FY2022 Project for Ministry of the Environment Government of Japan

FY2022 City-to-City Collaboration Program

for Creating a Zero-carbon Society

(Support Project for Technology Adoption and Policy

Building to Promote Decarbonization and Co-Benefits in the

State of Koror, Republic of Palau)

〔Kitakyushu City- Koror state Collaboration Project〕

Survey Report

March 2023

ATGREEN Co., Ltd.

Table of Contents

Abbreviation

Abbreviation	Formal name
ADB	Asian Development Bank
COVID-19	Corona Virus Infectious Disease, emerged in 2019
EV	Electric Vehicle
EVMJ	EV Motors Japan
GHG	Green House Gas
IGES	Institute for Global Environmental Strategies
INDC	Intended Nationally Determined Contributions
JCM	Joint Crediting Mechanism
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JOIN	Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development
LED	Light-Emitting Diode
MPIIC	Ministry of Public Infrastructure, Industries and Commerce
MRV	Measurement, Reporting and Verification
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OOC	Our Ocean Conference
PIAC	Palau International Airport Corporation
PCC	Palau Chamber of Commerce
PPR	Palau Pacific Resort
PRR	Palau Royal Resort
PPUC	Palau Public Utilities Corporation
PRR	Palau Royal Resort
PV	Photovoltaics
PVA	Palau Visitors Authority
SDGs	Sustainable Development Goals
WS	Workshop
3R	Reduce/Reuse/Recycle

1 Objective and Overview of Project and Work

1.1 Project objective

A new global goal of limiting the rise in temperatures to 1.5°C above pre-industrial levels was affirmed at the 26th UN Climate Change Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC), held in November 2021. It is essential to accelerate the pace of actions at the state, city, district and all other levels in each country and region in order to achieve this goal. Japan has also declared its aspirations of achieving the goal of a decarbonized society by reducing total greenhouse gas emissions to zero by 2050, with a record number of 871 municipalities stating their intentions to reach net zero CO2 emissions (as of 28 February 2023). Advanced measures have been developed in different areas under the Regional Decarbonization Roadmap formulated in June 2021.

Cities and municipalities are taking on increasingly important roles in considering and implementing specific local climate change measures and projects. The move to build sustainable societies must be accelerated in order to achieve the creation of decarbonized societies around the world, especially in Asia, which is facing a remarkable period of economic growth. There is a growing trend on the international stage to encourage urban initiatives to decarbonize cities, a focal point for activities that support social and economic development.

As cities contend with the recent spread of cross-border issues impacting health, such as COVID-19, while simultaneously in a position where they are under pressure to readjust and consider new measures to achieve sustainable development, it is of paramount importance to create innovative methods and new cities through city-to-city collaboration.

In this project, research institutes, private companies, universities and other groups, mainly from partner Kitakyushu City (Fukuoka Prefecture) in Japan, with experience and expertise related to the formation of decarbonized societies conducted studies in Koror State in the Republic of Palau to support local initiatives and introduce facilities and equipment that would be instrumental in realizing the creation of a decarbonized society.

1.2 Project overview

1.2.1 Project overview

(1) Sectors and fields covered in this study

This project investigated the following sectors and fields with the objective of introducing facilities and equipment that are advantageous to the decarbonisation process (Table **1-1** and Figure 1-1).

Table 1-1 ：Project overview

Target sectors and fields	Overview of implementation
Tourism sector	Studies and research on increasing the ratio of renewable energy (hereinafter, “renewable energy”) and achieving decarbonisation through the promotion of EVs as passenger transport vehicles for tourism (e.g., sightseeing buses) and vehicles for public transport
Waste collection and transport sector	Studies on the concept of achieving a 100% ratio of renewable energy in the waste resources circulation flow, including the use of EVs as collection and transport vehicles
Other technology fields that are pivotal to decarbonisation and resolving local environmental challenges	Follow-up to studies on energy-efficient and renewable-energy facilities and equipment in businesses with needs identified in earlier studies
Decarbonisation policy development field	Studies on the current status of GHG emissions in public facilities and government office buildings in Koror State and the feasibility of decarbonisation measures

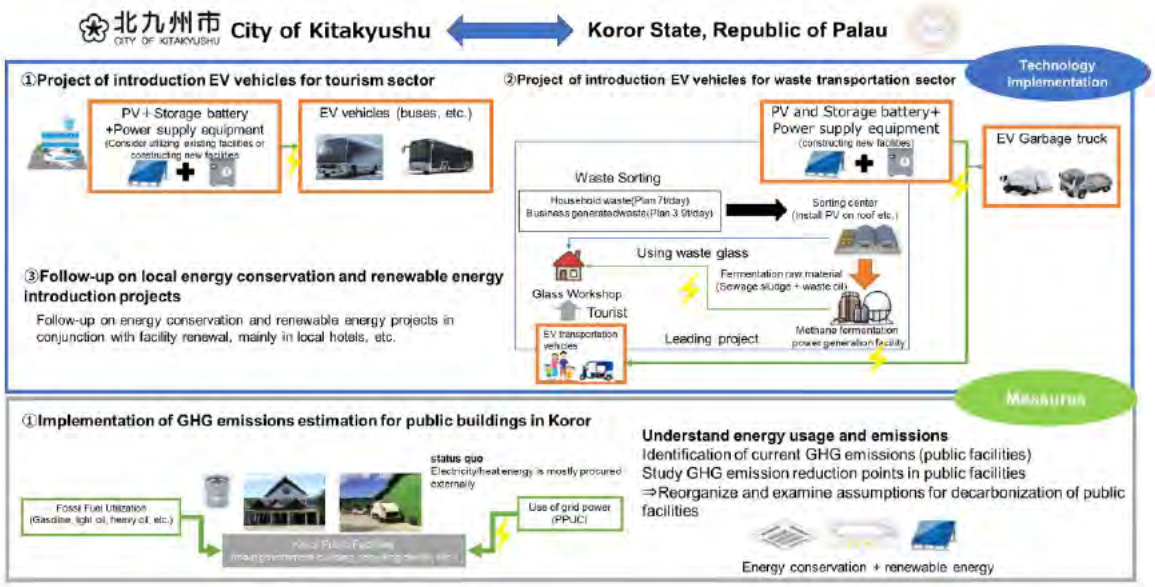


Figure 1-1 ：Project implementation diagram

(2)Areas covered in this study

Koror State and surrounding areas, Republic of Palau

1.2.2 Implementation method

(1)Contents of study

Table 1-2 below shows detailed information about this study in each of the sectors and fields listed in the previous section.

Table 1-2 ：Content of surveys in each sector

Tourism sector
(1) Detailed study on project model, including implementing bodies, project implementation system and facility/equipment scale, and feasibility study on public-private partnerships with Koror State Local partners and project implementation site candidates were selected after interviewing and discussing the project model (confirming technical requirements, e.g., cruising range, number of chargers, charging times; needs; and feasibility studies on project model) with private companies (with connections to the international airport in Palau) and various organisations that expressed interest in this project. (2) Study and review of project cost models, implementation systems, and investment recovery models Potential implementation systems and cost estimates were formulated based on the results of the above study to develop a more cost-effective project model that reflects local needs. Estimates on initial investment costs and number of years needed to recover cumulative losses were also calculated. (3) Study on identifying solutions to issues on maintenance and other operational challenges Studies were conducted to categorise local issues (e.g., conformity with communication conditions) and measures when introducing and utilising online maintenance tools, and to resolve maintenance issues in island nations. Studies also identified specific issues related to the operation of public transport in Koror State, and details on the expertise available from Japan was also examined. (4) Review and preparation of application for the JCM Model Project subsidy scheme and examination of proposed MRV methodologies Interviews and reviews were conducted on the JCM Model Project subsidy scheme and other funds (e.g., JICA, ADB) based on studies in (1) to (3) above, and proposed MRV methodologies were examined. Some of the field work for studies and analyses in items (1), (3) and (4) above was outsourced to Palau International Airport Corporation (PIAC).
Waste collection and transport sector
(1) Study and review of the feasibility of project development with related officials in Koror State and other potential stakeholders Interviews and discussions on the potential for developing a project model (e.g., confirming technical requirements and needs, such as cruising range, number of chargers and charging times) for the use of EVs for waste collection and transport were held with local waste management offices and officials from the final disposal site (M-

Dock). Organic methods for collaboration with the “Transportation Station Project” that is currently being promoted in Koror were also discussed and reviewed in terms of implementation systems, potential funding sources and other aspects.

(2) Study and review of project cost models, implementation systems, and investment recovery models

Potential implementation systems and cost estimates were formulated based on the results of the above study to develop a more cost-effective project model that reflects local needs. Estimates on initial investment costs and number of years needed to recover cumulative losses were also calculated.

(3) Study on identifying solutions to issues on maintenance and other operational challenges

As with the tourism sector, studies were conducted to categorise local issues (e.g., conformity with communication conditions) and measures when introducing and utilising online maintenance tools, and to resolve maintenance issues in island nations.

(4) Review and preparation of application for the JCM Model Project subsidy scheme and examination of proposed MRV methodologies

Interviews and reviews were conducted on the JCM Model Project subsidy scheme and other funds (e.g., JICA, ADB) based on studies in (1) to (3) above, and proposed MRV methodologies were examined.

Some of field work for studies and analyses in items (1), (3) and (4) above was outsourced to KE+ Environmental Consulting Service.

Other technology sectors that are pivotal to decarbonisation and resolving local environmental challenges

(1) Discussions on project development with Koror State and tourism-related companies

Follow-up studies were conducted on facility and equipment renewal needs received from several hotels in the previous year.

Decarbonisation policy development field

(1) Study to confirm GHG emission factors, collect data, calculate emissions, and develop estimation models for public facilities government office buildings in Koror State

A review was conducted to identify the current state of GHG emissions, which are important for studies on and the implementation of future decarbonisation measures, calculate emissions, and develop estimation models for BAU scenarios and when implementing reduction measures. The study then investigated points with potential to lead to reductions in GHG emissions at governmental office buildings. The study targeted GHG emissions related to energy consumption in up to 10 public facilities (e.g., state office buildings, recycling centres).

(2) Exchange of ideas on and introduction of Japanese initiatives to promote the SDGs in Koror State

In addition to municipalities’ expertise and experience in institutional design and planning together with Kitakyushu, which has been selected as an “SDGs FutureCity” by the Japanese Cabinet Office and as an SDGs model city by the OECD, an extensive number of case studies addressing decarbonisation, SDGs, resource recycling and other issues were introduced and ideas were exchanged.

Some of field work for studies and analyses in item (1) above was outsourced to KE+ Environmental Consulting Service.

(2)Field surveys

Field surveys were conducted in Palau from this fiscal year, following the easing of COVID-19 related entry and exit restrictions in Japan and Palau. Two field surveys were conducted in FY 2022, as follows.

【1st field survey】

Item	Details
Dates	15 December to 21 December 2022
Survey team	・Yoshihiro Muto (Division Manager (International Collaboration), International Environmental Strategies Division, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City) ・Tatsurou Nagahara (Section chief (International Collaboration), International Environmental Strategies Division, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City) ・Mitsuyoshi Hamada (Chief examiner (International Collaboration), International Environmental Strategies Division, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City) ・Seiya Tominaga (Senior Manager, ATGREEN Co., Ltd.)
Sites visited and persons interviewed	16 December ・Koror State Waste Management Office Mr. Katsuo Fuji (Consultant, Koror State Waste Management Office) Mr. Selby Etibek (Recycle center manager) 17 December ・Palau Pacific Resort (PPR) Mr. Seiji Sone (Property Operation Manager) ・Palau International Airport Corporation(PIAC) Mr. Manabu Yoshida (Representative) 18 December ・Koror State Waste Management Office ・Ngaremeduu Bay Conservation Area (proposed boardwalk construction site) Mr. Katsuo Fuji (Consultant, Koror State Waste Management Office) 19 December ・Koror State Government Mr. Eyos Rudimch (Governor) Mr. Milan Isaac (State Assembly Chair) Mr. Leslie Tewid (Director, Public Works) Mr. Katsuo Fuji (Consultant, Koror State Waste Management Office) ・Japan International Cooperation Agency (JICA) Palau Office

	Mr. Ryutaro Kobayashi (Director) Mr. Hirotoshi Sagami (Project Formulation Advisor) ・KE+ Environmental Consulting Service Ms. Kumiko Kurihara (Representative) 20 December ・Embassy of Japan in the Republic of Palau H.E. Hiroyuki Orikasa (Ambassador Extraordinary and Plenipotentiary of Japan to the Republic of Palau) Mr. Hajime Sugimura (First Secretary (Head, Economic and Development Cooperation Group))

【2nd field survey】

Item	Details
Dates	5 February to 8 February 2023 (only some members on Feb 13)
Survey team	・Takanori Arima (Executive Director, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City) ・Tatsurou Nagahara (Section chief (International Collaboration), International Environmental Strategies Division, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City) ・Hidenobu Sumi (Executive Vice President, EV Motors Japan Corp.) ・Seiya Tominaga (Senior Manager, AT GREEN Co., Ltd.) ・Sho Koizumi (Consultant, ATGREEN Co., Ltd.)
Sites visited and persons interviewed	6 February ・Palau International Airport Corporation(PIAC) Mr. Manabu Yoshida (Representative) ・Garden Palace Hotel Mr. Naohisa Ooya (Operations Manager) ・Aimeliik State Final Waste Disposal Site Maintenance application (SynQ Remort) connection test ・Belau Tour Mr. Yutaka Taikou (General Manager) 7 February ・Koror State Government Mr. Eyos Rudimch (Governor) Mr. Leslie Tewid (Director, Public Works) Mr. Selby Etibek (Manager, Recycling centre) Mr. Katuso Fuji (Consultant, Koror State Waste Management Office) ・Embassy of Japan in the Republic of Palau Mr. Hajime Sugimoto (First Secretary (Head, Economic and Development Cooperation Group)) Mr. Kenta Karamoto (Head, Political Affairs)

	・Japan International Cooperation Agency (JICA) Palau Office Mr. Ryutaro Kobayashi (Director) ・Koror State Waste Management Office Mr. Katuso Fuji (Consultant, Koror State Waste Management Office) 8 February to 12 February Surveys on local road conditions, vehicles in use, and maintenance conditions of tourism buses and school buses introduced

1.2.3 Implementation period

8 July 2022 to 10 March 2023

1.2.4 Project implementation system

The project implementation system is outlined in Figure 1-2, Table 1-3, Table 1-4 below.

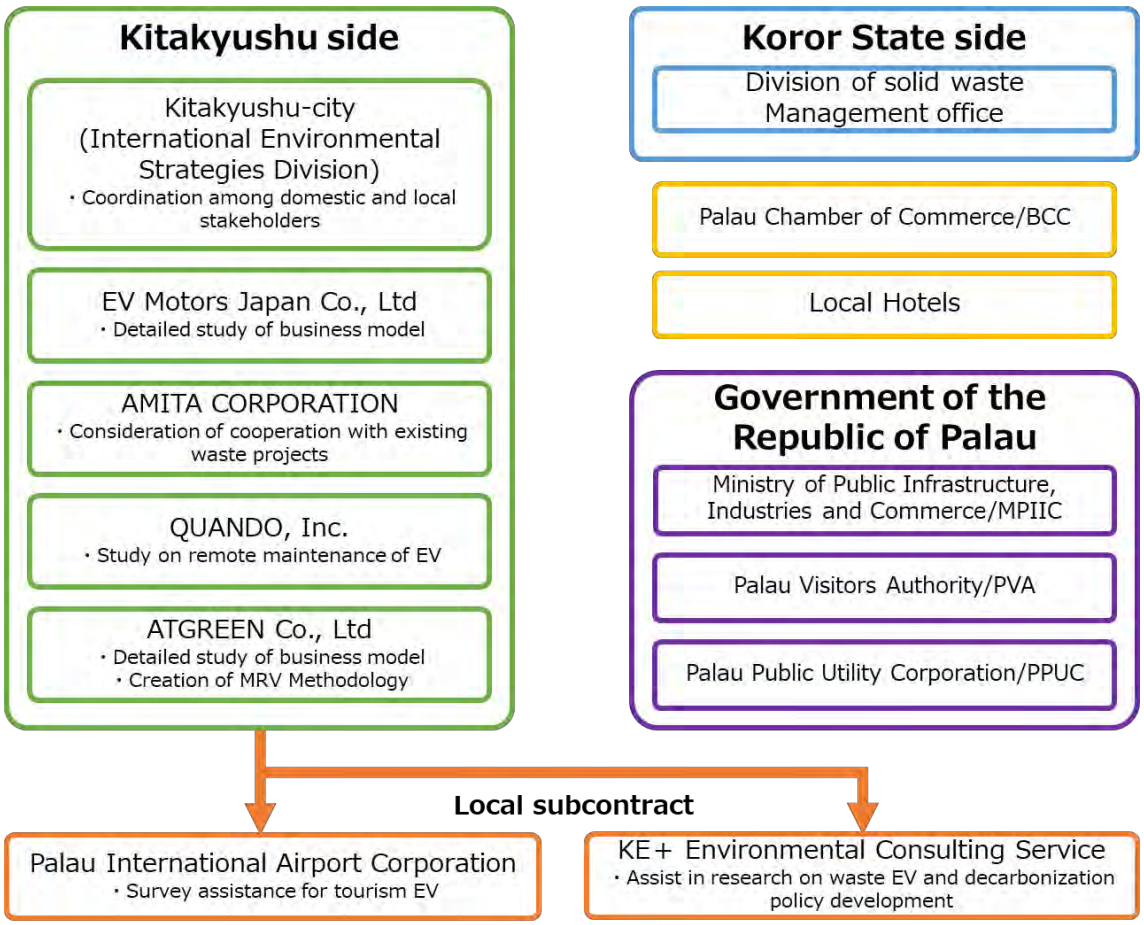


Figure 1-2：Project implementation system

Table 1-3 ：Overview of organizations in Japan and project roles and responsibilities

Organisation	Overview of organisation and projects/operations	Project roles and responsibilities
ATGREEN Co., Ltd. (Project lead)	Business offering consulting services in the fields of the environment, energy, waste, etc.	・Project lead ・Project model study
Kitakyushu City Environment Bureau (International Environmental Strategies Division, Overseas Environmental Project Department)	Local authority that aims to transfer the decarbonisation technologies and expertise of local companies through international city-to-city collaboration Selected by the OECD as an SDGs Model City in recognition of its advanced initiatives in various fields, including resource recycling, decarbonisation, energy use, social welfare, SDGs, other.	・Overall coordination of city-to-city collaboration ・Promotion of G to G collaboration ・Sharing of extensive experience and knowledge on the environment and SDGs
EV Motors Japan Corp.	Company engaged in the sales and maintenance of commercial EV vehicles (buses, trucks, etc.) and charging stations	・Review of locally compatible technology and equipment ・Review of project balance sheet model
AMITA CORPORTION	Business engaged in providing solutions to increase the sustainability of companies and municipalities (waste disposal, recycling, consulting)	・Study on potential for collaboration with existing resource circulation PJ ・Adjustments in terms of consistency with existing PJs
Quando Inc.	Company engaged in the development and sales of remote maintenance systems Selected as one of 50 supporting companies in the Startup City Acceleration Program (SCAP) implemented by the Japan External Trade Organization (JETRO), Cabinet Office and Ministry of Economy, Trade and Industry	・Study on the effectiveness of remote maintenance systems to resolve maintenance labour shortages in island countries and identification of challenges

Table 1-4 ：Overview of local subcontractors in Palau and project roles and responsibilities

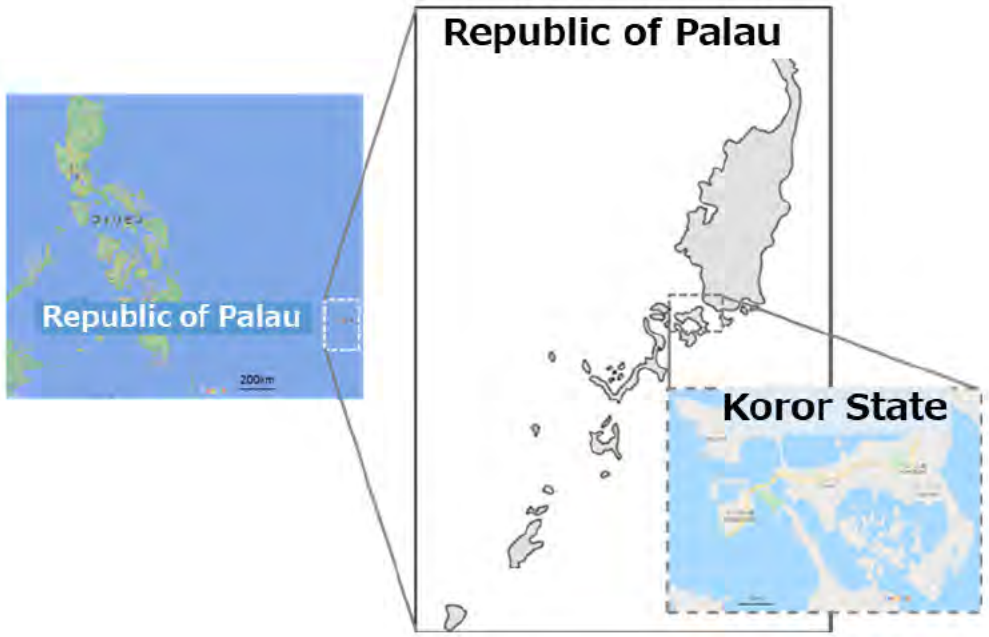
Organisation	Overview of organisation and projects/operations	Project roles and responsibilities
Palau International Airport Corporation	Joint venture between the government of the Republic of Palau and an intermediate holding company with Sojitz Corporation, Japan Airport Terminal Co., Ltd., and JOIN/Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development, which owns the rights to operate Palau International Airport for 20 years from	・Assistance in studies on introducing EV buses for passenger transport in the tourism sector ・Identifying conditions and challenges in introducing EV buses for transporting tourists and charging facilities at Palau International Airport

	2019 Engaged in efforts to add value to Palau International Airport and enhance value as a tourist destination	
KE+ Environmental Consulting Service	Local environmental consulting firm in Palau Extensive experience in coordinating with the Koror State Waste Management Office and conducting waste-related studies and research	・Assistance in conducting studies on local government stakeholders and the Koror State Waste Management Office in order to promote the introduction of EVs in the waste transport and collection sector ・Assistance in conducting interviews related to GHG emission calculations for public facilities in Koror (e.g., data on energy consumption, status of consumption in facilities, history of facility/equipment updates)

1.3 Project background

1.3.1 Overview of Koror State, Republic of Palau

The Republic of Palau is located at 7.5150° N, 134.5825° E in the northern hemisphere of the western part of the Pacific Ocean, along the western edges of Micronesia and the Caroline Islands. The capital was relocated from Koror to Ngerulmud in Melekeok State on Babeldaob Island in 2006. The country has a total population of 17,501 (as of 2012), with 11,655 people, or 66.7%, concentrated in Koror State, which is the subject of this study. As an island nation, Koror faces a number of challenges in terms of waste disposal, external dependence for food and energy, and an economy centered on foreign investment. The tourism industry accounts for over 50% of the nation's GDP, and environmental protection is a priority because of Palau's dependence on its marine environment, which includes rich coral reefs and fish species that are unique to the tropical region.



(Map Source : Google Map)

Figure 1-3 : Location of the Republic of Palau and Koror State

【Climate change measures】

Palau is a member of the Secretariat of the Pacific Regional Environment Programme (SPREP), and is promoting climate change action. Palau developed its Intended Nationally Determined Contributions (INDC) in November 2015. An overview of the INDC is below.

Table 1-5 : Overview of INDC[1]

Item	Contents
Implementation period	Starts in 2020, ends in 2025
Reductions	Emission reduction targets in the energy sector with additional reductions from the transport and waste sectors
Base year	2005: Emissions in this year were 88,000 t-CO_2
Reduction targets	Aims to achieve the following targets by 2025 ・Reduce greenhouse gas emissions by 22% from 2005 levels ・Increase the share of renewable energy to 45% ・Energy savings target of 35% from 2005 levels

[1] Republic of Palau INDC (http://prdrse4all.spc.int/system/files/palau_indc.final_copy.pdf)

【Energy policies and plans】

Palau has been implementing the “Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP)”, a mitigation project in the energy sector to promote the use of renewable energy, since 2007.

Palau is focused on mitigation measures to shift away from energy dependence on fossil fuels. This is an issue of paramount importance for Palau in terms of power generation costs, as the country is unable to secure fossil fuels without importing them from overseas. Palau has drawn up a roadmap to expand the introduction of renewable energy, shifting away from diesel power generation, which accounts for about 98% to 99%[2] of energy generation in the country to date, and has set a target of 45% of electricity generated by 2025 to be covered by renewable energy. As part of this target, five PV projects (equivalent to 2.5 MW) have been introduced through the JCM Model Project subsidy scheme to date, and PV-based renewable energy is continuing to be introduced with support from the governments of New Zealand and South Korea, and other stakeholders. The Palau government is also inviting international competitive bids for a PV microgrid construction project through the Asian Development Bank (ADB).

However, grid connections for large-scale PV systems such as these can prove problematic in terms of short- and long-term fluctuations, with challenges seen in the need to absorb excess power and sudden fluctuations in output. The introduction of microgrids runs the risk of further destabilising the power structure, as power generated by existing diesel-powered generation facilities has also resulted in frequent power outages due to aging facilities, inadequate maintenance and a lack of operational capacity.

In light of these perspectives, there is a compelling need to introduce and utilise renewable energy for private consumption, with consideration given to reducing the load on grids, an area in which Palau has also expressed a need.

[2] Okinawa Enetech Co., Ltd. (2015), Survey to Gather and Verify Information for Aid Measures to Improve Energy Security in the Pacific Region Power Sector, Japan International Cooperation Agency

In a separate study related to this project, a company called T-PLAN Inc. (in Nakatsu City, Oita Prefecture, Japan) proposed and launched a study in October 2022 to examine the development of a “Himeshima Model” in Palau, which combines mobility with a carport equipped with a solar power generation and energy storage system, under the JICA Private Sector Partnership programme (Business Model Formulation Survey with SMEs) (Figure 1-4). This initiative may serve as a potential solution to the issues in the tourism sector described below, so the possibility of collaboration with this project may be considered.

Figure 1-4：JICA Private Sector Partnership programme on small EVs

【Tourism sector】

Prior to the global COVID-19 pandemic (see below), Palau was the destination for 120,000 to 160,000 tourists each year, with about half of its total national income of JPY 25 billion originating from the tourism sector. Global warming and other environmental issues also simultaneously exert a strong impact on the tourism sector. Public transportation is not well-maintained and tourists are left with only the option of using taxis

or hotel shuttle services. With only one main road (Main Street) on Koror Island, there are frequent traffic jams, mostly in the mornings and evenings.

【Waste sector】

In reflection of the importance of the 3Rs, the Koror State government established a recycling centre in 2004 as a way to enhance waste management. Organic waste is composted and sold at the centre, and a deposit system has been established to collect customs duties on imports of beverages and to cover collection/disposal costs for empty cans, bottles and PET bottles. Koror State is actively promoting waste recycling projects, including the introduction of plastic oil conversion equipment in 2015. However, few types of waste can be recycled domestically due to the absence of industries in Palau that can utilise waste. There have also been reports of an increase in the volume of household and commercial waste to over 27 tonnes/day, due to an increase in imported goods and number of tourists.[3]

The M-Dock landfill, the final disposal waste site in Palau, is approaching the end of its remaining service life, which has been extended through several rounds of levelling construction work. In this context, a new final disposal site was constructed in Aimeliik State through Japanese grant aid and completed in August 2020. In the past, each state operated its own disposal site where they landfilled their own waste, however, the new site is planned to be used to landfill all waste in Palau, with the exception of outlying islands. A critical issue facing the country is the need to take additional waste reduction measures through the 3Rs, in order to effectively use the limited landfill capacity of the new disposal site. Koror State also needs to further improve the efficiency of its waste disposal practices, as transferring waste for disposal to the new final disposal site in Aimeliik State will increase transportation costs.

Koror State's vision for a waste collection and recycling project is based on a waste sorting transhipment and storage facility that will both increase recycling rates and reduce waste disposal costs, while also simultaneously leading to the establishment of a global

[3] CTI Engineering International Co., Ltd. (2018), Report on the Preparatory Survey on the Construction of a Waste Disposal Facility in Lao PDR, Japan International Cooperation Agency

recycling system to resolve the issue of waste that cannot be domestically treated and disposed.

【Impacts related to the global spread of COVID-19】

COVID-19, which has spread like wildfire around the world, had a considerable impact on Palau. Stringent border control measures posed significant restrictions on overseas travel to the region. Although the entry of international visitors resumed (with conditions) in August 2020, there have been particularly grave impacts for the tourism industry. The number of tourists fell to 18,000[4] in 2020, about one-tenth of the 164,000 visitors to the country at its peak in 2015. This decline has led to large-scale unemployment in the tourism sector, with the government providing compensation to the unemployed. Financially, Palau receives aid from a number of countries, including financing from the U.S. and a sovereign loan from the ADB.

Effective 1 July 2022, Palau's travel advice and warnings on infectious diseases have been lowered from Level 2 to Level 1, and as of 3 November, airlines require the submission of vaccination certificates, but do not necessitate negative test results.[5] COVID-19 has also affected Palau's economy, and thus, its fiscal revenue, so the Palau Goods and Service Tax (PGST), a 10% value-added tax (equivalent to consumption tax in Japan) which will be imposed on almost all goods and services from January 2023, is affecting the lives of the people of Palau.

1.3.2 Collaborative relationship between Kitakyushu City and Koror State

City-to-city collaboration between Kitakyushu and Koror has been in place since 2015 and is based on the foundation of the establishment of a resource recycling system. Activities to date are shown in Table 1-6 below.

Table 1-6 ：Past city-to-city collaborative activities between Kitakyushu City (and local businesses) and Koror State

FY	Project name	Project overview

[4] Ministry of Foreign Affairs, Basic data on the Republic of Palau (https://www.mofa.go.jp/mofaj/area/palau/data.html)

[5] Embassy of Japan in the Republic of Palau website, Information on Palau entry/exit and Japan entry (as of 3 November 2022), https://www.palau.emb-japan.go.jp/itpr_ja/11_000001_00364.html

2015	Project on the establishment of a comprehensive resource circulation system in island regions	・Jointly implemented with the AMITA Institute for Sustainable Economies (AISE) ・Conduct of surveys on landfill delivery volumes and setting the amount of material that can be disposed ・Review of specifications and costs for recycling facilities ・Review of business plans/schemes ・Consensus building with government/project stakeholders to realise the objectives of the project/business ・Visit by Palau officials to Japan and organisation of workshops ・Surveys on cultivating energy resource crops
2016	Project on the establishment of a comprehensive resource circulation system in island regions	・Jointly implemented with the AMITA Institute for Sustainable Economies (AISE) ・Conduct of additional studies and consensus building on project schemes and plans ・System design, acquisition of estimates, preparation for construction ・Signing of partnership agreement (between AMITA Institute for Sustainable Economies (AISE) and Koror State)
2017 2018	Feasibility study on the introduction of a comprehensive organic resource circulation system using small-scale methane fermentation technology in island areas	・Participation as outside human resources in the proposed corporation, Vioce Co., Ltd., with the AMITA Institute for Sustainable Economies (AISE) ・Study related to input materials for biogas facilities (food waste, resource crop napier grass, etc.) ・Establishment of food waste sorting and collection schemes ・Promotion of the use of liquid fertilisers ・Feasibility study on deploying systems to island areas ・Specifications and operational design of small biogas facilities optimised for local regions ・Awareness raising activities for local staff (activities to receive visitors to biogas facilities in Japan)
2019	Project on the development of a waste collection, sorting, and recycling system based on a transhipment and storage facility for sorting resources in Koror State, Republic of Palau	・Jointly implemented with AMITA CORPORATION and Beetle Engineering ・Construction of a transhipment and storage facility equipped with a resource sorting function, and establishment of integrated systems for resource sorting functions ・Consideration of international recycling system
2020 2021	FY 2020 City-to-City Collaboration for Zero-Carbon Society: Project to promote decarbonization	・Jointly implemented with EV Motors Japan, AMITA CORPORATION, IGES Kitakyushu Urban Centre, and AT Green ・Conduct of interviews online with representatives

	and create co-benefits through the introduction of EV vehicles in Koror State, Republic of Palau	from the state government, waste management offices, hotel operators, and others to verify local needs and the effectiveness of introducing EV vehicles into the tourism, waste collection and transport industries ・Identification of the formation of other decarbonisation-related projects

As per the table above, opportunities for exchange between the two cities are evolving, especially in the waste management sector. Kitakyushu has also been selected as an SDGs Future City by the Japanese Cabinet Office, as well as an SDGs model city by the OECD through its promotion of activities at the city level to achieve the targets set out by the SDGs. Koror State has also been involved in promoting activities to achieve the SDGs and is preparing to set up an SDGs-related department. Exchanges are taking place with knowledge being shared from Kitakyushu. Koror State Governor Eyos Rudimch, three state assembly members, and Mr. Katsuo Fuji (Consultant, Koror State Waste Management Office and Special Advisor for Economic Development to the Governor) visited Kitakyushu in August 2022 and met with the city's mayor. The visit also included a test drive of an EV community bus at the head office of EV Motors Japan (Wakamatsu ward, Kitakyushu), one of the project's partners, and a visit to AMITA CORPORATION, another partner.

Figure 1-5：Visit by Governor Eyos Rudimch and state assembly members (photo taken at EV Motors Japan head office)

1.3.3 Overview of project and challenges in FY 2020 and FY 2021

This project is the continuation of a project that has been conducted since fiscal 2020. The table below provides a summary of the content, outcomes and challenges faced in surveys and verifications carried out under the project in the past two years. The activities in this year's project follows the outcomes and challenges outlined below, with the aim of further enhancing and optimizing the project model.

Table 1-7 ：FY 2020 and FY 2021 City-to-City Collaboration Project for Zero-Carbon Society (commissioned project): Content of studies and verifications, outcomes and challenges

Tourism sector	Content of studies and verification	・Local traffic and passenger transportation conditions ・Laws and regulations related to the introduction and operation of EVs (tariffs, road traffic laws, etc.) ・Installation and operating conditions of photovoltaic power generation facilities/equipment ・Local needs for the introduction and operation of EVs (expected benefits, concerns, and important points) ・Studies and analysis on precedents in Japan and overseas (expected effects, challenges and measures for implementation and operation) ・Interviews on local technical requirements and examination of technologies to be introduced ・Development of hypotheses and testing project models, calculating CO_2 reduction effects ・Study on maintenance and utilisation systems ・Examination of project implementation structure and financing methods
	Outcomes	・Consideration of shuttle bus service model from airport (top candidate site for recharging base) to hotel ・Lack of public transport in the country shows that the project can be profitable if used by tourists ・Expression of high expectations for the project by stakeholders in Palau, which is in line with national policies ・Use of reused batteries can be expected to reduce the cost and increase capacity of storage batteries, which is a factor behind rising costs ・Importance of cooperation with the international airport, which serves as the starting points for tourists, to be studied in the future
	Challenges	・Reduction in initial costs

		・Necessary to ensure a menu of support for the tourism industry, which has been hard hit economically by COVID-19 ・Securing parts for repair (tangible support) and human resources training for local maintenance technicians (intangible support) ・Need to build capacity and establish a system with expertise on operational systems due to lack of expertise in public transport ・Additional studies on the development of optimal models for subsidies and other forms of support, as well as on leasing and other financial schemes ・Strengthening of cooperation with local stakeholders without traveling to the region
Waste collection and transport	Content of studies and verification	・Local waste collection and transportation conditions (vehicles in operation, collection areas, etc.) ・Status and progress of preliminary study on transhipment and storage facility for sorting resources ・Positioning of this study in the Koror State policy plan ・Laws and regulations related to the introduction and operation of EVs (tariffs, road traffic laws, etc.) ・Local needs for the introduction and operation of EVs (expected benefits, specifications) ・Survey and analysis on precedents in Japan and overseas (expected effects, challenges and measures for implementation and operation) ・Studies on technologies to be introduced ・Development of hypotheses and testing project models, calculation of CO_2 reduction effects ・Examination of project implementation system and financing methods
	Outcomes	・Study on the introduction of EVs for waste collection and transport (packer trucks) based at M-Dock ・Expectations that four packer trucks operating in the nearby collection and transport area and one large vehicle operating at the new landfill site (Aimeliik final disposal site) would be converted to EVs ・Expectations by Koror State for collaboration with the state's ongoing project to build a resource-recycling society ・Expectations for collaboration in the project to introduce EVs for waste collection and transportation vehicles as part of Koror's comprehensive project to create a resource-recycling society, in consultation with ADB
	Challenges	・Reduction in initial costs ・Selection of optimal driving models and battery capacities ・Need to secure as many subsidies as possible to reduce financial hardship, as this is a non-revenue generating project

		・Securing parts for repair (tangible support) and human resources training for local maintenance technicians (intangible support) ・Ensure competitiveness with a view to bidding on the international scale ・Identification of unique local needs for larger vehicles, etc.
Other decarbonisation projects	Content of studies and verification	・Organisation of know-how and candidate seeds for environmental technology that can be delivered by Kitakyushu ・Interviews on energy efficiency and renewable energy needs for large-scale hotels for tourists ・Creation of added value through the carbonisation of waste tires ・Conversion of streetlights to LED lights ・Electric-powered vessels (e-ships, electric outboard motors) ・Offshore PV generation ・Recycling of lead-acid batteries ・Ocean thermal energy conversion (OTEC)
	Outcomes	・Identification of large hotels that are upgrading facilities ・Difficulty in disposing of waste tires and high disposal costs ・Confirmation of the installation of stand-alone LED lights in almost all areas along public roads in Koror ・Needs exist for electric-powered vessels for eco-friendly marine recreation activities ・No needs identified in terms of offshore PV power generation as there is no scarcity of land in Palau ・Collection of lead-acid batteries at this time for value and exported overseas, with domestic recycling expected to provide various benefits (extended service life, reduced economic burden, GHG emission reductions, increased used of PV power generation)
	Challenges	・Confirmation of details on hotel energy requirements and determine scale of equipment required ・Necessary to consider the introduction of LED packages with unified standards since the needs of public facilities have been confirmed ・Necessity for electric-powered vessels to meet various conditions (sailing speed, environment, power infrastructure, etc.). Practical applications are extremely limited in terms of battery performance and cost. ・Necessity for studies on reconditioning and use of lead-acid storage batteries, safety assurance, human resources development, establishment of inspection systems and criteria, institutional design, etc. ・Extremely high costs of ocean thermal energy

		conversion in relation to the amount of electricity demand ・Lack of understanding on current GHG emissions in Koror, so no effective measures are being considered at this time to reduce GHG emissions. With Palau's vulnerable electric power systems, many large consumers of electricity, such as hotels, use only privately generated electricity, which complicates efforts to ascertain the amount of power consumed.

2 Project Formation Feasibility Study (Study on Promotion of EVs for Tourist Passenger Transport)

This chapter describes the results of an investigation into the replacement and consolidation of fossil fuel vehicles used for tourist transportation with large EVs. Currently, Palau has no public transportation system, so fossil fuel vehicles (cabs, hotel shuttles, etc.) are mainly used. The use of large EVs is expected to generate co-benefits such as decarbonization through reduced fossil fuel use, reduced exhaust gas emissions, and reduced traffic congestion. The large EVs will be powered by new solar power generation in combination with storage batteries, aiming for 100% renewable energy. Table 2-1 below summarizes the organizations and groups that are expected to be stakeholders in this project. In this year's survey, interviews were conducted with PIAC, local tour companies, and hotel companies regarding tourist traffic conditions, requests for the project, and issues. Part of the survey was conducted in cooperation with PIAC using an interview sheet we created. The subjects and methods of the interviews are shown in Table 2-2.

Table 2-1 ：Assumed Stakeholders (Tourism Sector)

Organization name	Abbreviation	Overview explanation
Ministry of Public Infrastructure, Industries & Commerce	MPIIC	Palau government ministries. Palau government ministries. It consists of six departments: Bureau of Aviation, Bureau of Public Works, Bureau of Land and Survey, Bureau of Commercial Development, Small Business Development Center, and Palau Energy Office.
Palau Visitors Authority	PVA	An independent organization established to promote tourism in Palau. A part of the Presidential Office of the Republic of Palau.
Palau Chamber of Commerce	PCC	An organization integrated by the Palau Travel Association (PTA), which was a group of the tourism industry such as travel agencies and hotels.
Japan International Cooperation Agency (Palau Office)	JICA	They are currently investigating the feasibility of the "Himejima Model," which combines a carport with solar power generation and storage facilities with vehicles in Palau, in cooperation with a private Japanese company. They are also studying the feasibility of introducing public transportation vehicles as part of a master plan for public transportation in the country.
Palau Public Utilities Corporation	PPUC	The Corporation was established in February 1994 to manage and operate the electric power system in Palau. It owns power generation facilities totaling 35 MW in various locations in Palau. Currently, it is also responsible for water and wastewater services.
Palau International Airport	PIAC	PIAC operates the Palau International Airport Terminal Building. PIAC is renovating and expanding the airport terminal. Support for this survey.

Corporation		
Palau Entrepreneurs for Growth	—	A small business support organization (NGO) spun off from the Palau Chamber of Commerce and Industry. Their CEO is the former President of the Palau Chamber of Commerce.
Palau Pacific Resort	PPR	One of the three major local hotels (160 guest rooms). A Japanese company (Tokyu Land Corporation) is their parent company.
Garden Palace Hotel	—	Small hotel (12 rooms). It is managed by a Japanese owner.
Belau tour	—	Local travel agency for Japanese and Asians. In front of COVID-19 Vine, they operate a bus service for tourists to tour around the city center.

Table 2-2 ：Hearing Targets (tourism sector)

Hearing subjects	Hearing method
Japan International Cooperation Agency Palau Office (JICA)	Site visit survey
Palau International Airport Corporation (PIAC)	Site visit survey
Palau Pacific Resort (PPR)	Site visit survey
Garden Palace Hotel	Site visit survey
Belau tour	Site visit survey
Palau Entrepreneurs for Growth	Interview sheet
Palau Visitors Authority (PVA)	Interview sheet

2.1 Local Needs, Possible Schemes, and Issues for EV Introduction in the Tourism Sector

(1) Hearing results: Recovery of tourists from COVID-19

The number of tourists, mainly Taiwanese and Western individual travelers, has increased slightly but remains limited. The tourism industry is in a difficult situation, as the number of airport users is about one-third of its maximum (as of the end of last year) and the occupancy rate of major hotels is between 10% and 30%. The number of Japanese travelers has not increased particularly due to the fact that charter flights have not resumed.

(2) Hearing results: Tourist needs for EV buses

Several interviewees commented that the case of EV buses transporting multiple hotel users between airports and hotels on an aggregated basis (hereinafter referred to as "Aggregated type") may not be in demand by tourists. The main reason for this is that hotel and tour companies already provide airport-hotel transfers as their own service, and access is quicker with less time to stop at other hotels. Arrivals and departures of airplanes serving Palau International Airport are always late at night (around 1:00 am to 3:00 am). Tourists arriving in Palau, especially those from Guam,

are in high demand to check into a hotel and rest as early as possible in order to start sightseeing the next day. Many respondents said that tourists tend to give priority to convenience and accept the cost of $20-$30 for a one-way transfer (sometimes included in the tour and accommodation fees). On the other hand, there are no major obstacles to replacing diesel buses used by hotels and local tour companies that already provide transportation services with EV buses (hereinafter referred to as "Individual type"), except whether or not the cost can be recovered

(3) Hearing results: Issues for the introduction of EV buses in the Tourism sector

Table 2-3 summarizes the opinions of the interviewees regarding the issues and proposed countermeasures. It is thought that the Individual type of bus service would be more effective in addressing the issues than the Aggregated type, which is in line with the needs of tourists. The model for the implementation system should be a PPP project in which the state or national government implements the introduction of EV buses and the private sector operates the buses.

Table 2-3 ：Results of the Hearing (Issues and proposed measures for the introduction of EV buses in the Tourism sector)

Issue Classification	Issue Details	Countermeasure program (plan)
Technical /Hardware	Vehicles traveling within Palau must drive on the right side of the road and handle on the right. Buses must be right-hand drive and have right-hand doors.	Available at EVM
	Durability against salt damage and strong winds.	Salt damage can be addressed by using stainless steel or carbon fiber reinforced plastic (CFRP) for the exterior (we have experience with this). Strong winds are not a problem due to the weight of the EV battery.
Operational /Software	Who will implement the EV bus service?	The introduction of EV buses could be implemented by the state or national government and operated by a private company (i.e., the government outsources the operation to the private sector).
	It is economically difficult for private companies to purchase new EV buses	
	EV bus operators do not know how many individual reservations are going to which hotels, making it difficult to manage the travel schedule.	The operational model should be Individual type rather than Aggregated type. An advance reservation system could be

	Inconvenient access to the hotel not on the main road.	introduced. Narrow alleys could be eliminated by building a connected transportation system using small EV-mobiles in combination.

Based on the results of the above hearings, it is difficult to consider introducing EV buses relying solely on the Tourism sector under the current circumstances where tourism demand has not returned. In addition, many people at the hearing suggested that the number of tourists will increase to the same scale as before the spread of the COVID-19 infection around 2025.

2.2 Local needs, possible schemes and issues for introducing EV buses in public transportation

Based on the results of the previous section, the use of EV buses in public transportation is a possible use of EV buses outside of the tourism sector. Therefore, interviews were conducted to determine local needs and challenges for the introduction of EV buses in the public transportation sector.

(1) Hearing results: Needs for EV buses as public transportation

Palau is characterized by a car-oriented society where "one resident owns one car," and a "pickup truck" culture has taken root whereby residents load their own cars onto each other's vehicles. The reason for this is that public transportation has never existed in the region. In such an environment, some people have suggested that the number of customers who would pay for an EV bus service that circles around the city center would be limited.

On the other hand, the parking lots in shopping centers in the central part of the state are always short of parking spaces, and this frequently leads to situations where shoppers arriving by car are unable to park. Therefore, there is a possibility of using the buses as shuttle buses for shoppers in cooperation with shopping center companies. Furthermore, several interviewees suggested that if the bus fares were low (several dollars) or if the system offered some kind of incentive to shoppers, it would be possible to secure a certain level of demand.

Many of the interviewees also said that bus demand for relatively long-distance travel from Koror to other states (such as Melekeok, the capital of Palau, and other places in the island of Babeldaob) could be expected for use by people going to the hospital or

commuting to work.

The Palau Palau national government is already operating a bus service for government employees residing in Koror who work in the capital city of Melekeok, as described in detail below.

(2) Hearing results: Issues for introducing EV buses to public transportation

The technical/hardware, and operational/software issues are generally the same as the ones for the introduction of EV buses in the Tourism sector (Table 2-3). In terms of additional considerations, cooperation with the state government is essential in terms of restrictions on bus stop sites and road widths (Table 2-4). Furthermore, since investment in EV buses is difficult for private companies at present, a PPP business model in which the state or national government introduces the EV buses and private operators operate them is considered appropriate

Table 2-4 ：Results of the Hearing (Only items related to public transportation other than those listed inTable2-2)

Issue Classification	Issue Details	Countermeasure program (plan)
Operational /Software	Need to widen stop spaces and roads.	Need to work with various stakeholders, including with national and state governments.

(3) Case study of urban tour bus operation in Palau

Belau Tour, a local tour company, has experience in providing bus service around the city for tourists before COVID-19 was rolled out. The following is a description of the service.

Figure 2-1 : Flyer for the bus tour around the city issued by Berau Tour

Table 2-5 : Overview of the Koror State city tour bus operated by Berau Tour

Item	Contents
Travel route	Two routes starting and ending at the main hotels (PPR/PRR) on the other two islands, each centered in the city center of Koror.
Fare	8 USD (unlimited rides for 1 week)
Operating time	5:00 p.m. to 10:30 p.m. (Time slots to meet the demand of tourists who go to the sea during the day and go to the city center in the evening)
Issues in operation	Traffic congestion on Main Street disrupted the schedule.
Operational innovations	Including bus ticket prices in tours offered by major Japanese travel agencies helped stabilize revenues.

Although the bus service is currently suspended due to a decline in the number of tourists, the company is considering resuming the service when tourist demand recovers, at which time it may be possible to switch from the conventional diesel buses to EV buses. However, as a private company, the initial investment in EV buses would be a heavy burden, so Berau Tour's operational know-how should be used as the basis for consideration.

(4) Case study of Public Transit bus operation in Palau

As mentioned above, the Palau national government operates a microbus service for government employees residing in Koror for a one-way fare of US$1 between the Palau Satellite Office in Koror and the capital city of Melekeok, a distance of about 30 km (about 40 minutes by car) (Figure 2-2)。The service is reportedly well utilized, partly due to the attractive price, and is used not only by government employees but also by students and other visitors.

In addition, students in Koror use school buses to commute to school, and we have confirmed that many school buses actually travel through the state in the morning and evening.(Figure 2-3) EV buses are expected to be used to replace these school buses. However, the Ministry of Education (MOE), not the state, has jurisdiction. Therefore, coordination and consultation with the national government is necessary.

(Map Source：Google Map)

Figure 2-2：Location of Koror and its capital, Melekeok

Figure 2-3：School buses running in the province of Koror

(5) Collaboration with JICA's Public Transportation Master Planning Project

In order to strengthen and expand cooperation between the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Republic of Palau Ministry of Public Infrastructure and Industries(MPII) and Ministry of Human Resources, Culture, Tourism & Development(MRCTD) in the areas of transportation and tourism, and to achieve sustainable and resilient economic development in Palau, a Memorandum of Understanding was signed on September 8, 2022, on the occasion of the visit of President Whipps of Palau to Japan. JICA is also planning to collaborate on this matter to develop public transportation in Palau.

Based on these backgrounds, JICA is to develop a master plan for public transportation in response to a request from the Government of Palau. In preparation for this, the "Detailed Planning Study for the Master Planning Project for the Introduction of an Environmentally Friendly Transportation System in Palau" was launched, and the study has already been completed.

Although our project was based on the premise of passenger buses for the tourism sector, we have also exchanged views with JICA headquarters and local JICAs, as the introduction of EV buses as public transportation should also be considered from a more integrated perspective in terms of demand.

In February 2023, a public call was launched for the "Palau Environmentally Friendly Transportation System Development Project". The project plans to conduct a test demonstration of public transportation, including a demonstration of EV bus operation. A possible route for EV buses is between Koror and Babeldaob Island, or a route that goes around Babeldaob Island (about 78 km)(Figure 2-4) We need to have further discussions with JICA headquarters (Social Infrastructure Department) and the local

JICA regarding collaboration between our project and JICA's project.

(Map Source：Google Map)

Figure 2-4：Image of the driving route for a round trip around Babeldaob Island

2.3 Introduction and operation model under consideration

This section summarizes the results of a feasibility study of an EV bus operation model for tourism and public transportation.

2.3.1 Details of Introduced Technology under consideration

The buses to be considered are the models shown in Figure 2-5, and Table2-6. See

Items	Contents
Model	F8 siries4-mini BUS
Size	Overall length: 6,990 mm Overall width: 2,100 mm Overall height: 3,050mm
Number of seats	14 seats (including driver), 30 people
Battery capacity	114kWh
Cruising range	230km
Other features	Adoption of lightweight EV chassis frame Can also be used as a large-capacity battery in the event of a disaster Flexible solar panels can be installed on the ceiling as an option

Table 2-7 below for chargers.

Figure 2-5 : EV bus and charging system to be considered for introduction

Table 2-6 : Specifications and features of EV buses to be considered for introduction

Items	Contents
Model	F8 siries4-mini BUS
Size	Overall length: 6,990 mm Overall width: 2,100 mm Overall height: 3,050mm
Number of seats	14 seats (including driver), 30 people
Battery capacity	114kWh
Cruising range	230km
Other features	Adoption of lightweight EV chassis frame Can also be used as a large-capacity battery in the event of a disaster Flexible solar panels can be installed on the ceiling as an option

Table 2-7 : Specifications and features of charger to be considered for introduction

Items	Contents
Model	ENC-DCB100-BJ
Maximum output	100kW
Charging standard	Compatible with CHAdeMO ver2.0
Other features	IP54 waterproof

The bus to be introduced is a model equipped with a 114 kWh battery and has a maximum continuous range of 230 km. This distance is enough to connect the airport to the center of Koror, as well as between Koror and Melekeok, and around the island of Babeldaob. The electricity used to charge the batteries will be entirely from renewable energy sources to promote decarbonization. The capacity of the solar power generation system required to charge the batteries is set at 50 kW, and the storage batteries at 288 kWh. (Reused batteries are utilized.)

2.3.2 Introduction and Operation Model under consideration

＜Tourism sector＞

As in the previous study, the base of the tourist EV bus is currently set at Palau International Airport. In this estimation, it is assumed that the buses will travel two routes, Route A from Palau International Airport to PPR and Route B to Icebox Park. See Figure 2-6 below for the routes.

(Map Source：Google Map)

Figure 2-6：Planned driving routes in the Tourism sector

●Planned driving routes

Route A (Palau International Airport～Palau Pacific Resort / 14.6km)

Route B (Palau International Airport～Icebox Park / 13.1km)

＜Fare＞

Based on the results of the interviews, the EV bus was considered as an alternative to the current hotel pick-up service provided by tour companies. The fare would be approximately $40 round-trip ($20 one-way), the same amount as the current cost of hotel pick-up service and cab transportation. The number of users was estimated based on the assumption that 2.5% of local tourists (122,000 in 2017 x 2.5% = 3,050) would use the bus.

Figure 2-7：Battery container unit

The storage batteries were studied in a model that utilizes a mobile storage battery container unit and reused batteries. The use of reused batteries will increase battery capacity while reducing costs. The challenge is that solar power generation capacity needs to be increased and batteries are in short supply around the world. (Figure 2-7)

＜Public Transportation＞

The study was based on an operational route from Koror Province to Melekeok.(Figure 2-4) Since we have information that the route is almost full at a price of $1 each way, we assumed that 20 passengers per way x 2 round trips for a total of 80 passengers per day, and that $80 revenue is generated 5 times a week.

(Map Source：Google Map)

Figure 2-8：Location of Koror and its capital, Melekeok

An operational model that balances the needs of the tourism sector and the public

transportation needs of local residents is needed to make efficient use of EV buses. A model in which EV buses are used as public transportation during the daytime and operated by tour companies as shuttle buses for tourists during the nighttime would be appropriate.(Figure 2-9) In this case, it is assumed that recharging would be conducted in between intervals.

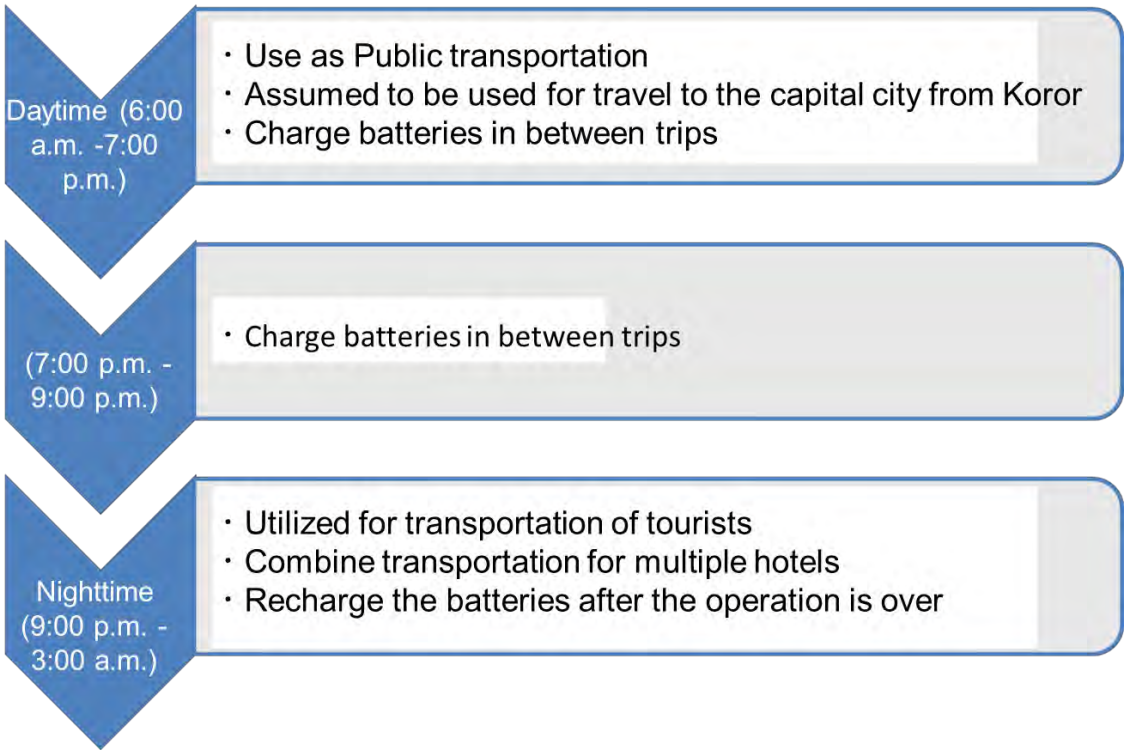


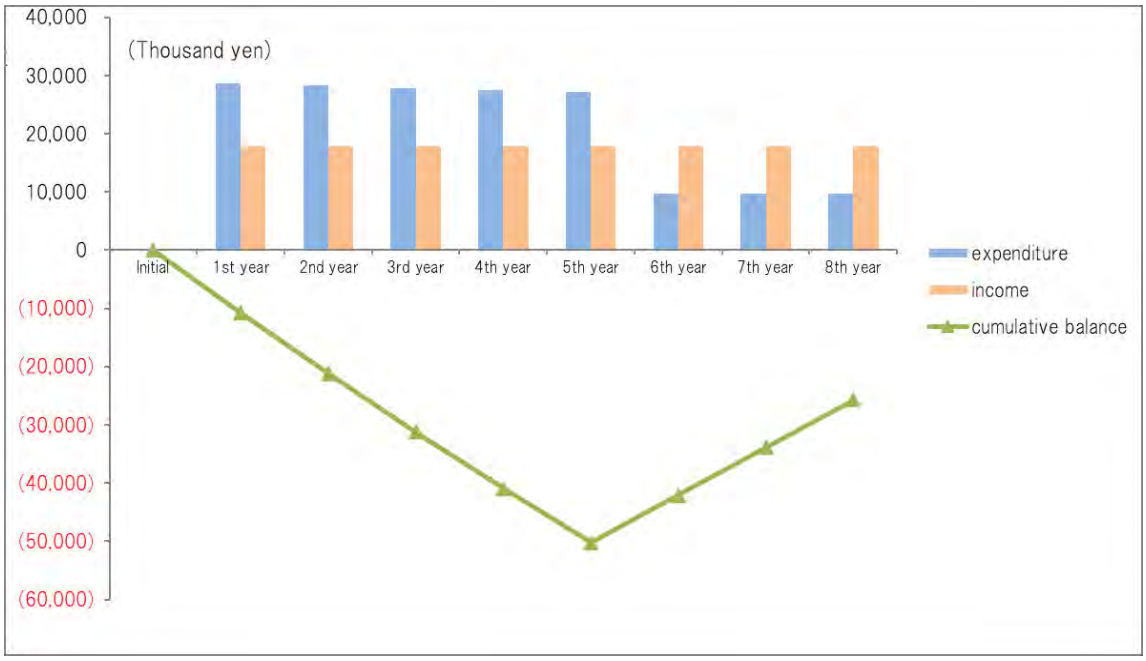
Figure 2-9：Proposed operational model to be compatible in the Tourism and Public transportation sectors

2.3.3 Consideration of Profitability

The profitability of the project was evaluated for a case in which one EV bus, a battery charger, solar panels (including a power conditioner), and storage batteries are installed under the conditions described in 2.3.1 to 2.3.2. The initial cost was evaluated in the case of 100% self-payment and in the case of 50% subsidy. Other conditions for the calculations are as follows.

＜Common conditions for estimation＞
・Vehicle and equipment costs
(85 million yen/ Including various equipment, tariffs, engineering costs, training costs, etc)
・Revenue from tourists and public transportation (18 million yen per year)

・Borrowing period is 5 years
・Equipment transportation costs are not included
・Maintenance cost (5% of equipment cost is allocated annually)
・Driver expenses are recorded
・Transportation service fees from hotels are not recorded
・Reserve of about 5 million yen is set aside each year as a reserve for equipment renewal.



＜ No subsidy; 100% self-funded projects to be implemented＞

Figure 2-10：No subsidy; 100% self-funded projects to be implemented

In this case, the operator became profitable in a single year from the sixth year after the borrowing was completed, but was not able to achieve profitability in the cumulative total until the tenth year. Since the initial cost repayment burden is relatively high for the operator, measures to reduce it are considered necessary. Since the capacity of the storage batteries is sufficient to charge two buses, the cost of the facilities can be reduced by introducing multiple EV buses and using one charger to charge the batteries every other day.

＜Subsidy equivalent to 50% of equipment cost＞

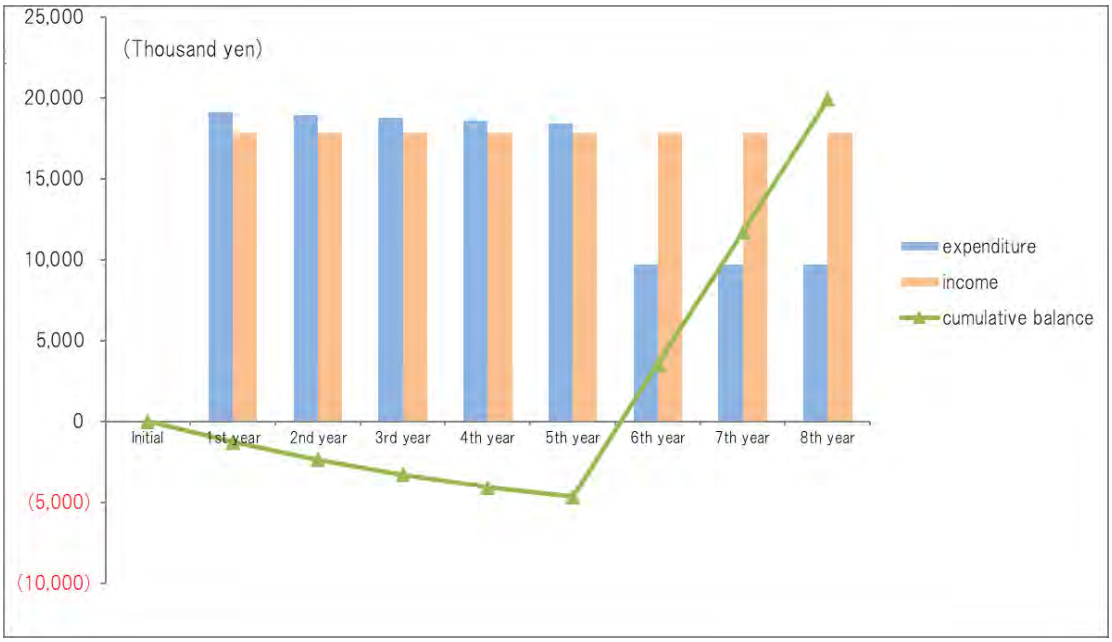


Figure 2-11：Subsidy equivalent to 50% of equipment cost

In this case, the project was able to turn a profit in the first year. In order for this model to work, it is important for the operator to generate the income as expected, and the acquisition of subsidies is shown to contribute significantly to profitability.

2.3.4 CO_2 reduction effect

We referred to J-Credit System Methodology EN-S-012 Ver3.2 “Introduction of Electric Vehicles or Plug-in Hybrid Vehicles” for the effect of reducing greenhouse gas emissions associated with the conversion of tourism buses to EVs.

$$ER = EM_{BL} - EM_{PJ}$$

Table 2-8 ：Concept of emission reduction

Sign	Definition	Unit
ER	Emission reduction	tCO_2/year
EM_{BL}	Baseline emissions	tCO_2/year
EM_{PJ}	Post project Emissions	tCO_2/year

Since this project is the introduction of electric vehicles, baseline emissions will be emissions from the use of fossil fuels associated with the use of (conventional) vehicles, and post-project emissions will be emissions from the use of electricity from the use of electric vehicles. The emission factor for electricity is considered as zero as renewable energy is used.

Post-project emissions are calculated by the following formula.

$$EM_{PJ} = EL_{PJ} \times CEF_{electricity.t}$$

Table 2-9 ：Calculation of project emissions

Sign	Definition	Unit
EM_{PJ}	Project Emissions	tCO_2/year
EL_{PJ}	Electricity consumption in electric vehicles project	kWh/year
$CEF_{electricity.t}$	CO_2 emission factor of electric power	tCO_2/kWh

Baseline emissions are organized according to the following concept.

$$D_{BL} = D_{PJ}$$

$$D_{PJ} = EL_{PJ} \times BU_{PJ}$$

Table 2-10 ：Concept of baseline emission reduction

Sign	Definition	Unit
D_{BL}	Baseline car mileage	km/year
D_{PJ}	Post project car mileage	km/year
EL_{PJ}	Post project electricity consumption in electric vehicles	kWh/year
BU_{PJ}	Post project energy consumption efficiency electricity of electric vehicles	km/kWh

The calculation of baseline emissions is carried out based on the following concept.

$$EM_{BL} = D_{BL} \times 1 \div BU_{BL} \times HV_{BL,fuel} \times CEF_{BL,fuel}$$

Table 2-11 ：Calculation of baseline emissions

Sign	Definition	Unit
EM_{BL}	Baseline emissions	tCO_2/year
D_{BL}	Baseline car mileage	km/year
BU_{BL}	Baseline energy consumption efficiency of fossil fuel vehicles	km/kL etc.
$HV_{BL,fuel}$	Unit calorific value of fuel used in baseline automobiles	GJ/kL etc.
$CEF_{BL,fuel}$	CO_2 emission factor per unit calorific value of fuel used in baseline automobiles	tCO_2/GJ

Based on these assumptions, the CO2 reduction effect of EV bus driving when the annual mileage is about 46,000 km is as follows.

Table 2-12 ： CO_2reduction amount by introducing EV bus

Number of EV buses introduced	Expected CO_2 reduction
1bus	26.37t-CO_2/year
10 buses	264t-CO_2/year
30 buses	791t-CO_2/year

If the number of buses increases and economies of scale can be achieved in terms of price, the unit price per bus is expected to decrease, and the cost-effectiveness of CO2 emission reduction per ton in applying for JCM facility subsidies is also expected to improve. Chargers, solar panels, and storage batteries can also be operated more efficiently (e.g., one charger can be used alternately by two buses) if the number of buses increases. A model with multiple EV buses would be appropriate for creating cost-effectiveness in GHG reduction.

2.3.5 Monitoring method

Regarding the methodology used to calculate the amount of reduction in certification due to the conversion of vehicles to EV, the "Promotion of Electric Vehicle Use for Taxi in Costa Rica (2014 JCM F / S)" project and the methodology in the J-credit system in Japan " Refer to "EN-S-012 Ver.3.2 Introduction of electric vehicles or plug-in hybrid vehicles.

The target is project activities that introduce EV vehicles and replace ICE vehicles (internal combustion engine vehicles). The general monitoring parameters are shown in Table 2-13 below.

Table 2-13 ：Monitoring items

Items	Unit
Car mileage	km
Energy consumption efficiency electricity of electric vehicles	km/kWh
Power consumption for driving	kWh
Energy consumption efficiency of fossil fuel vehicles	km/L

In this project, it is assumed that the EV vehicles will be powered by renewable energy sources, but it is possible that backup power from the local grid could be used in the event of capacity shortages due to solar or power system failure or continued bad weather, etc. Therefore, when evaluating the reduction of GHG emissions, it is necessary to know where the charged power is generated from (grid power or renewable energy). In this regard, it is assumed that vehicle ID management and recharge data from storage batteries will be recorded and managed using data loggers, etc.

2.3.6 Study of project implementation scheme

The project implementation structure has received favorable comments from the Ministry of Public Infrastructure, Industry and Commerce (MPIIC), which has been in line with national policies for the past several years. PIAC has also expressed interest in some kind of collaboration with the project from the perspective of adding value to the airport and the country's tourism industry. It is necessary to study the implementation structure of this project, including the possibility of developing it as a public transportation system. In addition, as mentioned above, Palau will be updating its master transportation plan, and the State of Koror has expressed a desire to promote decarbonization from the transportation sector. Therefore, both the state and the country are expecting a shift to mobility, including EVs, in the transportation sector. Figure 2-12 below shows the scheme if the project were to apply for the JCM equipment subsidy program.

However, under the current economic situation in Palau, where tourism income is declining, private companies may be able to operate in Palau if capital investment is provided by public organizations through ODA, etc., and minimum sales guarantees and land use rights are granted in the form of PPPs. We believe that it is necessary to create a scheme involving the government. From this perspective, it is important to collaborate with the " Palau Environmentally Friendly Transportation System Development Project " that is being considered by JICA.

Because the global pandemic of COVID-19 caused the start of travel to Palau to begin in late fall, there are still issues in this regard in developing an implementation system and building communication with stakeholders. In the next year, we would like to discuss a specific implementation structure with interested parties. Figure 2-12 shows the structure that is currently envisioned. It is necessary to further develop the structure by deepening relationships with local hotels and other organizations.

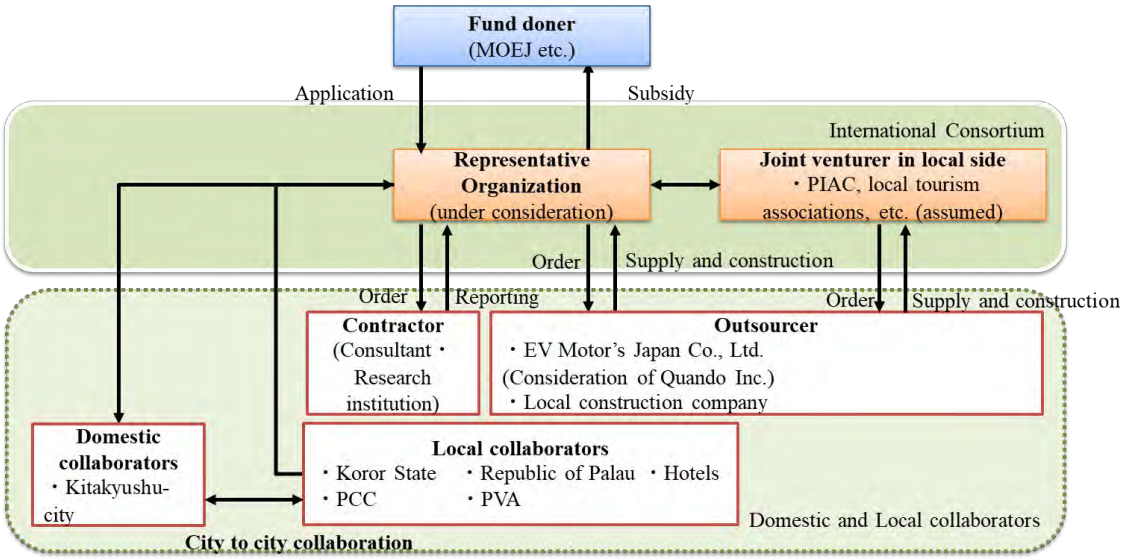


Figure 2-12：Image of International Consortium

2.4 Maintenance scheme and utilization system

All stakeholders have been commented Maintenance is the biggest issues. Maintenance issues exist in both the securing parts and human resources aspects. The issues of securing parts are mainly related to the cost of maintaining spare parts, etc., while the issues of human resources are related to the training of maintenance personnel, etc.

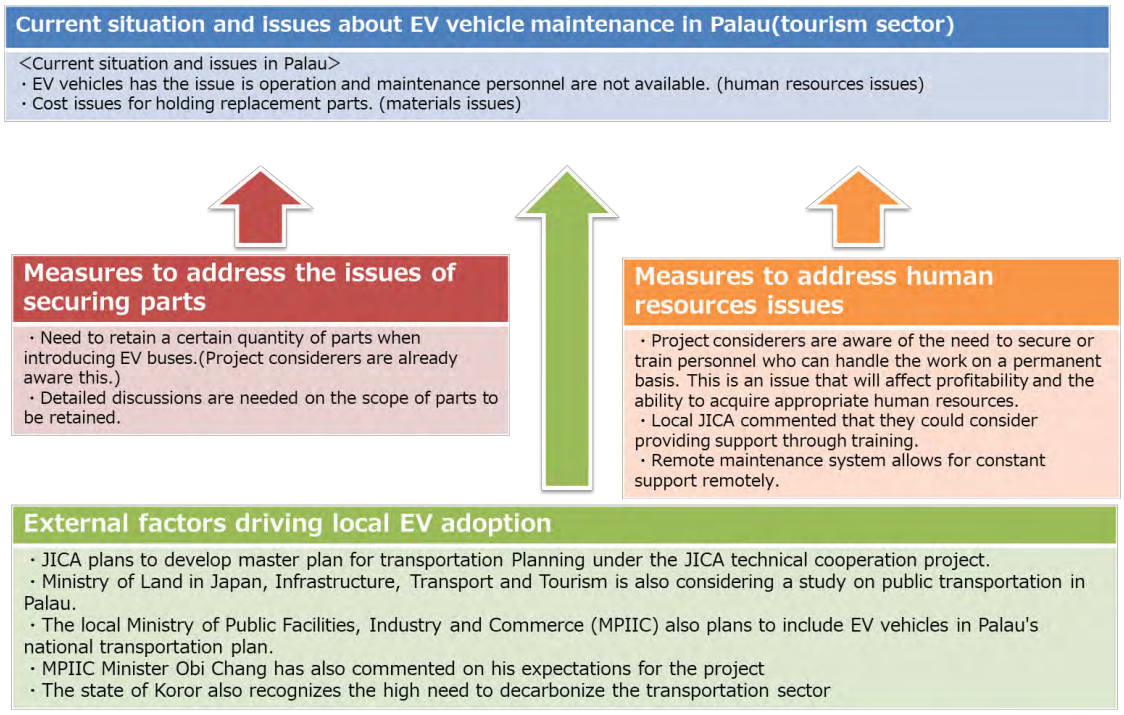


Figure 2-13：Maintenance issues and proposed measures

Project considerers are aware of the need to retain a certain quantity of parts when introducing EV vehicles. They are also aware of need detailed discussions on the scope of parts to be retained. In most cases, the majority of parts for internal combustion engine vehicles can be secured on the island. Therefore, there is a high possibility that parts used for both internal combustion engine vehicles and EVs will be available locally.

Project considerers are aware of the need to secure or train personnel who can handle the maintenance work on a permanent basis. This is an important issue that will affect profitability and the ability to acquire appropriate human resources. In any case, human resource development is also necessary, and JICA has commented that support for training sessions can be considered in this regard. In addition, it is considered necessary to take various measures, such as providing online support by utilizing "SynQ Remote" provided by Quando Inc. within our survey team.

SynQ Remote is a remote work tool that allows remote workers to communicate as if they were in the field, even when they are in a remote location such as an office or home.

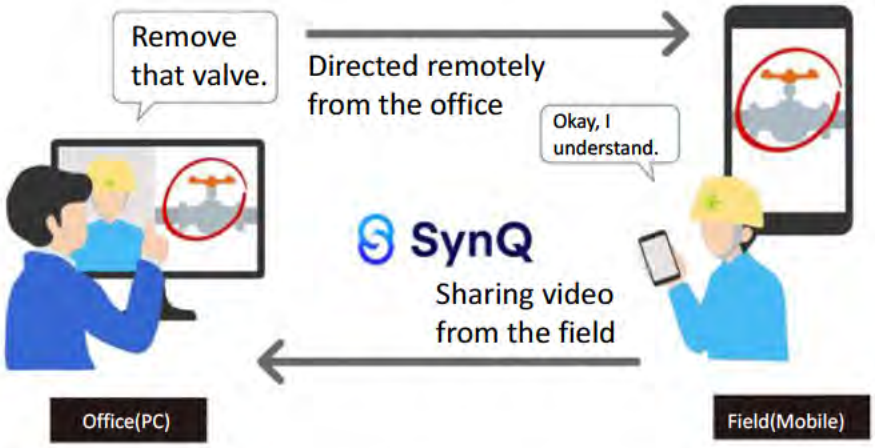


Figure 2-14：Conceptual diagram of remote maintenance tool

During this field survey, the remote maintenance system "SynQ" was connected and tested for use. The results are described below

＜Test Overview＞

Item	Details
Date	February 6, 2023 (Monday)
Place	Central Koror and the Aimeliik Final Landfill
Methods	With Wi-Fi connected, the test was conducted to determine the availability of calls, conversations, and various functions (screenshots, writing on photos, transcription of voice, etc.).

Figure 2-15：テスト実施場所

The use of the system in the center of Koror was not a problem. The final landfill in Aimeliik

was usable, but the local Wi-Fi made the communication speed problematic, causing audio and images to be delayed and choppy. The communication speed in the center of the state was approximately 20Mbps, so there was no problem, but in the state of Imerik, only 8-12Mbps could be secured, which is believed to have caused the delay. It was confirmed that the system could be used without any problems as long as the local Internet environment could be secured.

EVM is also planning to introduce a system that allows data transmission from the Internet on faulty locations, etc., and by combining this with human resource development, software issues related to maintenance can be addressed.

Figure 2-16：Conducting a connection test in the center of Koror Province

2.5 Consideration of financing methods

Regarding funding, Minister Obi-chang, the MPIIC, mentioned the possibility of public-private partnerships depending on the business model, but the reality is that it is difficult to generate funds in the Republic of Palau, where the tourism industry, which is the core industry, has been hit hard.

Therefore, securing subsidies or other means to reduce initial costs is considered essential. Specifically, we are considering applying for the JCM equipment subsidy program, but the amount of GHG reduction per EV vehicle is inevitably limited. For example, while utilizing the JCM equipment subsidy project for solar power generation equipment and storage batteries, it is necessary to consider a multifaceted support scheme for EV buses, such as utilizing JICA and ADB funds from the aspects of infrastructure development and corona recovery, and this study should be continued. Among them, we believe that it is necessary to actively promote collaboration with the demonstration project under JICA's " Palau Environmentally Friendly Transportation System Development Project " in order to provide an opportunity to expand EVs in Palau in the future.

In addition, for financing, collaboration with leasing companies is also expected. There have been an increasing number of tie-ups with leasing companies in recent years, where

the Japanese representative and the local company are affiliated, and leasing companies have commented that such projects are relatively easy for them to work on. In Palau, where it is difficult to raise initial costs, the introduction of such a system should be considered.

2.6 Consideration of Project Implementation Schedule

Based on the results of this year's survey, the project implementation schedule for the Tourism EV Project is envisioned in Table 2-14 below.

Table 2-14 ：Examination of future project implementation schedule

Items	FY 2023		FY 2024		FY 2025	
	1st half	2nd half	1st half	2nd half	1st half	2nd half
Examination and construction of project implementation system						
Scrutiny of cost / introduction model						
Examination for acquisition of various subsidies						
Support application such as JCM equipment assistance						
Examination and construction of project implementation system						

The study of the tourism sector will depend largely on the spread of COVID-19 and the recovery of tourism demand, but the goal is to obtain the subsidy program in the next fiscal year or in 2024.

2.7 Summary / Issues to overcome in the future

The following is a summary of the survey for the introduction of tourist EV vehicles and future issues.

＜Summary＞

- We have been studying a model for shuttle bus service from the airport to the hotels
- Domestic tourism demand has declined dramatically due to COVID-19, and it will take a few more years before it recovers to the same scale as before the COVID-19 expansion.
- Since transportation by hotels and local tour operators is already in place, the respondents expressed that it would be tough to find a way other than updating the existing buses to EV buses.
- Based on the above, it is difficult to commercialize the project only in the tourism sector, and it is necessary to design a model that takes into account the linkage with

public transportation.

- When receiving equipment subsidies, it is necessary to consider applying to different fund donors for solar power generation, storage batteries, and EV buses, considering for effective operation
- Since storage batteries are a cost-increasing factor, cost reduction and higher capacity can be achieved by utilizing reused batteries.
- It is expected to be linked to the transportation policy (master plan) by JICA's upcoming "Palau Environmentally Friendly Transportation System Development Project".
- It is important to continue to work with international airports and resolve issues one by one toward implementation.
- The most efficient form would be to receive buses through ODA or other means and have local tour companies or other entities implement and operate the buses as part of a PPP initiative.

＜Issues to overcome in the future＞

- Ongoing review of initial costs
- Strengthening collaboration with JICA's "Palau Country Environmentally Conscious Transportation System Development Project".
- Tourism, a core industry, has been hit hard economically by COVID-19 and needs to secure a support menu
- Optimal subsidy models and financing schemes, including leases
- Consideration of operators for bus operations, also taking into account PPP format

3 Project Formation Feasibility Study (Study on Promotion of EVs for Waste collection and Transportation)

3.1 Understanding local issues and needs

3.1.1 Identifying local stakeholders

Table 3-1 below summarizes the organizations that are assumed to be interested parties in this study. Interviews were conducted with these interested parties regarding local needs and the possibility of collaboration for this project.

Table 3-1 ：Assumed Stakeholders (Waste Sector)

Organization name	Abbreviation	Overview explanation
Solid Waste Management Division, Public works Department, Koror State Government	—	It belongs to the state's Public Works Department and is responsible for Koror's recycling projects, waste collection and transportation, waste research, composting and education programs and material recovery.
Solid Waste Management Office	SWMO	An organization that aims to reduce landfill waste generated in Koror through the 3Rs and resource recovery. It consists of the Bureau of Public Services System and Ministry of Health of Palau, the Environmental Quality Protection Commission, and the State Solid Waste Management Division.
Ministry of Public Infrastructure, Industries & Commerce	MPIIC	Palau government ministries. Palau government ministries. It consists of six departments: Bureau of Aviation, Bureau of Public Works, Bureau of Land and Survey, Bureau of Commercial Development, Small Business Development Center, and Palau Energy Office.
Asian Development Bank	ADB	An international development finance institution established to foster economic growth and economic cooperation in Asia and the Pacific and to contribute to the economic development of developing member countries. A study on a project to establish a comprehensive resource-recycling society in Koror State is planned.

3.1.2 Preliminary study project "Resource segregation type transshipment storage facility" and its progress

(1) Project background and outline

In Palau, the resident population, corporate offices, hotels and stores are concentrated in Koror, and its high environmental load has been an issue for Koror. SWMO has been planning and developing a recycling center that contributes to the collection and recycling of specified waste in collaboration with AMITA CORPORATION, which is a member of this business implementation system, in order to reduce the environmental burden Since 2014. (Table 3-2)。

Table 3-2 ：Past collaboration and survey results between Koror and AMITA CORPORATION

Year	Phase	Activity
2014-15	Basic survey	Waste composition survey Demonstration of waste separate collection
2015-16	MOEJ project of Promoting Overseas Expansion Commercialization	F/S for Business plan Demonstration of liquid fertilizer Partnership agreement signed
2016-17	MOEJ project of Promoting Overseas Expansion Commercialization	Specification design of biogas plant
2017-18	JICA Knowledge co-creation program (private partnership) under the SDGs business model formulation survey (Feasibility survey)	F/S for small biogas plant Specification design of plant
2019-20	MOEJ project of Promoting Overseas Expansion Commercialization	F/S for resource-separated transshipment storage facility

Koror State and AMITA CORPORATION will use a public-private partnership (PPP) to consider the construction of a "storage facility", where is separate and sort waste using the site of the M-Dock. The relocation spot of final disposal site is the Aimeliik (located in northside in Palau)。 The reason for this consideration is that the new final disposal site in Aimeliik will be far away (about 15 km from the M-Dock) and will incur tipping fee, so it will be efficient in the state to reduce the amount of landfill waste through the implementation of waste disposal and the expansion of recycled items and quantities. Furthermore, the goal of this project is not limited to waste recycling, but ultimately it is a project that aims to create a wide range of value such as agricultural development, creation of tourism industry (green tourism), zero emission management by renewable energy.(Figure 3-1)

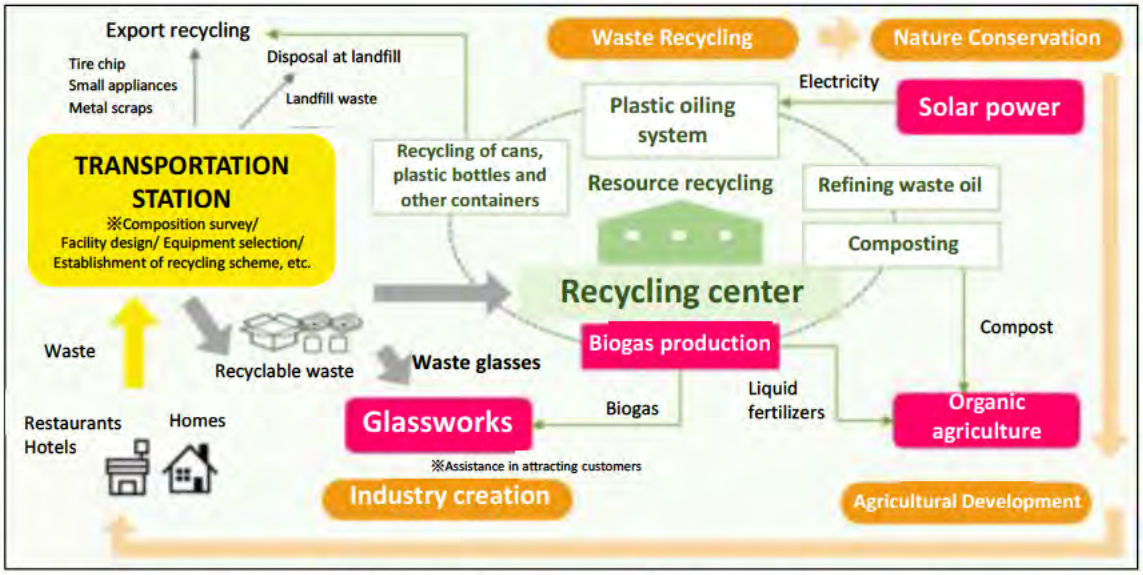


Figure 3-1 : Concept for resource circular recycling model

From an energy point of view, there are several projects.

1) Self-use of power generated from plastic oiling,

2) Self-use of power generated by the introduction of solar power generation

3) Generated gas from a biogas refining facility is used for tourists in glass workshop

The glass workshop uses waste glass that has been sorted and separated, and has been successful in attracting tourists. For 1) of these, equipment has already been installed and is in the process of being prepared for full-scale operation.

Figure 3-2 : Facility of Plastic oiling

(2) Transportation station project progress

The recycling center is already in stable operation as an initiative unique to Koror, and all but the methane fermentation facility and the solid fuel conversion/gasification facility have already been installed. The glass workshop has been demonstrated in a test workshop, and construction of the main operational facility was completed in July 2020.

Figure 3-3：Glass workshop

However, due to the serious economic impact of Covid-19 (due to the fact that about 50% of GDP depends on the tourism industry), PPP's consideration of " Transportation station " is pending.

It is expected to resume with the convergence of Covid-19 and the resurgence of tourists.

3.1.3 Positioning of this EV introduction survey in the Koror State Policy Plan

The state of Koror has been considering the ideal way of " Transportation station " to promote resource recycling in the state, triggered by the consideration of "resource-separated transshipment storage facility" by PPP with AMITA CORPORATION. (Figure 3-4) The study project for the introduction of the EV waste collection and transportation vehicle is also being positively consideration in this whole project.

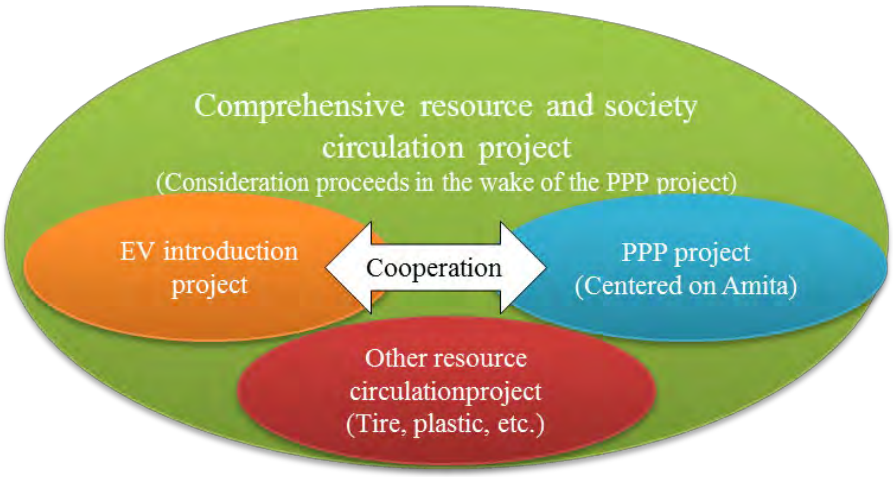


Figure 3-4：Relationship of each project in Koror State

The Asian Development Bank (ADB) is currently scheduled to conduct a feasibility study on this project as a PPP project, which will include the EV project for the waste collection and transportation vehicles.

3.1.4 Local needs, possible schemes, and issues for conversion to EV

The following is a summary of the results of interviews with Mr. Selby (Recycling Center Manager) and Mr. Fuji (Solid waste management office Consultant) regarding their impressions of the project concept and local needs for waste vehicles, EV vehicles, and specifications for charging facilities.

(1) Understanding of the business concept

1) Reduce reliance on fossil fuels and reduce fuel costs when renewable energy is the source of charging.

2) Improving the image of environmental consideration in the waste management department and building a zero-carbon society.

3) There are three points that contribute to the achievement of the SDGs in terms of waste management.

While these merits will lead to the creation of a clean and safe environment for the state, the following are the issues for introduction.

1) High initial cost burden required for acquisition and installation of equipment to maintain the operation of EV vehicles

2) Concerns about maintaining the durability and safety of vehicles and charging stations

3) Establishing a maintenance system in case of emergency.

The Solid Waste Management Office has commented that it will be the lead agency for this project and will install, operate, and maintain the vehicles and equipment.

(2) Specifications of waste transportation vehicles, EV and charging equipment

The points when procuring a waste collection and transportation vehicle are as follows.

1) Economic efficiency of vehicles and systems
2) Loadable capacity
3) Resistance to salt damage

The points when procuring EV waste collection and transportation vehicles are as follows.

1) Battery capacity
2) Battery durability and service life
3) Battery control and safety (control against overheating)
4) Convenience of quick charging
5) Vehicle load capacity and salt damage countermeasures

(3) Assumptions for Procurement of Electricity and Location of Charging Facilities and Photovoltaic Power Generation

The current plan for the transportation station calls for approximately 150 kW (250 W/sheet x 600 panels) of solar panels to be installed on the roof of the facility and on adjacent land (Red frame in Figure 3-5) to provide part of the power source for facility operations. The existing biofuel generator (220 kVA) can also be used to supply power, and it is assumed that these renewable energies will be used to power the EV waste collection and transportation vehicles. The installed capacity of solar panels is currently under review by ADB, and further capacity increase is expected due to the high potential for facility expansion (Black box in Figure 3-5)

In addition, the area framed in yellow plus black in Figure 3-5 is planned to be a parking lot for about 20 large vehicles. The state is considering installing photovoltaic panels on the roof of this building as well as a charging space for EV vehicles.

Figure 3-5：Planned solar panel installation at a resource separation and Transshipment storage facility

(4) Status of vehicle maintenance and maintenance when EVs are introduced

As noted above, we have received comments that SWMO expects to perform maintenance on EV vehicles as well.

Regarding the current maintenance system for internal combustion engine vehicles, SWMO has a full-time mechanic who oversees the regular maintenance of existing refuse collection vehicles and other vehicles under its jurisdiction, and currently handles minor breakdowns with no problems. When major repairs are required, inspections and repairs are carried out at vehicle maintenance stores in Koror.

The state does not keep vehicle parts in stock, and if parts cannot be procured domestically, the state can arrange for the necessary parts within two weeks, depending on the urgency, based on supply contracts with local, Japanese, and U.S. manufacturers and maintenance companies.

They recognize the need to train personnel first when introducing EV vehicles, as well as the need to stock a certain number of parts depending on the frequency and importance of replacement.

3.2 Consideration for introduction and operation model

In this section, technologies for introducing EV vehicles for waste collection and transportation will be studied, and cost estimates will be made to understand issues to be

addressed in further studies in the future.

3.2.1 Contents of introduced technology

The waste collection and transportation vehicles to be considered are the models shown in Figure 3-6 and Table 3-3. See

Table 3-4 for chargers.

Figure 3-6 : EV waste transportation vehicle and charging system to be considered for introduction

Table 3-3 : Specifications and features of EV waste transportation vehicle to be considered for introduction

Items	Contents
Model	pure electric compression type garbage truck
Size	Overall length: 6,795mm Overall width: 2,100 mm Overall height: 2,400mm
Vehicle total weight	8,280kg
Load capacity	1,995kg
Battery capacity	110kWh
Cruising range	Less than 180km
Other features	Compression method: Press type
Items	Contents
Model	Semi-trailer type vehicle
Size	Under detailed investigation
Vehicle total weight	18,000 kg
Load capacity	12,000 kg
Battery capacity	Under detailed investigation
Cruising range	200km
Other features	Compression method: under detailed investigation

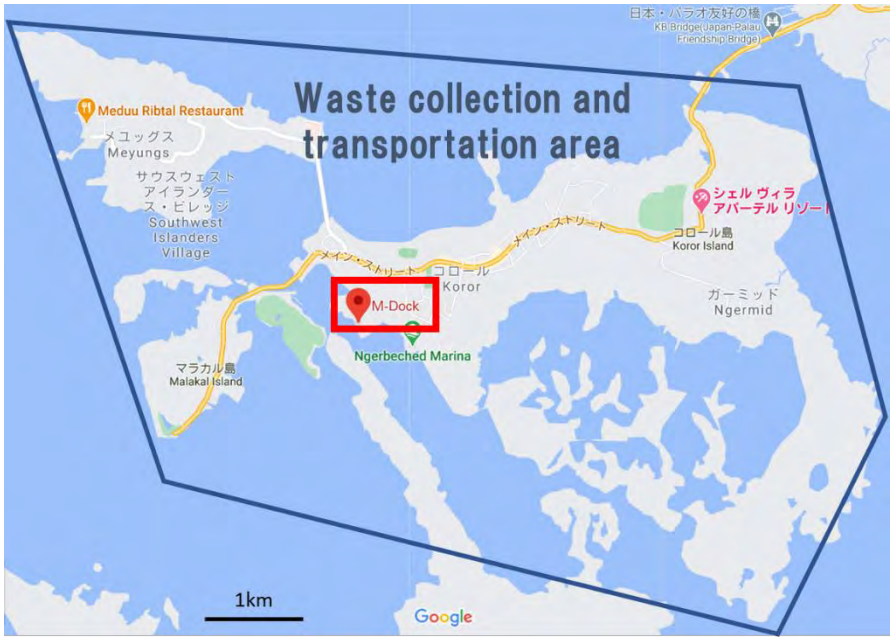
Table 3-4 ：Specifications and features of charger to be considered for introduction

Model	ENC-DCB100-BJ
Maximum output	100kW
Charging standard	Compatible with CHAdeMO ver2.0
Other features	IP54 waterproof
Model	ENC-DCB100-BJ

We are considering introducing two types of waste collection and transportation EVs: one is a packer truck model with a 110 kWh battery and a continuous driving range of less than 180 km. The other is a semi-trailer type vehicle with a continuous driving range of about 200 km. All electricity used will be from renewable energy sources stored in storage batteries, with the aim of promoting decarbonization. The solar power generation system required to charge these batteries has a capacity of 50 kW, and the storage batteries have a capacity of 288 kWh. As for the storage batteries, the project envisions the use of container units that accumulate reused batteries, as is the case with the tourism EV vehicles.

3.2.2 Introduction and Operation Model

The State of Koror has requested the following two transportation routes using EV vehicles: 1) collection and transportation of waste within the State of Koror(Figure 3-7) and 2) transportation to the new final disposal site in Aimeliik(Figure 3-8) The Koror State is considering using a semi-trailer type vehicle for 2), as it wishes to transport as much waste as possible in one vehicle and has requested a larger vehicle In addition, the Koror State Solid Waste Management Office has expressed a need to convert all four of its packer trucks to EV vehicles. In this regard, it was confirmed with the Koror State that one charger may be insufficient and that it is necessary to consider using two chargers in order to reduce the risk of breakdowns..



(地図データ出所：Google Map)

Figure 3-7：Waste collection and transportation area for EV vehicles to be considered for introduction

(地図データ出所：Google Map)

Figure 3-8：Waste Collection and Transportation EV's waste hauling route to the Aimeliik Landfill.

Figure 3-9：Aimeliik Landfill.

3.2.3 Project Feasibility

The profitability of the project was evaluated based on the following conditions: one EV waste collection and transportation vehicles (packer trucks), one Semi-trailer type EV , two battery chargers, solar panels (including power conditioners), and storage batteries. The initial cost was evaluated in the case where 50% of the initial cost was subsidized or supported and the rest was borne by the client, and in the case where all of the initial cost was covered by subsidies, etc., and 0% was borne by the client. Other estimation conditions are as follows.

＜Common trial calculation conditions＞
・Vehicle and equipment costs(approx. 100 million JPY/accounted for various equipment, tariffs, engineering & training costs, etc.)
・Installment payments are estimated based on a five-year loan term.
・Equipment transportation costs are not included.
・Maintenance cost (5% of equipment cost is allocated annually)
・Fuel cost reduction contribution is recorded as an income component.
・The company estimates that it will set aside about 4 million yen annually for equipment renewal.

＜Case of 50% subsidy and:50% self-pay project implementation＞

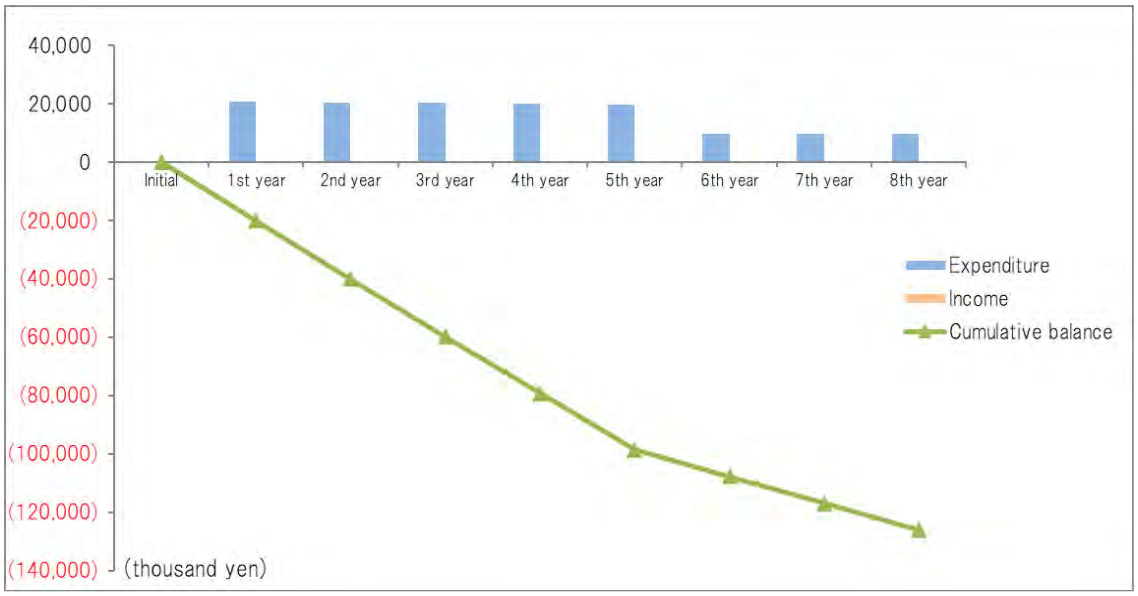


Figure 3-10：50% subsidy for introducing two garbage truck EVs

＜Case of 100% subsidy for initial cost＞

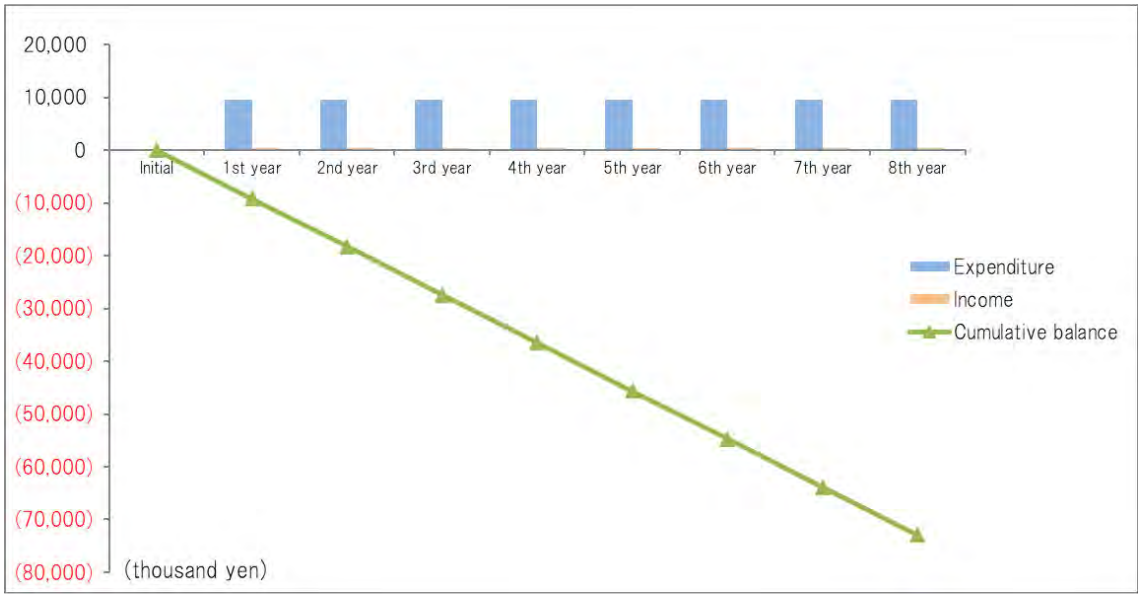


Figure 3-11：100% subsidy for introducing two garbage truck EVs

In each case, the project is a public project, and it is difficult to secure profitability only by reducing energy costs, since EV vehicles are introduced in a non-revenue-generating project. It is clear that this project would be difficult to implement without obtaining subsidies as well as reducing initial costs. (Note that this estimate is positive if 100%

subsidy is received and the accumulation of maintenance and equipment renewal is excluded.)

Further investigation is needed to determine whether the benefits of introducing EV vehicles, including maintenance costs, can be increased. In general, it is said that the use of EV vehicles will reduce maintenance costs, but it remains to be seen to what extent this will be applicable in island areas.

3.2.4 CO_2 reduction effect

We also referred to J Credit System Methodology EN-S-012 Ver3.2 “Introduction of Electric Vehicles or Plug-in Hybrid Vehicles” for the effect of reducing greenhouse gas emissions associated with the conversion of waste transportation vehicles to EV.

Based on the concept of this methodology, the CO2 reduction effect of EV waste collection and transportation vehicle running when the annual mileage is set to about 6,000 km based on the results of hearings in Koror is as follows.

Table 3-5 ：Amount of CO2 reduction when introducing EV waste collection and transportation vehicles

The number of EV waste collection and transportation vehicles introduction	Expected CO_2 reduction
1car	4.35t-CO_2/Year
2cars	8.7t-CO_2/Year

Unlike tourism buses, it is not a profitable business and there are no economies of scale, so it is difficult to secure the cost-effectiveness of reducing CO_2 emissions per t when applying for JCM equipment subsidies.

In this regard, it is considered realistic to receive financial assistance from ODA such as ADB and JICA. On the other hand, this initiative is in line with the effects of co-benefits and the philosophy of building a comprehensive resource-recycling society in the region. Therefore, it is required to design the business from the next fiscal year onward with a view to funding the deposit system and forming various project finance.

The possibility of applying for a JCM equipment subsidy project for only PV power generation or only PV power generation and storage batteries will be discussed in the future. Since it is thought that this will lead to supporting the realization of the above-mentioned projects, we will consider this issue in cooperation with the ADB's investigation.

3.2.5 Monitoring method

Regarding the methodology used to calculate the amount of reduction in certification due to the conversion of vehicles to EV, the "Promotion of Electric Vehicle Use for Taxi in Costa Rica (2014 JCM F / S)" project and the methodology in the J-credit system in Japan " Refer to "EN-S-012 Ver.3.2 Introduction of electric vehicles or plug-in hybrid vehicles".

The target is project activities that introduce EV vehicles and replace ICE vehicles (internal combustion engine vehicles). The general monitoring parameters are shown in T

able 3-6.

T

able 3-6 ：Monitoring items

Items	Unit
Car mileage	km
Energy consumption efficiency electricity of electric vehicles	km/kWh
Power consumption for driving	kWh
Energy consumption efficiency of fossil fuel vehicles	km/L

In this project, it is assumed that the power source for EV vehicles will be a renewable energy power source. However, there is a possibility of using a backup power source from the local grid power when the capacity is insufficient due to a failure of solar power or a power conditioner or unseasonable weather.

Therefore, when conducting a reduction evaluation of greenhouse gas emissions, it is necessary to understand where the charged power is generated (renewable energy or non-renewable energy).

In this regard, it is assumed that vehicle ID management and recharge data from storage batteries will be recorded and managed using data loggers, etc.

3.2.6 Study of project implementation scheme

As for the implementation structure of the project, as mentioned above, the Koror State Waste Management Office has expressed its willingness to positively incorporate the project into the project to establish a resource-recycling society, which is currently under study and consultation by the ADB, so the project can be implemented while reducing the financial burden. It is necessary to consider the implementation structure of this project. The promotion scheme is shown in Figure 3-12 below.

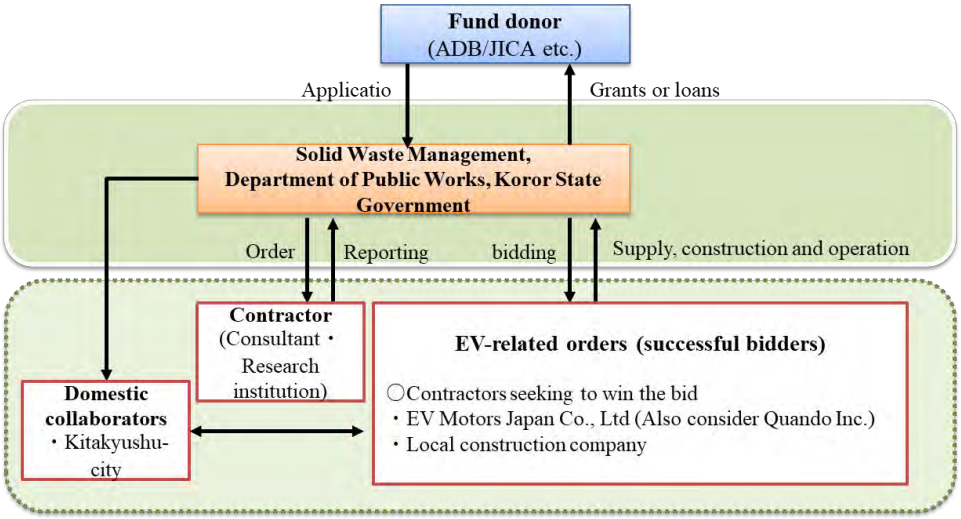


Figure 3-12：実施体制の検討

3.3 Maintenance and utilization scheme

As in the tourism sector, all stakeholders have commented maintenance is a major issue. The issue of maintenance exists in both the parts and human resources aspects, as previously mentioned.

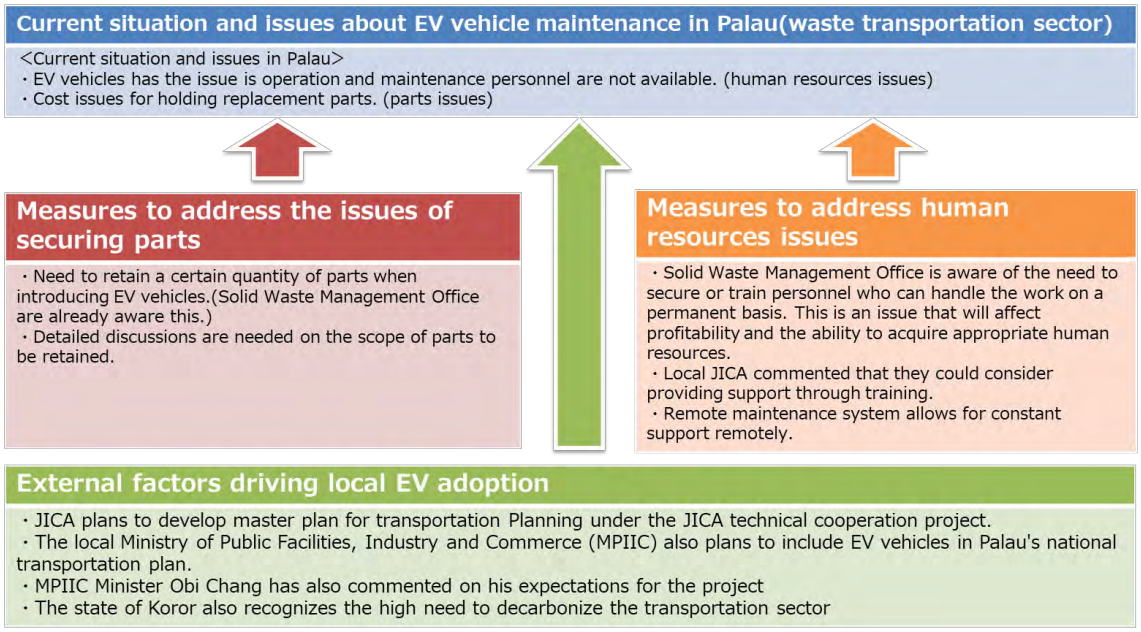


Figure 3-13：Maintenance issues and actions

The Solid Waste Management Office of Koror is aware of the need to retain some of these hardware parts, and has indicated its intention to do so. However, detailed discussions with the manufacturer are required regarding the retention of detailed parts.

On the other hand, there are some soft aspects that cannot be completed in the short term, and the state solid waste management office has expressed a desire for assistance in training maintenance personnel. In this regard, as mentioned previously, JICA has commented that support for training sessions, etc., could be considered. In addition, it is necessary to promote measures by providing online support through the use of "SynQ Remote" by Quando Inc.

3.4 Discussions for funding

It is essential to secure subsidies to reduce the burden of fundraising for this project, which is a public project. It is necessary to consider a multifaceted support scheme that includes JICA and ADB funds from the aspect of infrastructure development, as well as JCM facility subsidy projects. As one of the possibilities, we exchanged opinions several times with the Koror State Solid Waste Management Office and ADB officials of the Public-Private Partnership Division on how to procure funds in cooperation with the "Comprehensive Resource Recycling Project" in Koror State, as described in 3.1.3.

【Summary of exchange of opinions. Comments by ADB staff unless otherwise noted】
(1) History in Palau and ADB to date
・ADB has been paying attention to the waste management project currently planned by the state government (referring to the project to establish a comprehensive resource-recycling society) as a candidate for a regional model project. Solid Waste Management Office in Koror State is willing to promote the project through public-private partnership.

・The ADB's Public-Private Partnerships Department is responsible for advising the government on projects that use the vitality of the private sector to build social infrastructures. Technical assistance is deployed on a project-by-project basis to support project implementation.
・The project was for solar power generation (13 MW) in Palau, and the company provided advice to the government on this project as well.

(2) Obtaining funds for waste management projects, including the introduction of EV

vehicles

・We believe that the funds being considered are not only ODA from ADB, but also the possibility of collaboration with JICA and the Ministry of Environment, Japan. JFJCM and others could also be a possibility.

・The project is being considered in order to maximize results by securing a certain level of scale from an overall project perspective.

(3) Comments after the explanation of the project regarding the introduction of EV vehicles

・The project is considered to be useful as a model because it contributes to the utilization of renewable energy and decarbonization.

・The fact that the battery can be moved in a container unit may also be useful from the viewpoint of resilience.

・For container units, trucks are needed to move them. However, the Solid Waste Management Office does not currently own any vehicles, so the cost of renting a vehicle is an issue (comment from Koror Province).

・If the project is to be supported by ADB in the future, it is highly likely that it will be an international bid, so it would be desirable to have some strong points in this regard.

・We would like to study the model in cooperation with the survey that ADB will conduct in the future.

3.5 Project implementation schedule

Table 3-7 is assumed for the project implementation schedule of the waste collection and transportation EV project based on the survey results of this year.

Table 3-7 ：Examination of future project implementation schedule

Items	FY2022		FY2023		FY2024	
	1st half	2nd half	1st half	2nd half	1st half	2nd half
Examination and construction of project implementation system						
Scrutiny of cost / introduction model						
Examination for acquisition of various subsidies						
Support application such as JCM equipment assistance						

In collaboration with the ADB study to be launched in the future, we will finalize the

model, create the strengths of the project, prepare for bidding, and build a scheme for bidding. At the same time, we will examine the possibility of JCM facility subsidy projects in which only a portion of the facilities are cut out, and move toward obtaining various other subsidy programs, with the aim of obtaining subsidy programs in FY2023.

3.6 Summary / Challenges to overcome in the future

The following is a summary of the study and future issues for the introduction of EV vehicles for waste collection and transportation.

<Summary>

- Study on introduction of waste collection and transportation EV vehicles (packer trucks) based at M-Dock was conducted.
- Solid Waste Management Office expressed a desire to convert all four packer trucks to EV vehicles, and estimates were made based on this request.
- Solid Waste Management Office has commented that it would like to conduct a study on a project to introduce EVs in waste collection and transportation vehicles as part of a comprehensive resource recycling project.
- After discussions with ADB, the company commented that it would conduct a survey and study on a project to introduce EVs in waste collection and transportation vehicles as part of a project to build a comprehensive resource-recycling society in Koror State.

<Future issues>

- Ensure competitiveness with international bidding in mind
- Continued reduction of initial price
- Conducting surveys on local needs for larger vehicles, unique, etc.
- Ongoing concrete establishment of a maintenance system

4 Study to examine decarbonization measures in the State of Koror

Through the previous year's survey, we found that the Koror State government has not set clear targets for decarbonization. As a first step toward future decarbonization and GHG emissions reduction, a survey was conducted to determine energy-derived CO_2 emissions in key sectors and major public facilities in Koror State. The results are presented below.

4.1 Status of initiatives and support needs for decarbonization in Koror State identified in the previous year

The Republic of Palau has set targets for the introduction of renewable energy and reduction of greenhouse gas emissions from the energy sector. We interviewed the State of Koror in the previous year and received the following responses regarding the current situation.

Table 4-1：The efforts of Koror State for decarbonization

Item	Contents
Target Setting for Decarbonization	No clear goal setting exists.
Specific reduction action plan	No clear plan exists.
Current efforts	Promoting the following activities, mainly in the waste sector ● Composting ● Recycling for beverage container ● Utilization of energy from waste plastic through oil conversion
Issues (policy)	The following points are perceived as issues ● Current greenhouse gas emissions are not yet understood. ● The amount of reduction in the specific initiatives described above is also not yet understood.
Emission Reduction Focus Areas	The following areas of reduction are considered important ● Emission reductions in the transportation sector, including traffic congestion, is a priority. ● Consumer (household/business) sector ● Hotel / Resorts ● Power generation ● Waste management sector

The above results were obtained. Currently, Koror State is not able to grasp the situation, and therefore, Koror State is not able to effectively consider measures for reduction. Palau has a weak power grid, and many hotels and other facilities do not use power from the grid, but only generate their own power. It can be inferred that it is difficult to keep track of energy consumption, especially electricity consumption, from these points of view, and this is an issue that needs to be addressed.

On the basis of these backgrounds, the following points were raised as expectations from the Koror side.

- Assessing and evaluating greenhouse gas emissions in Koror
- Recommendations to Koror for emission reductions based on the assessment results

The issues raised by the Koror State are of great importance, as they are fundamental to the consideration of future decarbonization measures, and we will consider the framework for support in this fiscal year of this project.

4.2 Organizing the greenhouse gas emission bases of the Koror state government facilities

With the help of a local consultant, a list was made of sectors and facilities that are major sources of emissions in the Koror State. (Table 4-2)

Table 4-2 ：4.2 Organizing the greenhouse gas emission bases of the Koror state government facilities

ID	Facility Name	Facility Overview
1	Koror State Capitol	The main office of Koror State, which houses the Governor's Office, the Legislature, the Ministry of Finance, the Building and Zoning Commission, and the Public Lands Authority.
2	Koror State Solid Waste Management Office	Recycling Center
3	Dept. of Conservation & Law Enforcement	Law Enforcement Office, Environmental Conservation Office, Boat Mechanic Shop
4	Dept. of Public Works	Facilities located in Malakal, Department of Public Works. Consists of administrative offices, maintenance shop, carpentry shop, small engine maintenance shop, electrical and HVAC shop, welding and body shop, gas station, and employee housing
5	Dept. of State & Cultural Affairs	Cultural Affairs Department, Youth Department, Animal Shelter & Clinic (Paws), and the Koror State Exercise Gym are located there.
6	House of Traditional Leaders	There is a meeting hall with offices and administrative offices for the Traditional Chiefs of Koror State.
7	Koror State Streetlights	Koror State All secondary road-oriented streetlights in Koror State are covered

Energy use by six departments is a major source of emissions. Another major source of emissions is the energy use of streetlights on secondary roads.

4.3 Estimated energy-derived CO_2 emissions from the Koror State government

CO2 emissions were estimated based on the energy consumption of each facility and equipment described in the previous section. The energy consumption of each facility is shown in Table 4-3.

Table 4-3 ：Energy consumption of Koror State government-related major facilities

ID	Facility Name	Gasoline	Diesel	Heavy Oil	Electricity(Purchase)	Electricity(Self Consumption)	Purchase	Back up
		Kl	kl	kl	kWh	kWh		
1	Koror State Capitol	18	0	0	145,000	0	All	Diesel
2	Koror State Solid Waste Management Office	32	12	0	168,000	0	All	Diesel
3	Dept. of Conservation & Law Enforcement	190	0	0	53,000	0	All	Diesel
4	Dept. of Public Works	90	50	0	9,000	0	All	Diesel
5	Dept. of State & Cultural Affairs	15	0	0	55,000	0	All	Diesel
6	House of Traditional Leaders	5	0	0	23,000	0	All	Diesel
7	Koror State Streetlights	0	0	0	225,000	0	All	なし

The estimated energy-derived CO_2 emissions from the energy consumption of each facility are shown in Table 4-4 below.

Table 4-4 ：Energy-derived CO_2 emissions from major facilities and equipment related to the Koror State government

ID	Facility Name	Gasoline	Diesel	Heavy Oil	Electricity (Purchase)	Total (t-CO_2)
		t-CO_2	t-CO_2	t-CO_2	t-CO_2	
1	Koror State Capitol	41.8	0.0	0.0	77.3	119.0
2	Koror State Solid Waste Management Office	74.2	31.0	0.0	89.5	194.7
3	Dept. of Conservation	440.8	0.0	0.0	28.2	469.0

	& Law Enforcement					
4	Dept. of Public Works	208.8	129.0	0.0	4.8	342.6
5	Dept. of State & Cultural Affairs	34.8	0.0	0.0	29.3	64.1
6	House of Traditional Leaders	11.6	0.0	0.0	12.3	23.9
7	Koror State Streetlights	0.0	0.0	0.0	119.9	119.9
Total		812.0	160.0	0.0	361.4	1,333.3

The estimated emissions of the main facilities in Koror were 1,333.3 t-CO_2.

As reduction measures at each facility, they were adjusting air conditioning temperatures and turning lighting on and off. The basic measure was to improve the operation.

As for the streetlights, they are switching to LED type lights one after another.

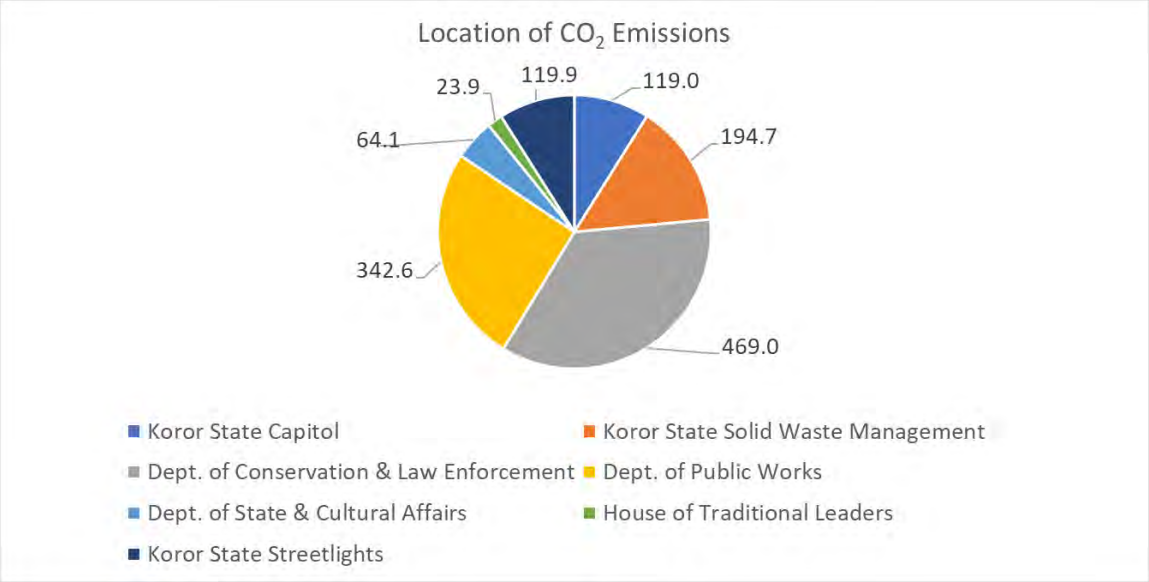


Figure 4-1：Percentage of CO_2 emissions location

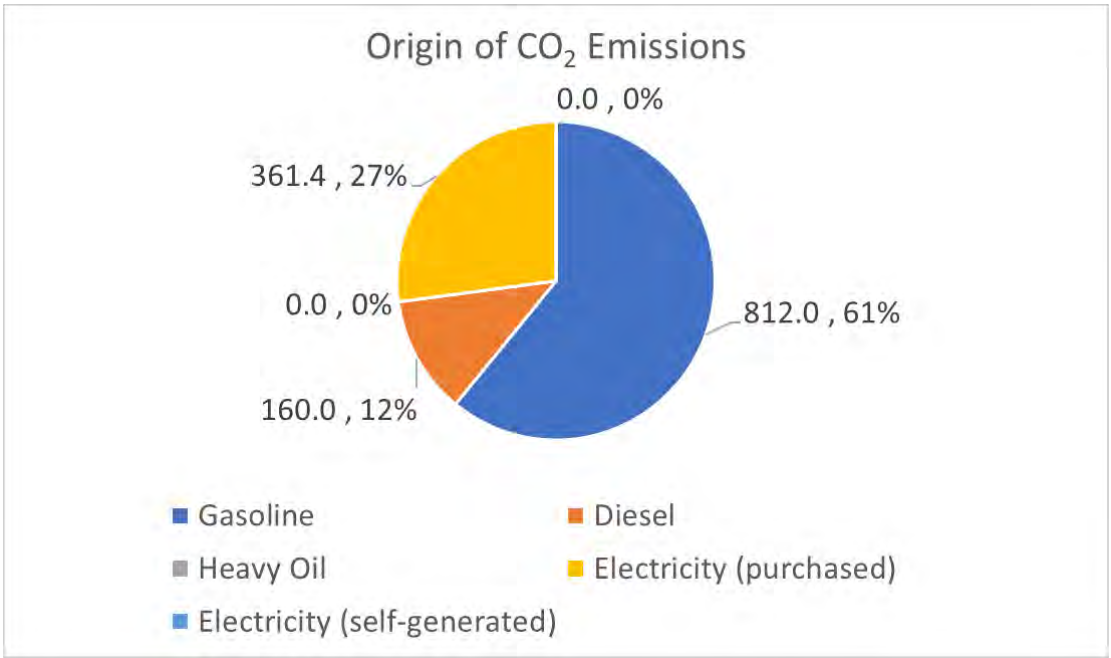


Figure 4-2：Percentage of CO_2 emissions origin

The Department of Environmental Protection and Law Enforcement was the largest emitter. This is probably due to the fact that most of the emissions are gasoline-derived (vehicles and boats). The Department of Public Works was next, with gasoline-derived (vehicles and boats) emissions also accounting for a large portion of emissions. Emissions from electricity are mostly from street lighting, the Koror State Waste Management Office, and the Koror State Office Building. (Figure 4-1)

Emissions from gasoline accounted for 61% of the total emission sources. If diesel fuel is included, it accounts for 73%. Electricity accounted for 27%. (Figure 4-2)

4.4 Study of greenhouse gas emissions reduction potential of state government-related facilities

Regarding the emission trends observed in the previous section, it is emissions outside of the marine sector of the transportation sector that are most likely to be considered for realistic technology implementation. We checked the status of reduction technologies being considered for two sites in Koror: the Koror State Capital and the Recycling Center.

＜Koror State Capital＞

Method	Status of implementation and consideration to date
Renewable Energy(Solar)	No implementation / Wish to implement
Renewable Energy(Biomass)	No implementation and not planned
Other energy (Waste to Energy, etc.)	Energy generation from plastic oil
Storage batteries	No implementation and not planned
Replacement of air-conditioning	Wish to implement
Replacement of LEDs	Ongoing for implementation / Wish to implement
Energy saving actions (Adjust air conditioning, turn off lights frequently)	Ongoing activities in progress

＜Recycle center＞

Method	Status of implementation and consideration to date
Renewable Energy(Solar)	No implementation / Wish to implement (Plans to implement to the transportation and storage station under consideration)
Renewable Energy(Biomass)	No implementation and not planned
Other energy (Waste to Energy, etc.)	Energy generation from plastic oil
Storage batteries	No implementation and not planned
Replacement of air-conditioning	Not planned
Replacement of LEDs	Ongoing activities in progress
Energy saving actions (Adjust air conditioning, turn off lights frequently)	Ongoing activities in progress

We have confirmed that the following activities have been considered at each facility and site so far

1) Study on the introduction of Solar panel fields at the Koror State Capitol
2) Replacement of the centralized air conditioning system at the Koror State Capitol
3) One solar power system is currently installed at the recycling center, but the inverter (or power conditioner) is not working, according to the site.

In each of these cases, cost has been the main factor preventing progress. In the

Transportation Station Project described in Chapter 3, the construction of a methane fermentation (biogas) plant is being considered.

4.5 Proposed GHG reduction measures in the Koror State with potential for efficiency

According to the list of facilities in Koror and the intentions up to the previous section, efficient emission reduction measures to be considered are the replacement of outdated air conditioning systems and the installation of solar power generation facilities. The introduction of self-consumption power generation facilities is also an item to be considered in view of the rising cost of electricity and the fragility of the power grid. Although they were not considering the introduction of storage batteries due to a lack of technical understanding, it would be desirable to consider the introduction of storage batteries on a certain scale, considering the likelihood of power outages and the need to strengthen resilience.

As the number of EV vehicles increases, a model that utilizes the batteries used in the vehicles as reused batteries can be considered, and it will be necessary to design an energy model that includes batteries in the future.

4.6 Future Considerations (Emission Reduction Plan)

There has been interest in developing a reduction plan for future state utilities through a study of Koror's facility list and current emissions. We have also received feedback that there is potential for reductions at water treatment plants and sewage treatment plants, and would like to discuss how to proceed with this support in the next fiscal year and beyond.

5 Consideration for further strengthening city-to-city collaboration

Further strengthening city-to-city collaboration is expected to contribute not only to the direct introduction and deployment of superior decarbonization technologies, but also to the resolution and mitigation of local policy issues. Since expanding the decarbonization dominoes will also create opportunities for the transfer of superior technologies from Japan and Kitakyushu, this report will examine the initiatives and challenges faced by businesses and the state government in Koror, and describe the projects that have emerged as a result of strengthening inter-city linkages.

5.1 Energy savings in large hotel

Palau is one of the Pacific countries with the highest dependence on tourism, which accounted for 36.5-53.4% of GDP[6] in FY 2010-2019 before the COVID-19 pandemic . In Palau, where there are many small-scale businesses, large tourist hotels are among the major energy consuming sectors. Therefore, in past surveys, interviews were conducted with two major large hotels to ascertain their needs for updating their facilities to reduce CO2 emissions. As a result, Palau Royal Resort (PRR) responded that it has no immediate plans to renew its facilities because its facilities are relatively new, while Palau Pacific Resort (PPR) responded that it has plans to renew its diesel generators and chillers because its facilities are old.

Since it has been difficult for the hotel industry in Palau to make a decision on facility renewal due to the disruption of tourist arrivals (i.e., income) caused by COVID-19, the JCM equipment subsidy program was explained in detail to PPRs in last year for reference when updating their equipment in the future, and further interviews were conducted on their needs for facility renewal.

(1) Interview with PPR in last year

As a result of interviews with PPR, in addition to the needs for updating diesel generators and air-cooled chillers identified in the previous fiscal year, we were able to identify a new need for updating 20KW mercury lamp to LED lighting. In addition, we

[6] ADB (2021) Recovery through Improved Systems and Expenditure Support Program, Subprogram 1: Report and Recommendation of the President. https://www.adb.org/projects/documents/pal-54284-001-rrp

were able to identify issues such as problems caused by the long-term shutdown of facilities due to COVID-19, deterioration of facilities due to salt damage, replacement of parts when facilities fail, and lack of personnel who can perform maintenance

(2) Conduct follow-up on the possibility of utilizing JCM equipment subsidy projects in PPR

We spoke with Mr. Sone, the equipment management manager at PPR, and exchanged opinions on the outline and utilization of the JCM equipment subsidy program. (Conducted on Saturday, 17 December 2022)

- LED Lighting

Regarding LED lighting, they are continuing to consider updating areas outdoors that use mercury lamps. LED lighting consumes about 1/3 to 1/4 of the power and lasts 4 to 10 times longer than mercury lamp lighting, so the benefits of replacing it are great, including the reduction of running costs (electricity bills). If we compare 1000W mercury lamps (20 units) and 1000W equivalent LED lighting (20 units) for a 5-hour use per day, we can reduce the monthly electricity bill from US$930 (about 116,000 yen) to US$269 (about 33,000 yen) (Table 5-1)。

Table 5-1 ：Comparison of energy consumption and electricity rates for LED lighting with the same illuminance as 1000W mercury lamps

Specifications	Power consumption and electricity rates
1000W mercury lamps	Power consumption: 1,000 W x 20 units x 5 h x 30 days = 3,000 kWh/month Electricity rates: 3,000 kWh x US$0.31/kWh[7] = 930 US$/month
LED lighting equivalent to 1000W (RZNA-1000-50RT[8])	Power consumption: 289.2 W x 20 units x 5 h x 30 days = 867.6 kWh/month Electricity rates: 867.6 kWh x US$0.31/kWh = 269 US$/month

- Diesel generator

PPR indicated that there is a continuing need for updating generators. Currently, hot water is still being generated from the generator's radiator using a heat exchanger, and cogeneration efforts are underway to effectively utilize the heat generated by the generator. Therefore, it is possible that the introduction of a high-efficiency cogeneration system when

[7] Palau Energy Snapshot: Energy Transitions Initiative: https://www energy.gov/sites/default/files/2020/09/f79/ETI-Energy-Snapshot-Palau_FY20.pdf

[8] RZNA-1000-50RT (NIINUMA): Power consumption 289.2 W, consumption efficiency 159.8 lm/W

updating a generator may be eligible for the JCM equipment subsidy project.

- Steam Needs

They have a need for using steam in their dryers, irons, and press machines. Currently, they are using an independent diesel boiler, but since steam can be utilized by introducing a generator and cogeneration system, consideration of cogeneration is expected to be beneficial, except for the higher equipment cost. Cogeneration system has a track record of adopting several JCM equipment subsidy projects in the past, so the introduction of cogeneration is something that can be considered at this location.

- Air-cooled chillers

PPR indicated that repairs have been made to the chiller and that there are no problems with it at this time.

- Other Discussions

In Palau, the high cost of sewage treatment is an issue, and whether the sewage is treated at the sewage treatment plant or at home, the high cost is a problem.

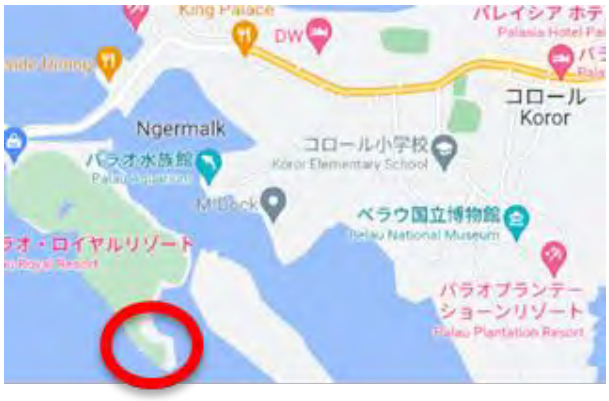
5.2 Project to utilize recycled materials on boardwalks

When Governor Eyos Rudimch visited Kitakyushu in August 2022 (see Section 1.3.2 and Figure 1-5), he showed interest in the wood decking material (a mixture of recycled wood and recycled plastic) produced by Kitakyushu Eco-Town company Eco Wood Co. (a company located in Kitakyushu Eco-Town), who saw the company's wood decking material (a recycled wood/plastic composite material made from a mixture of recycled wood and recycled plastic) during a visit to Kitakyushu Eco-Town. The product is being used in a recreation area in the state of Koror, where a project is underway to install a boardwalk.

The project is currently being promoted with the cooperation of the local JICA and embassy. This project is the result of city-to-city collaboration projects and exchanges between Koror and Kitakyushu, and the Koror State has requested that they consider replacing the benches

and tables on Rock Island Island with ones made of these materials.

Figure 5-1：Planned promenade installation site



(地図データ出所：Google Map)

Figure 5-2：Planned promenade installation site

5.3 The efforts and support need of Koror State for promoting SDGs achievement

Kitakyushu city was selected as one of the first SDG Future Cities by the Cabinet Office, Government of Japan and was also selected as a "Global Model City for SDG Promotion" by the OECD. Koror State has expressed a desire for collaboration based on this experience from the beginning.

Table 5-2 ：Current Status of Koror State's Efforts to Achieve the SDGs

Item	Contents
Target Setting for SDGs achievement	Although no clear set of goals exists, they are focusing on achieving the following goals. (Goals 6, 7, 8, 9, 11, 13, 14, 15, and 17) 
Specific action plan for SDGs	No clear plan exists.
Current Initiatives Promoting	the following activities, focusing on the waste sector ● Recycling activities (composting/beverage container recycling/use of energy from waste plastic oil) ● Integrated waste management (Urban Grower's Program) ● Marine environment conservation ● Biodiversity Protection  Urban Grower's Program
Issues (policy)	The following points are perceived as challenges ● Limited funding makes it difficult to address only the above priority areas (transportation, marine conservation, waste management, agriculture, and power generation).

The above results were obtained. Currently, the SDGs are being achieved on an individually specific activity basis, depending on the priority level for achieving the SDGs promoted by the government.

In light of these points, the following points were raised as expectations from the local side.

- Introduction of Japanese Cities' Efforts to Achieve the SDGs
- Assistance in developing a plan to achieve the SDGs in the State of Koror
- Implementation of joint projects in the areas of solid waste management/transportation/power generation (also applicable to this project)

The Koror State has expressed a desire to create a plan, and since there is a high affinity between the decarbonization measures discussed in Chapter 4 and activities to achieve the SDGs, we will continue to consider a framework for continued support.

5.4 Organize local workshops

A workshop with the Governor of Koror was held as an opportunity to share contents and exchange views on this study. In addition, internal meetings with the Koror State Waste Management Office have been held separately several times since its adoption.

＜Workshop with local communities (minutes)＞

Date： February 7, 2023, 10:00-12:30
Place： Koror State Capital Office, Conference Room
Participants: :
・Mr. Eyos Rudimch (Governor of Koror)
・Mr. Leslie Tewid (Director General of Public Works)
・Mr. Selby Etibek (Recycling Center Manager)
・Mr. Katsuo Fuji (Consultant, State Waste Management Office)
・Takanori Arima (Executive Director, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City)
・Tatsurou Nagahara (Section chief (International Collaboration), International Environmental Strategies Division, Overseas Environmental Project Department, Environment Bureau, Kitakyushu City)
・Hidenobu Sumi (Executive Vice President, EV Motors Japan Corp.)
・Seiya Tominaga (Senior Manager, AT GREEN Co., Ltd.)
・Sho Koizumi (Consultant, ATGREEN Co., Ltd.)

1. Explanation of EV bus vehicles and flexible solar power generation (EV Motors Japan (hereinafter referred to as "EVMJ"): Hidenobu Sumi) (Appendix 5)

2. Q&A and exchange of opinions
   - What is the size of the large trucks that are supposed to be hauled to the final disposal site in the state of Aimeliik? (Mr. Leslie Tewid)
     - We have a lineup up to 20-ton trucks capable of carrying 40F containers. Japan has weight restrictions and the bodies are lighter, but adjustments can be made if you give us more time(EVNJ)
   - Are there any large vehicles in the non-waste section of the state-regulated fleet? (Kitakyushu-city)
     - 1 van, 1 dump truck, 2 jumbos. For transporting road maintenance (soil, fallen trees, etc.). We also have jurisdiction over regular van trucks (Mr. Leslie Tewid)
   - There is a movement in Japan to reduce the number of gasoline-powered

vehicles, including passenger cars. Already, about 30% of the vehicles on the road in Japan are EVs and hybrids. It is expected that Palau will eventually come to a point where it will have no choice but to convert to EV vehicles. (Kitakyushu-city)

  - Japanese technology is very much ahead of the curve. We would like your support to help Palau respond to it. (Mr. Eyos Rudimch)

- Vehicles carrying documents, mail, and supplies are also under the jurisdiction of the state government. Due to the heavy traffic on the state's narrow streets, it is expected that smaller sized vehicles that can travel on sidewalks will also be utilized. (Mr. Leslie Tewid)
- How many batteries does the state office own for disaster response? (ATGREEN)
  - We have only diesel generator as a back-up. (Mr. Eyos Rudimch)
- Are there disaster-ready buildings in the state? (Kitakyushu-city)
  - The Protection Department of Koror (350 employees) is a disaster response building. In case you are wondering, ambulances and fire trucks are under the jurisdiction of the national government, and there are three bases in the country (two in Koror and two in Babeldaob). Further branch offices should be established. (Mr. Eyos Rudimch)

Figure 5-3：Workshop held

Reference: About Our Ocean Conference/OCC

Our Ocean Conference is an international conference where heads of state and other representatives from around the world, as well as representatives of international organizations, research institutions, and non-profit organizations, gather to discuss ocean-related issues and announce their commitments. The first meeting was held in 2014 in the

United States and has been held annually since then. The government of Palau, as a representative of the island nations, has committed to the meeting and announced that it will host the 7th meeting in Palau on August 17-18, 2020[9]

In this study past year, a planning application had been submitted to organize a side event in participation with the Our Ocean meeting. In addition to the side event, a new commitment, "Development of Transportation Station at the former landfill site (M-Dock) in Koror State: As an important base for building a resource circulation society" was submitted as a joint proposal by Koror State, AMITA CORPORATION, and Kitakyushu City[10] However, due to the global spread of COVID-19, the event was postponed to December 7 and 8, 2020, and since there was no improvement in the situation after that, it was decided to postpone it for another year.

Last year, we were preparing to travel to the site in conjunction with the field survey, to hold a side event there, and to resubmit the commitments submitted last year. However, the meeting that was scheduled to be held on February 16 and 17, 2022 was further postponed due to COVID-19, finally, the meeting was held on-site (physically) on April 13 and 14, 2022. Since it fell outside the study period of this survey and was not held online, we had to give up participation this time.

[9] 7th Our Ocean Conference: https://www.ourocean2020.pw/

[10] ATGREEN Co., Ltd. (FY2021) FY2021 City-to-City Collaboration Program for Creating a Zero-carbon Society

(Promoting of carbon-free society and co-benefits through the implementation of EV vehicles in the state of Koror, Republic of Palau〔Kitakyushu-City – Koror State〕Study Report. Ministry of Environment , in Japan.