickup lockers at bus terminal for passengers to receive products they purchase online
Layer 4 Service to enrich life in cyberspace 【Improvement of digital services】	Taking advantage of contact points of customers of existing business, connect with each customer also in cyberspace and provide finely-tuned services that meet their need	・Linked with toy subscription service ・Linked with online fitness subscription service

Source: Compiled by survey team based on Osaka Metro's information

The company has also built an energy management system integrated with electric bus operation management shown in エラー! 参照元が見つかりません。 in collaboration with a power company and launched development of local bus and on-demand bus operation and management system integrated with the power management system of the power company.

With the system, Osaka Metro aims to realize an operation management system that controls efficient charging with minimized power peak to traveling mobility at all locations that include wired chargers at offices and feeding points during traveling while understanding the power supply and demand real time of the entire area and observing the operation plan.

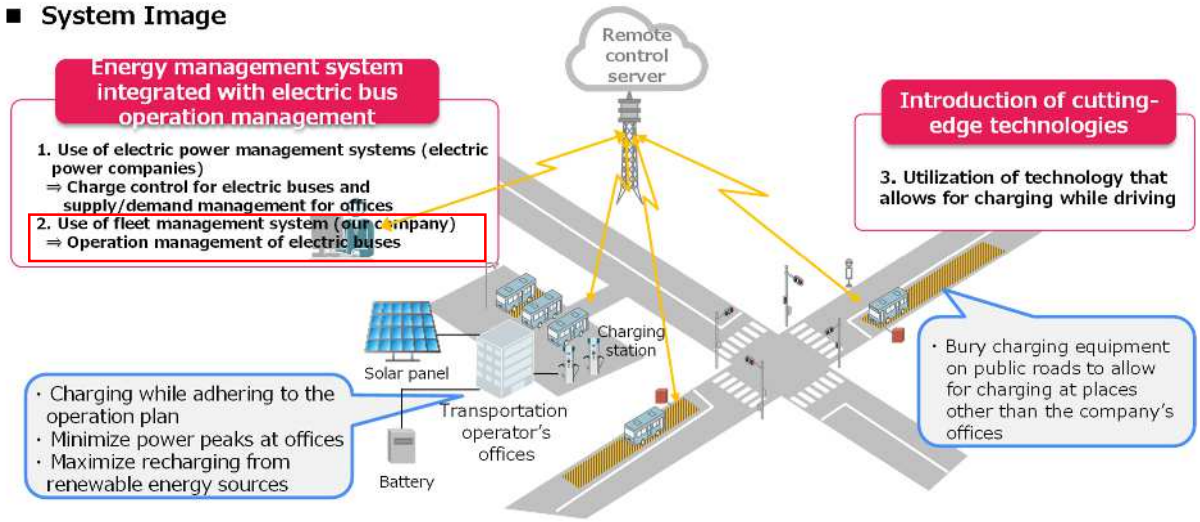


Figure 4-23　An Image of Operation Management System Linked with Electric Power Management System

Source: Osaka Metro

4.2 Understanding of Current Status and Study of Measures concerning Air Quality Management

For mobility improvement, challenges caused by traffic congestion can be quantitively measured and awareness of improvement can help identify the problems. To do so, the survey team summarized the current status of how monitored items, monitoring method and results are made public and how monitoring is conducted in order to propose air quality monitoring.

4.2.1 Air Monitoring System in the Philippines

（1） Air Pollution Standards

The causes of air pollution in urban areas in the Philippines are mainly classified into two: such moving sources as automobiles, etc., and such fixed sources as power generation plants and factories. According to the survey results conducted in Metro Manila in 1990, 21% of particulate substances, 83% of nitrogen oxide, 99% of carbon monoxide, and 12% of sulfur oxide are estimated to be generated by automobile gas emissions. There is a program to tackle automobile emissions: private cars that were manufactured more than 5 years ago are required to receive emissions inspection when registered. Although there are two inspection centers in Metro manila, the improvement of diesel engines and jeepney are insufficient and are cause of air pollution.

As for the fixed source, new factories are required to be equipped with pollution prevention device and inspectors from the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR) visit them and inspect emissions before the approval of operation. Before issuing the operation license, they designate the scope of pollution and evaluate the pollution prevention device.

As for laws and regulations concerning air pollution prevention, they have been revised several times similarly to the laws and regulations concerning water pollution prevention. The latest one is the DENR Administrative Order No.14 and No.14a, Revised Air Quality Standards of 1992, Revising and Amending the Air Quality Standards of 1978, issued on March 18, 1993. The standards for general items are provided for short term and long term and concentration, average exposure time duration and analysis methods are

provided for specific emissions sources. Furthermore, the pollutants, emissions sources and standards and analysis methods are provided for the national emissions standards of air pollutants of specific sources. To regulate sulfur compounds emissions, ratio of sulfur content in liquid and solid fuel used at the existing fixed sources and the sulfur oxides emissions standards for the sources are also provided. They are shown in エラー! 参照元が見つかりません。 toTable 4-9 Regulations on Sulfur Compounds. Furthermore, automobile emissions are regulated by PD1181; Prevention, Control &Abatement of Air Pollution from Motor Vehicles & for Other Purposes / Motor Vehicle Pollution Control and Notice 551 that provides the rule that automobiles be equipped with pollution prevention device.

Table 4-6 National Air Pollution Standards (General Items)

Pollutant	Short-term (a)			Long-term (b)		
	µg/N	ppm	Average exposure time duration	µg/N	ppm	Average exposure time duration
Suspended particulate matters (SPM) (e) TSP PM-10	 230(f) 150(g)	 - -	 24 hours 24 hours	 90 60	 - -	 1 year (c) 1 year (c)
Sulfur dioxide (e)	180	0.07	24 hours	80	0.03	1 year
Nitrogen dioxide	150	0.08	24 hours	-	-	
Photochemical oxidant Photochemical oxidant (ozone)	140 60	0.07 0.03	1 hour 8 hours	- -	- -	
Carbon monoxide	35mg/N 10mg/N	30 9	1 hour 8 hours	- -	- -	
Lead (d)	1.5	-	3 months (d)	1.0	-	1 year

(a) The maximum value expressed as 98 percentiles must not exceed once a year.

(b) Arithmetic average

(c) Year, geometric average

(d) The evaluation of the guidelines is calculated from 24-hour average over successive 3 months. The average of the 3 months must not exceed the value of the guidelines.

(e) Sulfur dioxide and SPMs are collected by manual measurement every 6 days. The lowest value in the samples for a quarter or 12 days of 48 days must observe the standard value. When a continuous analyzer is obtained and usable, sampling is conducted every day.

(f) Standard value of SPMs whose central diameter does not exceed 25 to 50µm

(g) Tentative standard value of SPMs whose central diameter does not exceed 10µm until sufficient monitoring data is obtained. After that, proper values of the guidelines are provided.

Source: Global Environmental Forum

Table 4-7 National Air Pollution Standards (Items for Specific Emissions Source)

Pollutant (a)	Concentration (c)		Average exposure time duration (min.)	Analysis method (b)
	µg/N	ppm		
Ammonia	200	0.28	30	Nessler method
Carbon dioxide	30	0.01	30	Tessier method
Chlorine and chloride (Cl2)	100	0.03	5	Methyl orange
Formaldehyde	50	0.04	30	Chromotropic acid method or MBTH (3methyl – 2 benzothiazolone hydrazone) colorimeter method
Hydrogen chloride	200	0.13	30	Volhard titration using iodine solution
Hydrogen sulfide	100	0.07	30	Methylene blue
Lead	20	-	30	AAS(b)
Nitrogen dioxide	375 260	0.20 0.14	30 60	Salzman method
Phenol	100	0.03	30	4- aminoantipyrine method
Sulfur dioxide	470 340	0.18 0.13	30 60	Pararosaniline colorimeter method
Suspended particulate natters TSP PM-10	300 200	- -	60 60	Gravimetric procedure

(a) For antimony, arsenic, cadmium, asbestos, nitric acid, and nitric acid mist, refer to 1978 NPCC regulations.

(b) Other methods approved by DENR are acceptable.

(c) 98 percentiles of 30-minute sampling at 25℃ at 1 atm

Source: Global Environmental Forum

Table 4-8　National Emissions Standards of Specific Air Pollutants（NESSAP）

Pollutant *	Source	Standard	Analysis method (a)
Antimony and its compounds	All	10mg/N-Sb	AAS(b)
Arsenic and its compounds	All	10mg/N-As	AAS(b)
Cadmium and its compounds	All	10mg/N-Cd	AAS(b)
Carbon monoxide	All industrial sources	500mg/N-Co	Orsat gas analysis
Copper and its compounds	All	100mg/N-Cu	AAS(b)
Hydrogen fluoride and fluorine compounds	Factory that manufactures aluminum from alumina	50mg/N-HF	Tiltraton with ammonium thiocyanate
Hydrogen sulfide	1). geophermal plant 2). geothermal explosion and well inspection 3). Other than 1) and 2)	(C)、(d)、(e) 87mg/N-H_2S	Cadmium sulfide method
Lead	Commerce and industry	10mg/N-Pb	AAS(b)
Mercury	All	5mg/N-Hg	AAS(b) cold atomic absorption analysis or mercury analysis
Nickel and its compounds excluding nickel carbonyl (g)	All	20mg/N-Ni	AAS(b)
Nitrogen oxide	i). Nitric acid production plant ii). Fuel combustion vapor generator Existing plant New plant, coal fuel Oil fuel iii). Other than i) and ii) Existing plant New plant	2,000mg/N-NO_2 1,500mg/N-NO_2 1,000mg/N-NO_2 500mg/N-NO_2 1,000mg/N-NO_2 500mg/N-NO_2	Sulfuric acid phenol -do- -do-
Diphosphorus pentaoxide	All	200mg/N-P_2O_5	Absorption photometry
Zinc	All	100mg/N	AAS(b)

(a) Equivalent methods approved by DENR are acceptable.

(b) Atomic absorption spectrometry

(c) All new geothermal plants whose construction starts by Jan. 1, 1994, must have H2S below 150g/GMW-Hr.

(d) All existing geothermal plants must have H2S below 200g/GMW-Hr within 5 years after the enforcement of the law.

(e) Moat practical technology to regulate gas emissions and wastewater. Environmental standards for air and water quality need to be observed.

(f) tentative guidelines

(g) Nickel carbonyl must not exceed 0.5mg/N.

* 1978 regulations are effective for substances not shown in the table.

Source: Global Environmental Forum

Table 4-9　Regulations on Sulfur Compounds

①　Ratio of sulfur content in liquid and solid fuel consumed at existing fixed sources（weight）

Liquid fuel	In Metro Manila	Metro Manila
Fuel oil (all grades)		
July 1, 1993	3.5%	3.8%
Jan. 1, 1996	3.0%	3.0%
Industrial diesel		
July 1, 1993	0.7%	0.8%
July 1, 1996	0.5%	0.5%
(1). Solid fuel (coal)		
July 1, 1993	2.5%	2.5%
July 1, 1996	1.0%	1.0%

②　sulfur oxides emissions standards at fixed sources

(1). Existing	
①　Process of production and use of sulfuric acid	2.0mg /N m3-SO_3 1.5mg/Nm3-SO_2
②　Fuel combustion vapor generator	1.0mg/Nm3-SO_3
③　Other than ① and ②	
(2). New	
①　Process of production and use of sulfuric acid	1.5mg/Nm3-SO_3
②　Fuel combustion vapor generator	1.0mg/Nm_3-SO_2
July 1, 1994	0.7mg/Nm_3-SO_2
July 1, 1998	0.2mg/Nm_3-SO_3
③　Other than ① and ②	

Source: Global Environmental Forum

（2）　Air Monitoring System and Method

Air pollution monitoring in Metro Manila is performed at 10 locations (Valenzuela, Pagasa, Quezon Avenue, East Avenue, EDSA－Quezon City, Araneta Avenue, Makati City, Ateneo, Las Pis, and Pasig City) by NCR in collaboration with the Environmental Management Bureau (EMB - EQD Environmental Quality Division. All suspended particulate matters (SPMs) are measured at all locations. At Ateneo, sulfur oxides (Sox), nitrogen oxides (NOx) and ozone (photochemical oxidants) are measured using the autosampler. Automobile emissions, excluding Sox, are the biggest cause of air pollution in Metro Manila. Most of the Sox is caused by industry and energy (fixed sources).

4.2.2 Air Quality Monitoring System in Quezon City

Among C 40 cities that work in collaboration with world major cities that promote climate actions, Quezon City has been one of the most actively working cities since 2015. Recently, on August 11, 2022, city mayor, Joy Belmonte, led the launch of CAI program as a new environmental effort to take urgent action to deal with climate crisis in cooperation with C 40 cities. The program is to implement transformative climate actions and mainstreaming activities based on the city's enhanced climate action plan with financial assistance from the UK Government.

The program focuses on energy efficiency improvement, revision of green building act, policy and action for more introduction of renewable energies to government-owned buildings, commercial facilities and residences. The program also recommends the realization of carbon neutrality by 2050 to secure green future

for the 3.1 million citizens and for the city to serve as a model city in the Philippines. A program overview is provided below.

Table 4-10 Project Overview

Action	Supplementary Action
1. Expansion of city air quality monitoring network	・ Support for evaluation and correction of optimal location of air monitoring device and sensors procured by the city government and proposals on other necessary requirements ・ Instruction on data analysis, interpretation, reporting and overall management of air quality data
2. Communication planning for air environment management	・ Baseline survey and roundtable among concerned parties ・ Implementation of communication planning workshop and formulation of strategies ・ Holding workshop on implementation of city's air quality communication strategies ・ Holding workshop on implementation of city's air quality communication strategies ・ Trial communication and awareness improvement campaign that can be assisted with specified fund with Quezon City
3. Production of emissions inventory (EI)	・ Data map compilation and information gathering necessary for EI production ・ Estimates and mapping of emissions amount by pollutant and emissions sources ・ Modeling of emissions reduction impacts including impact assessment on health
4. Formulation and implementation of air quality management plan	・ Formulation of comprehensive actions for air quality improvement ・ Systemization and mainstreaming of AQMP ・ Formulation of air quality improvement funding plan ・ Capacity development of city employees to be prepared for action implementation ・ Pilot clean air initiative specified in AQMP is assisted by existing funding resources identified in air quality funding plan or by the Quezon City Government.

Source: Quezon City

Quezon City installed air quality monitoring sensors across the city through CCESD. The sensors measure air pollutants including the most dangerous particulate matters 2.5 (PM 2.5) caused by emissions from automobiles, trucks and industrial facilities. PM 2.5 has become a serious issue being 1.8 to five times higher than the WHO recommendation level. Through the sensors, Quezon City gathers air quality baseline data useful for program and policy formulation and decision. Quezon City is assisted by C 40 cities and Clean Air Asia and continuingly providing instruction and training that contributes to achieving city's target.

Figure 4-24　Climate Actions

Source: Quezon City

As an effort of air quality management, Quezon City hires Clean Air Initiative for Asian Cities（CAI-ASIA）Center Inc. to receive consulting services. It is working in collaboration with an US startup company, Clarity Movement Co., which is partially funded by Ayala Corp Technology Innovation Venture Fund that is a corporate venture capital (CVC) of Filipino Ayala Corp. Ayala Corp Technology Innovation Venture Fund jointly funded a total amount of 9.60 million dollars to the US startup company. It is ta funding round planned mainly by a venture capital, Amasia , to assist projects by startup companies. Clarity Movement provides high-precision air pollution monitoring solution using I0T-based air sensing technology and data analysis and it has entered 60 countries including the Philippines. It works together with Quezon City for an air quality monitoring initiative project.

4.2.3 Air Quality Monitoring of Osaka City

（1） Air monitoring method

Osaka City has set up measuring stations on the roof of school buildings and roadside to constantly monitor nitrogen dioxide (NO2), particulate matters (PM2.5) and other air pollutants to understand and assess the trend of air pollution over time and reflect it on environmental measures. Recently, the values are on a decline trend excluding that of photochemical oxidants. In the city, there are 13 ordinary air quality measuring stations and 11 automobile emissions measuring stations and the environmental standards of air pollutants have been achieved, excluding photochemical oxidants, non-methane hydrocarbon and nitrogen dioxide (automobile emissions measuring stations)　at each measuring station.

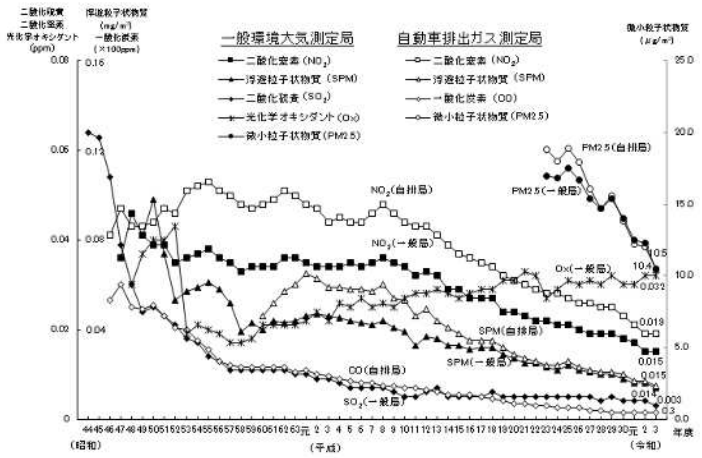


Figure 4-25　Trend of Air Pollutant Concentration

Source: Osaka City

Table 4-11　Achievement of Environmental Standards concerning Air Pollutants (last 10 years)

測定項目／年度			平成24年度	25年度	26年度	27年度	28年度	29年度	30年度	令和元年度	2年度	3年度
二酸化窒素（NO_2）	一般環境大気測定局	環境基準	13/13	13/13	13/13	13/13	13/13	13/13	13/13	13/13	13/13	12/12
		環境保全目標※1	0/13	2/13	5/13	7/13	11/13	9/13	11/13	12/13	12/13	12/12
	自動車排出ガス測定局	環境基準	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
		環境保全目標※1	0/11	0/11	1/11	1/11	4/11	1/11	6/11	7/11	9/11	9/11
浮遊粒子状物質（SPM）	一般環境大気測定局	環境基準	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	13/13
	自動車排出ガス測定局		9/9	8/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9
微小粒子状物質（PM2.5）	一般環境大気測定局	環境基準	0/5	0/5	0/5	0/5	0/5	1/5	3/5	1/5	3/5	2/5
	自動車排出ガス測定局		0/4	0/5	0/5	0/5	3/5	2/5	3/5	4/5	4/5	5/5
光化学オキシダント（Ox）	一般環境大気測定局	環境基準	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/12
	自動車排出ガス測定局											0/1
非メタン炭化水素（NMHC）	一般環境大気測定局	環境保全目標※2	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3
	自動車排出ガス測定局		0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2
二酸化硫黄（SO_2）	一般環境大気測定局	環境基準	14/14	12/12	12/12	10/10	10/10	10/10	10/10	10/10	10/10	10/10
	自動車排出ガス測定局		2/2	2/2	2/2	2/2	2/2	1/2	2/2	2/2	2/2	2/2
一酸化炭素（CO）	自動車排出ガス測定局	環境基準	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3

注1. 内グラフの色部分は、基準値(環境基準)の適合を示す
2. 環境基準の評価方法は、光化学オキシダント及び非メタン、炭化水素を除き、長期的評価による。
3. 分母の数字は環境基準値(環境保全目標)の有効測定局数を示す。
4. 二酸化窒素及び浮遊粒子状物質(とも一般局)の一局減は、淀中学校測定局の廃止による。
5. 光化学オキシダントの局減は、淀中学校測定局(一般局)と弓出架線小学校測定局(自排局)への令和3年度からの移設による。
※1 二酸化窒素については、国の環境基準や大阪府独自の環境保全目標を設定している。
※2 非メタン、炭化水素については環境基準はなく、大阪府独自の環境保全目標を設定している。

凡例：達成 / 非達成

Source: Osaka City

Figure 4-26　Locations of Constant Air Pollution Monitoring Stations (FY2021)

Source: Osaka City

4.2.4 Automobile-related Air Quality Management by Osaka Prefecture

The Osaka Prefectural Government formulated the Osaka prefectural plan to reduce the total emissions of nitrogen oxides and particulate matters from automobiles in July 2003 based on the special measures law concerning reduction of total emissions of nitrogen oxides and particulate matters from automobiles in designated areas,8automobile NOx PM law) revised in June 2001. The plan aims to reduce emissions of nitrogen oxides and particulate matters from automobiles in target areas[4] and achieve the environmental standards of nitrogen dioxide and suspended particulate matters in the areas by FY 2010. The Nox emissions in FY2020 were reduced by 52% from FY2009 and PM emissions also in FY2020 reduced by 49% also from FY2009.

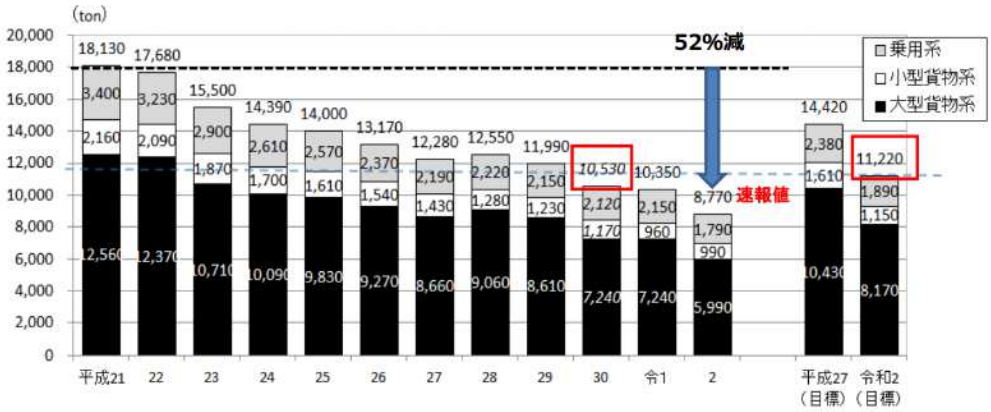


Figure 4-27　Trend of NOx Emissions (in target areas)

Source: Osaka prefectural NOx and Sox reduction plan formulation council

[4] Target areas based on automobile NOx/PM law:　37 municipalities excluding 6 municipalities in Osaka Prefecture (Toyonocho, Nosecho, Misakicho, Taishicho, Kanancho and Chihaya-asakusamura) are designated.

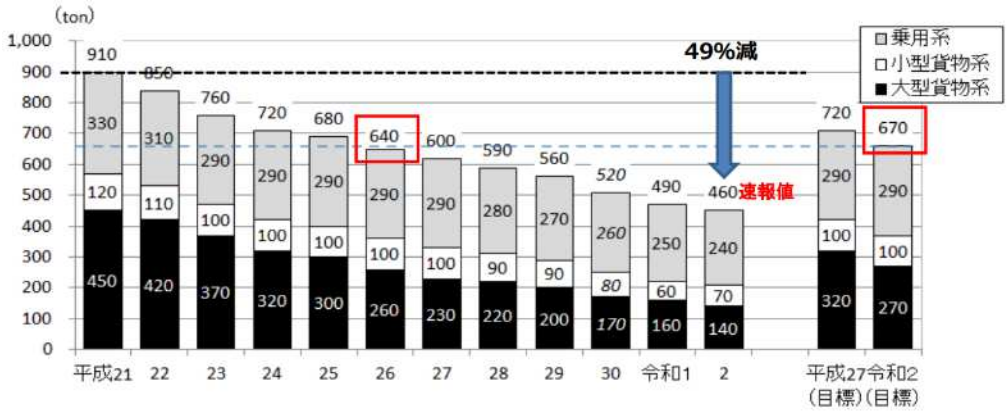


Figure 4-28 Trend of PM Emissions (in target areas)

Source: Osaka prefectural NOx and Sox reduction plan formulation council

Chapter5　Collaborations Between Cities and Third Countries

5.1 Consultation for achieving the CN Declaration through workshops and policy dialog

5.1.1 Policy dialog at Director-General level

On 30 August, 2018, the Mayor of Osaka, Mr. Yoshimura, visited Quezon City where a Memorandum of Understanding (MOU) was signed between Quezon City and Osaka for cooperation in forming a low-carbon city in Quezon. This was also the first visit to feature policy dialog at mayoral level. In May 2019, Mr. Tanaka, Deputy Mayor of Osaka, visited Quezon City for the second such policy dialog to discuss how to achieve a low-carbon outlook in both cities. The impact of COVID-19 meant policy dialogs at the director level were conducted online. However, in August 2021, the above-mentioned MOU was renewed as a cooperation memorandum to establish a low/decarbonized city in Quezon. Under the stable relationship established by this memorandum, Osaka is striving to create low-carbon projects in Quezon City by utilizing the framework of the Ministry of the Environment's "Inter-city Cooperation Project for Achieving a Decarbonized Society" and the "JCM (Joint Crediting Mechanism) ".

On August 2, 2022, the two cities communicated online at director level. At the beginning of the dialog, Deputy Mayor Takahashi of Osaka City and Mayor Joy Belmonte of Quezon City expressed their hope that the cooperative relationship between both cities would be strengthened as part of efforts to establish a decarbonized city. The investigative team presented the initiatives of the inter-city cooperation project and confirmed the cooperative framework between the two cities. Osaka City initiatives included promoting LED lighting, power generation via sewage gas at sewage treatment plants and anaerobic/aerobic activated sludge method (AO method), based on its successful track record of reducing greenhouse gas emissions by about 18% compared to 2013 in fiscal 2018 in its Execution Plan for Countermeasures against Global Warming. Officials from various departments, including the Environmental Conservation and Waste Management Bureau, urban planning, engineering and construction-related departments, participated from Quezon City. They presented priority actions to mitigate climate change in four areas: energy, buildings, transportation and waste, which are being promoted under the C40 framework. See Appendix 4-1 for the presentation material.

Quezon City expressed its gratitude at Osaka City's support for environmental measures and its wish for continued inter-city cooperation with the following points:

- Mutually introducing both cities' plans to combat climate change and ensuring mutual understanding of both cities' efforts to decarbonize.
- Many common initiatives, such as promoting and expanding renewable energy, energy efficiency in buildings, decarbonization of mobility and promoting resource recycling.

The hope is to continue our stable relationship and actively promote initiatives towards carbon neutrality in both cities as part of the overarching aim of realizing a sustainable world.

The program for the day is as follows:

1. Greetings (Osaka: Deputy Mayor Takahashi, Quezon City: Mayor Belmonte)
2. Taking a commemorative photo
3. Presentation to be made by Osaka City on "Osaka City's efforts towards decarbonization".
4. Quezon City: Presentation "Quezon City Climate Change Action Enhancement Plan 2021-2050".

5. Oriental Consultants Ltd Presentation.

'Details of the Ministry of the Environment's Intercity Cooperation Project initiatives'

6. Exchange of opinions

Table 5-1 Directorate-level policy dialog program

14:00 PHT 15:00 JST	**<Opening Address>** **Mr. Toru Takahashi,** Deputy Mayor of Osaka City Government **Ms. JOY BELMONTE,** Mayor of Quezon City Government
14:08 PHT 15:08 JST	**<Photo Session>** Screenshot of two shots of Deputy Mayor of Takahashi and Mayor of Belmonte.
14:10 PHT 15:10 JST	**<Osaka City: Presentation>** **Mr. Toru Takahashi,** Deputy Mayor of Osaka City Government - Osaka City Initiatives for Decarbonization
14:20 PHT 15:20 JST	**<Quezon City: Presentation>** **Ms. JOY BELMONTE,** Mayor of Quezon City Government - Quezon City Enhanced Local Climate Change Action Plan 2021-2050 (Enhanced LCCAP)
14:30 PHT 15:30 JST	**<Oriental Consultants: Presentation>** **Mr. FUJII Masanori,** Team Leader, International Projects Division Oriental Consultants Co., Ltd. - Zero Carbon Development in Quezon City for the Realization of Carbon Neutral Society
14:40 PHT 15:40 JST	**<Quezon City and Osaka City: Discussion>** - Climate Action Plan - Low-Carbon Projects - Overall Discussion
14:55 PHT 15:55 JST	<Closing Address> **Mr. Toru Takahashi,** Deputy Mayor of Osaka City Government **Ms. JOY BELMONTE,** Mayor of Quezon City Government

Figure 5-1 Directorate-level policy dialog (online) involving Mayor Belmonte (left) and Deputy Mayor Takahashi (right)

Figure 5-2　A look at the venue

5.1.2 Inter-city collaboration workshops

In December 2022, the Osaka City Environmental Bureau also visited Quezon City Hall for the first in-person workshop included in the scope of this inter-city collaboration project in three years, taking the content of the policy dialog into account. The program for the day was as follows and see Appendix 4-2 for the presentation material:

Table 5-2　Inter-city collaboration workshop

Opening Remarks	
13:00-13:10	● "Opening Remarks" by Climate Change and Environmental Sustainability Department, Quezon City Government ● "Opening Remarks" by Environment Bureau, Osaka City Government
Presentations, Q&A and Discussion Session	
13:10-13:20	● Review of the 2022 project scope, progress, expected results and timeline by Oriental Consultants
13:20-14:15 14:15-14:55	<Building Sector> 15 min. presentation each and 10 min. discussion (including interpretation) ● Presentation by Quezon City Government on the Low Carbon Initiatives and Climate Chang Mitigation <Transport Sector> 15 min. presentation each and 10 min. discussion (including interpretation) ● Presentation by Quezon City Government on the basic information of on-road transport system, traffic management and control systems for mitigating the traffic congestion and improving the mobility ● Presentation by Osaka Metro on their initiatives of Mobility as a service (MaaS) for the zero-carbon and smart development of urban areas
Closing Remarks	
14:55-15:00	● "Closing Remarks" by Quezon City Government and Osaka City Government

Figure 5-3　View of the inter-city cooperation workshop

Topics at the workshop included the fact that Quezon City is considering the introduction of (green) EV buses as part of future efforts at the city's Power Table. This is a key component in its plans to provide clean and safe transportation in an environmentally friendly way. Additionally, the city is keen to strengthen its existing bus routes and make them more interconnected. The agenda also included plans by the city to implement bus routes and EV buses to improve the downtown air quality and environment. The city currently operates eight bus routes, with a total of 91 buses running on fossil fuels rather than electric power. Currently, a total of 1,110 buses operates on weekdays and holidays and it was noted that during the COVID-19 lockdown, the city worked to provide healthcare workers with free bus transportation.

At the same workshop, Osaka Metro provided an outline of its company, including its efforts to run on-demand buses on a pilot basis in five areas of Osaka, plans to switch from diesel buses to EV buses going forward and collaboration with power companies to develop a power management system that integrates with Osaka Metro's operational management system to minimize operation plans and power peaks and maximize potential for renewable energy charging. After the presentation, Quezon City commented that despite the efforts being made by the government and transportation industry in the Philippines in the transportation sector, its transportation history is relatively short and has only reached the level of supporting people's daily commuting needs. Accordingly, they expressed interest in studying the high-tech technologies presented at the workshop based on Osaka Metro's experience. Other questions addressed questions were raised about the number of railway and bus routes operated by Osaka Metro and the density of its service areas.

During the workshop, there was a statement from Quezon City that they are considering introducing EV buses (Green buses) as a future initiative and that they want to provide clean and safe transportation options for their citizens. They are interested in utilizing EV buses to contribute to the environment. They also expressed their willingness to enhance existing bus routes and connections. Furthermore, they are considering implementing bus route systems and introducing EV buses to improve the air quality and environment within the city. During the workshop, Osaka Metro presented their efforts to reduce carbon emissions in the transportation sector. In response, Quezon City shared their own initiative to reduce the number of private vehicles on the roads by introducing large-scale free shuttle buses in the transportation sector.

As part of Quezon City's future carbon reduction efforts, they are considering the electrification (E-Bus or Green Bus) of their large-scale free shuttle buses. They expect Japan to contribute in the technical support for the conversion of their existing fossil fuel buses to electric buses. However, there are several issues that need to be examined, such as the installation of rapid charging facilities, introduction of solar power generation equipment for charging and strengthening of existing power grids. As of 2022, Assemble point, a venture company based in Yokohama, has delivered a 10-person smart bus to the Philippines for demonstration purposes. Quezon City plans to investigate such cases while considering the future use of these buses in their city.

During the visit to the Quezon City Hall, they also conducted a tour of the on-site solar power generation facilities installed in the same building. Additionally, they exchanged opinions about future initiatives and expressed their readiness to conduct technical workshops by Japanese manufacturers on renewable energy and energy management as one of the government and private sectors' joint efforts.

Figure 5-4 On-site photovoltaics in Quezon City Hall

March 2023 saw a report meeting held on the first year of the project, in which Osaka City and Quezon City participated, to discuss the second year's activities.

During the review of the first-year activities, Quezon City indicated their plans to bid for solar power generation in three city-owned hospitals and 50 municipal schools, but also to utilize PPP schemes given the limited budget. They are also considering the introduction of smart LED in model districts and E-bus. However, concerns over the initial investment costs mean they are keen to promote initiatives proposed by the private sector using the same PPP scheme.

Against this backdrop, the parties agreed to ramp up cooperation with Japanese private companies and Quezon City collaborative entities from the second year and beyond in the urban cooperation project and contribute to Quezon City's CAI program and Enhanced QC-LCCAP. In terms of cooperation with Japanese private companies, the Osaka Chamber of Commerce and Industry, which strengthens relationships, established the ASEAN Business Promotion Platform in February 2023 and the government-level relationship has accelerated as Japan and ASEAN celebrate half a century of friendship and cooperation. The platform aims to support overseas collaboration to create new business by Osaka and Kansai companies in anticipation of the Expo. Another aim is to promote synergy to help solve social problems through innovation and co-creation with ASEAN's overflowing young talent and thereby consolidate relationships.

In addition, based on the urban cooperation project, the parties confirmed their policy of continuing policy dialog at mayoral level between Osaka City and Quezon City to promote the development of the project through intercity cooperation. During the second year of the project, they plan to hold dialog at mayoral level in Quezon City in person and proceed with schedule adjustments.

5.1.3 Technical workshop

The main focus of previous inter-city cooperation workshops was on policy aspects and the technical aspects of project formation were insufficiently addressed. Proposals were also made to Manila Electricity Company (Meralco) and Quezon City to use EMS to optimize the supply-demand balance when utilizing renewable energy, by Fuji Electric, which is considering the supply and market entry of solar power generation equipment (PCS, EMS, BESS) while leveraging JCM equipment subsidies in the Philippine market. The project was launched following initial preparations with Fuji Electric, Sumitomo Electric and Sumitomo Electric Industries. Fuji Electric gave a presentation on energy management in renewable power

generation from the perspective of a system integrator for the entire photovoltaic power generation system, while Sumitomo Electric Industries gave a technical explanation, including storage battery functions, mainly to Meralco and its subsidiary SPECTRUM, which supply electricity to Quezon City as private companies on the Quezon City side. See Appendix 4-3 for the relevant materials.

Meralco inquired about scope for funding from the Asian Development Bank (ADB) and an explanation of the JF JCM program, which combines JCM funds with ADB finance, was given citing the example of a solar power and battery project in Mongolia.

Consequently, system integrators in the field of energy management systems and pump manufacturers of energy recovery equipment that achieve power saving effects in reverse osmosis (RO) desalination plants, as well as makers that have supplied renewable energy storage batteries for the Asia Development Bank (ADB) JCM project in Mongolia, have also expressed interest in joining Team OSAKA. Further cooperation with manufacturers that have not previously participated in Team OSAKA will also be expected going forward.

Incidentally, Fuji Electric, which presented at the aforementioned technical workshop, applied to join the Team OSAKA network as a new member in February 2023, which Sumitomo Electric Industries, headquartered in Osaka, is also considering joining. At Sumitomo Electric, orders have been received for battery storage systems in projects using factory rooftop solar panels and batteries in Fukui Prefecture for the fiscal year 2022 under a subsidy program of the Ministry of the Environment and they are considering introducing the same project in future.

The JCM facility assistance (renewable energy) project in the Philippines also involves Japanese manufacturers interested in EPC system integration based on solar power generation, battery storage and EMS, such as PCS (Power Conditioning Subsystem) and EMS, as well as Japanese manufacturers who already have orders for battery storage systems for local hydropower projects on hand. However, given the issues involved with the scheme aspect of the JCM facility assistance project and the length of the CO2 monitoring period after commissioning the plant, it is expected to take time for them to consider becoming the Japanese representative business operator.

The operating secretariat of the JCM business, the non-profit organization Global Environment Centre Foundation (GEC), also recommends a technical proposal combining solar power generation, energy storage systems (EMS), and batteries, as shown in the figure below. Accordingly, by going forward, continuing initiatives like this technical workshop and strengthening collaboration with local private companies, we aim to pave the way to establish highly reliable projects and promote the JCM business.

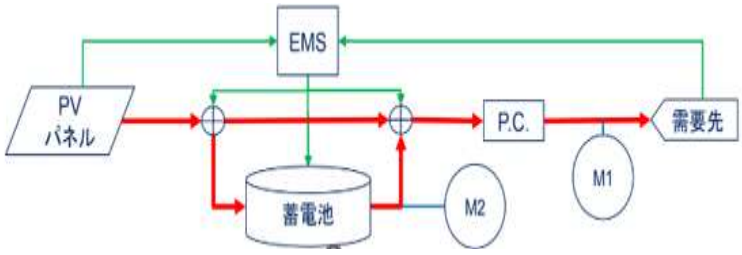


Figure 5-5 GEC envisages a combination of solar PV + storage batteries + EMS

5.1.4 Third-country collaboration

On May 24, 2022, the QUAD summit was held spotlighted the continued collaboration between the United States, Australia, India, and Japan. Against this backdrop, Osaka City has existing cooperation agreements with Chicago in the United States, Melbourne in Australia, and signed a memorandum of understanding (MOU) related to environmental and energy sector cooperation with Maharashtra state in India.

In February 2022, Osaka City, along with the Osaka Environmental Bureau, Osaka Port Authority, and the Earth Environment Center, held the second Japan-India Business Online Seminar, which was attended by 91 participants. This seminar, held in collaboration with Maharashtra State, focused on sustainable development goals (SDGs) in the areas of the environment, port, and logistics sectors. The seminar featured lectures from speakers in Osaka City, Maharashtra State, and Japanese private enterprises, as well as Indian port administrators. The speakers discussed initiatives related to climate change, atmospheric pollution management systems, and other topics. These themes align with the intercity collaboration workshop held in December 2022 between Osaka City and Quezon City.

Although efforts were made to have Maharashtra State participate online in the intercity collaboration workshop, it was not possible due to scheduling conflicts. However, Osaka City and Maharashtra State have renewed their memorandum of understanding on environmental conservation, carbon reduction, and energy sector cooperation. Given that communication between the two cities is primarily online, the specific initiatives of the intercity cooperation project will be presented to promote exchange between the two cities. In the coming year, further efforts will be made to engage in active collaboration with third countries.

As part of the intercity collaboration, the Ministry of Economy, Trade, and Industry (METI) and the Japan External Trade Organization (JETRO) are proposing the use of a high-temperature fermentation treatment device to improve waste disposal, which could contribute to Quezon City's Enhanced QC-LCCAP initiative by reducing greenhouse gas emissions. Quezon City is currently considering the implementation of small-scale composting and biogas power generation systems to collect and treat food waste generated by restaurants in each barangay by fiscal year 2024. There is also interest in the high-temperature aerobic fermentation technology. In January 2023, Japanese companies with proposed technology for the intercity collaboration initiative and Quezon City officials met face-to-face to discuss processing capabilities, maintenance management systems, and pricing. A follow-up meeting is planned for May 2023.

Figure 5-6　Meeting with Quezon City

Moreover, as described in Chapter 4, we are also cooperating on the metro Manila Subway Project and the Philippines North-South Commuter Railway Extension Project, both of which aiming to enhance the flow of transportation within the Manila metropolitan area, assisted by ADB and JICA. We aim to explore further collaboration with JICA projects that will help improve the transportation flow through this project.

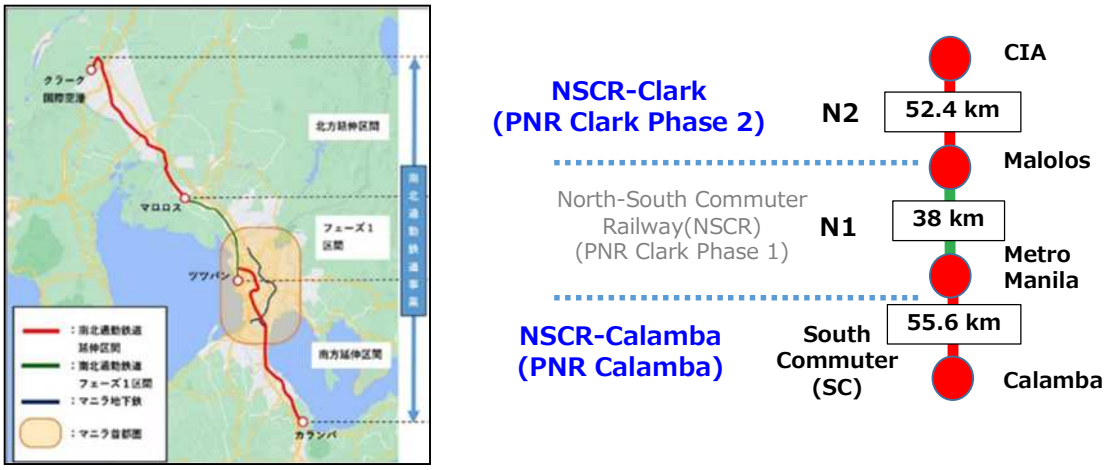


Figure 5-7 North-South Commuter Railway Extension Project in the Philippine