Project commissioned by the Ministry of the Environment in 2022

City-to-City Collaboration Programme for Zero-Carbon society in 2022 (Support project for the achievement of SDGs and developing a sustainable decarbonized society: City-to-City Collaboration between Ehime Prefecture and Gorontalo Province)

Report

March 2023

Japan NUS Co., Ltd.

Ehime Prefecture

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List of Abbreviations

Abbreviation	English/Indonesian	Japanese
BAPPEDA	Badan Perencanaan Pembangunan Daerah	地方開発計画局
BAU	Business as usual	成り行きシナリオ
COP26	The 2021 United Nations Climate Change Conference	国連気候変動枠組条約第 26 回締約国会議
DLHK	Dinas Lingkungan Hidup dan Kebersihan	環境衛生局
DPRD	Dewan Perwakilan Rakyat Daerah	地方国民代表評議会
ESDM	Ministry of Energy and Mineral Resource	エネルギー鉱物資源局
FACT 対話	Forest, Agriculture and Commodity Trade Dialogue	森林・農業・コモディティ貿易対話
GSS	Gas Solid Separator	三相分離装置
JCM	Joint Crediting Mechanism	二国間クレジット制度
KLHK	Kementerian Lingkungan Hidup dan Kehutanan	環境林業局
NDC	Nationally Determined Contribution	自国が決定する貢献
PLN	Perusahaan Listrik Negara	インドネシア電力公社
POME	Palm Oil Mill Effluent	パーム油排水
PUPR	Pekerjaan Umum dan Perumahan Rakyat	公共事業・国民住宅局
RAD-GRK	Rencana Aksi Daerah Penurunan Emisi Gas Rumah Kaca	地方温室効果ガス排出削減行動計画
RAN-GRK	Rencana Aksi Nasional Penurunan Emisi Gas Rumah Kaca	国家温室効果ガス排出削減行動計画
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries	途上国の森林減少・劣化に由来する排出の削減
RKPD	Rencana Kerja Pemerintah Daerah	地方作業計画
RPJMD	Rencana pembangunan jangka menengah daerah	地方中期開発計画
RPJMN	Rencana pembangunan jangka menengah nasional	国家中期開発計画
RUED	Rencana Umum Energi Daerah	地方エネルギー総合計画

RUEN	Rencana Umum Energi Nasional 2015-2050	新国家エネルギー政策
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik	インドネシア電力供給事業計画
SDGs	Sustainable Development Goals	持続可能な開発目標
JANUS	Japan NUS Co., Ltd.	日本エヌ・ユー・エス株式会社(本都市間連携提案事業者)

Chapter 1 Purpose and background of this project

1.1 Purpose

With a consensus document produced at the 2021 United Nations Climate Change Conference (COP26) held in November 2021, it was confirmed that a new global goal is to keep the increase in air temperature since the industrial revolution by no more than 1.5℃. In order to attain this goal, it is indispensable to accelerate initiatives at various levels, including provincial, municipal, and ward levels, in each country. The Japanese government, too, declared that it aims to realize a decarbonized society by decreasing the net emissions of greenhouse gases to zero by 2050, and the number of municipalities that have declared that they will decrease the net CO_2 emissions to zero increased rapidly to over 600 (as of April 30, 2022). Based on the roadmap for decarbonization in each region, which was formulated in June 2021, advanced measures have been designed in each region, and activities for spreading them nationwide are ongoing.

Accordingly, the role of cities and local governments is becoming more important when discussing and implementing specific regional measures and projects against climate change. In order to realize a global decarbonized society, we must accelerate the movement toward building a sustainable decarbonized society, especially in Asia, where economic growth is remarkable. The movement to support the decarbonization and low-carbonization efforts of cities, which are places for activities that support socio-economic development, is being strengthened internationally.

Furthermore, in the midst of the current COVID-19 pandemic, cities are under pressure to address issues related to the spread of infection, while readjusting and considering new measures to achieve sustainable development. It is vital to establish new methods for collaboration among cities and build new cities.

Considering the above situation, the purpose of this research project was defined as formulating a plan to realize both decarbonization and development and disseminate technology in Gorontalo Province, where economic growth is remarkable, in cooperation with Ehime Prefecture.

1.2 Background

Gorontalo Province is a region of Indonesia that has experienced particularly remarkable economic growth in recent years. However, it also faces various environmental and social issues such as underdeveloped infrastructure, water pollution, and deforestation. In order to solve these issues, Gorontalo Province recognizes the necessity of formulating a plan for decarbonization due to the need for climate change mitigation. Nevertheless, although the province implemented such a plan, it has been

unable to enter the implementation stage. Moving forward, although there are plans for incorporating the perspective of decarbonization in various measures—the development plan for Gorontalo Province is one such plan—it is still necessary to take measures that will lead to effective efforts. Gorontalo Province expects Japan's support and cooperation in order to utilize the precedent cases and knowledge in such efforts, and is particularly interested in deriving solutions in collaboration with Ehime Prefecture.

In Gorontalo Province and Ehime Prefecture, starting with academic exchanges between Gorontalo State University and Ehime University in 2007, a delegation from Gorontalo Province visited Ehime Prefecture in 2016 and laid the foundation for industry-academia-government collaboration, including the interaction with Ehime Prefecture, Ehime University, and private companies.

Against this background, Ehime Prefecture received a request for support in deriving solutions based on the formulation of decarbonization policies to address environmental and social issues such as underdeveloped infrastructure, water pollution, and deforestation in Gorontalo Province, which led to the start of the city-to-city collaboration project.

1.3 Implementation system

Figure 1- 1 shows the work implementation system for the current fiscal year. Under the framework of city-to-city cooperation, Ehime Prefecture and Gorontalo Province signed a cooperation agreement in which the Regional Development Agency of Gorontalo Province (Badan Perencanaan Pembangunan Daerah: hereinafter, “BAPPEDA”) will serve as the contact point. The parties held discussions on sharing knowledge and supporting policymaking related to decarbonization policies and planning that promotes projects such as the regional water infrastructure development project using decarbonized energy, sustainable forest utilization through cacao cultivation, and other projects under consideration for this survey.

When considering commercialization, we cooperated with corporations based in Ehime Prefecture; specifically, Daiki Axis Co., Ltd., which possesses experience in the installation and maintenance of septic tanks, and Aiken Kakoki K.K., which possesses experience in wastewater treatment and in the design and construction of methane fermentation facilities for sludge, etc. Moreover, in the project for sustainable forest utilization, we collaborated with Kanematsu Corporation, which has been engaged in Reducing Emissions from Deforestation and Forest Degradation in Developing Countries project (hereinafter: “REDD + project”) in the western part of Boalemo Regency since 2011. JANUS managed the entire project, including information

gathering related to city-to-city collaboration, support for various surveys, and liaison and coordination of related organizations and companies.

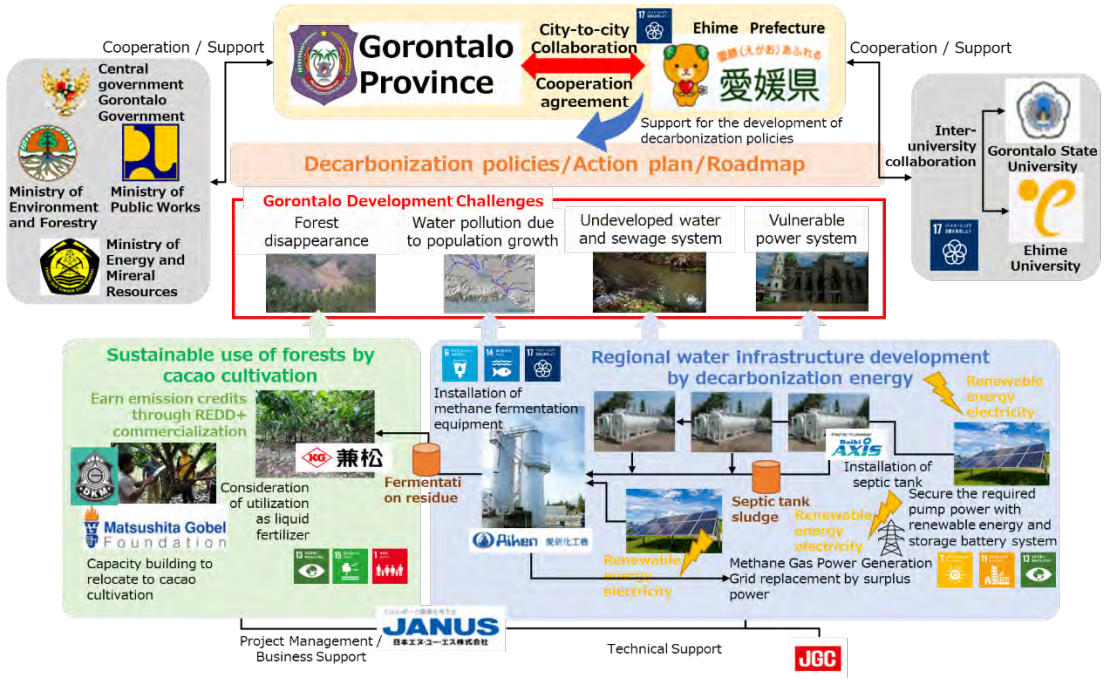

Figure 1-1 Overview and implementation system for this project

Chapter 2 Overview of Gorontalo Province

2.1 Basic information

Gorontalo Province is located in the northern part of Sulawesi Island. Gorontalo Province became independent from North Sulawesi in 2000, and is composed of five regencies (Boalemo, Bone Bolango, Gorontalo, North Gorontalo, and Pohuwato) and one city (Gorontalo). Approximately 70% of the entire province is composed of hills ranging from 884 to 2,100 m above sea level, and there is little flat land. The population of Gorontalo Province is currently 1.17 million, and the average population has increased by 1.56% each year from 2010 to 2020. When looking at the population distribution by municipality, Gorontalo Regency has the largest population of 390,000, but the city of Gorontalo has the highest population density of about 2,500 per km^2[1]。

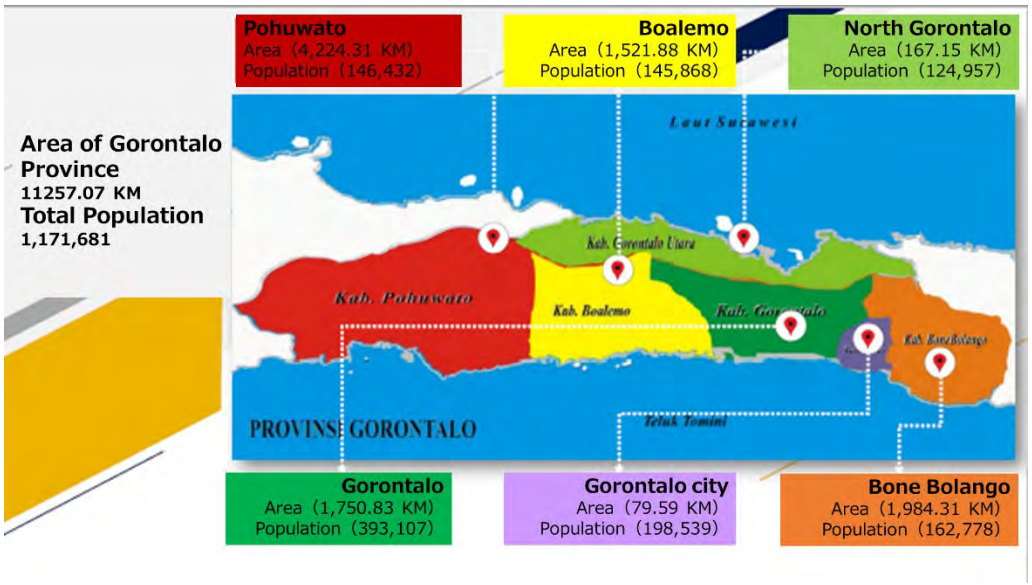

Figure 2-1 Composition of Gorontalo Province[2]

In terms of the economic conditions on Sulawesi Island, which includes Gorontalo, regional real GDP growth rate from 2014 to 2018 has ranged from 6.7% to 8.2% (with respect to 2010), a level which exceeds the national average.[3] This shows remarkable economic growth in the region. The main industry is agriculture, forestry and fisheries,

[1] BADAN PUSAT STATISTIK PROVINSI GORONTALO (September 2021), Regional Statistics of Gorontalo Province 2021 (https://gorontalo.bps.go.id/publication/2021/09/27/c7f09b2c19efb8efde4f5221/statistik-daerah-provinsi-gorontalo-2021.html)

[2] Excerpt from the presentation material for the workshop of BAPPEDA, Gorontalo

[3] JBIC (December 2019), Investment Environment of Indonesia 2019 (https://www.jbic.go.jp/ja/information/investment/images/inv_indonesia201912.pdf)

and the ratio of primary industry to the regional nominal GDP in 2018 was 24.9%, which was twice the national average (12.5%). Among the primary industries, the ratio of agriculture and fisheries is particularly high. Rice and corn are actively grown in the agriculture industry. Plantation crops, too, are actively grown, including sugar cane, coconut, cacao, coffee, and cloves.

Since Gorontalo Province is located near the equator, it has a warm climate with an average annual temperature of 26 to 28 degrees Celsius and an average annual rainfall of 29.6 mm. The month with maximum precipitation is November, and the month with minimum precipitation is May.

2.2 Government of Gorontalo Province

Gorontalo Province became independent of North Sulawesi Province on December 5, 2000. At the beginning of its independence, the province was composed only of Gorontalo Regency, Boalemo Regency, and the city of Gorontalo. However, in conjunction with regional development, Pohuwato Regency and Bone Bolango Regency were established in 2003, and North Gorontalo Regency was established in 2007. The development of the new regencies and the revitalization of the region have progressed rapidly, and Gorontalo Province is currently composed of five regencies, one city, 77 counties, 72 districts, and 684 villages.

Since 2017, the governor of Gorontalo Province has been Drs. H. Rusli Habibie MAP and the vice-governor has been DR. Drs. H. Idris Rahim, MM. After assuming office, the governor espoused his vision for the province as "realizing an advanced, outstanding, and prosperous society in Gorontalo." A regional secretariat serves under the governor and vice-governor. Under the regional secretariat, there are three assistants and seven bureaus on politics, economics, and other administration. The organizational structure of the Gorontalo Province government is shown below.

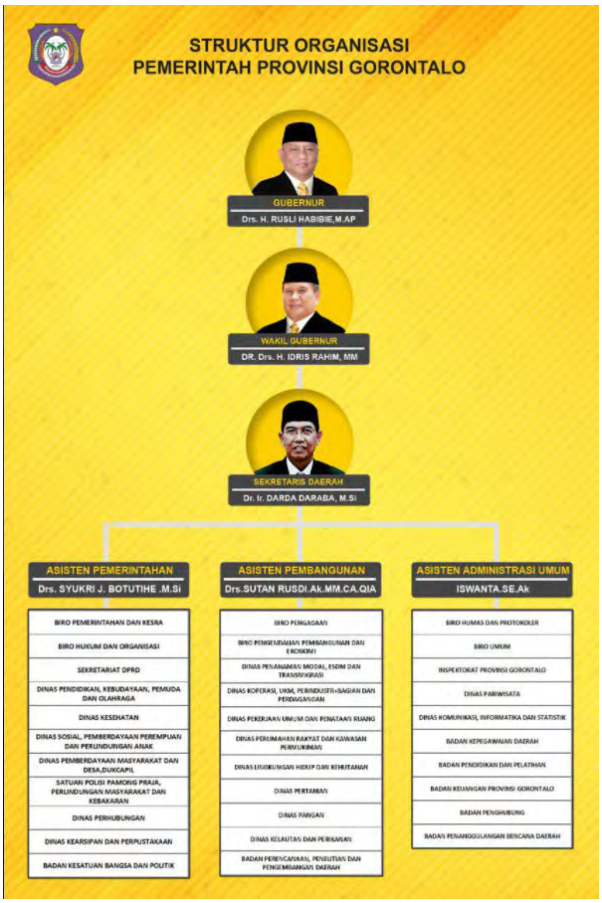

Figure 2-2 Organizational structure of Gorontalo Province government[4]

In addition to the regional secretariat, the provincial government agencies include the secretariat of the Regional People's Representative Council (Dewan Perwakilan Rakyat Daerah: DPRD), as well as ten regional technical agencies, twelve administrative agencies, and five regional organizations based on statutory rules and regional needs. These agencies are responsible for the administration in Gorontalo Province[5].

2.2.1 Primary political measures and policies

The primary political measures and policies in Gorontalo Province are formulated in the Regional Long-Term Development Plan (Rencana pembangunan jangka menengah daerah: hereinafter, “RPJMD”). The period of the latest RPJMD is 2017 to 2022. Local governments are required to formulate the RPJMD in accordance with the National Medium-Term Development Plan (Rencana pembangunan jangka menengah nasional:

[4] Website of the Gorontalo Province government (https://gorontaloprov.go.id/pemerintahan_provinsi/)

[5] DINAS KOMINFO DAN STATISTIK PROVINSI GORONTALO (November 2019) “BUKU PROFIL PROVINSI GORONTALO 2019”

hereinafter, “RPJMN”) for Indonesia. The latest RPJMN for Indonesia will be explained in detail in the next section.

1） National Medium-Term Development Plan (RPJMN)

The Indonesian government announced the new RPJMN in January 2020. In the plan, the average annual growth rate of real GDP is expected to be 5.7% to 6.0%. It is estimated that investment of about 35,000 trillion rupiah will be required to achieve the growth target. The plan also sets the goal of raising gross national income per capita from $5,810 to $6,000 by 2024.[6]。

The RPJMN sets the president's nine missions and five directives. Moving forward, the seven development challenges listed below will be dealt with. They pursue development that is environmentally-friendly, improves disaster resilience, and copes with climate change.

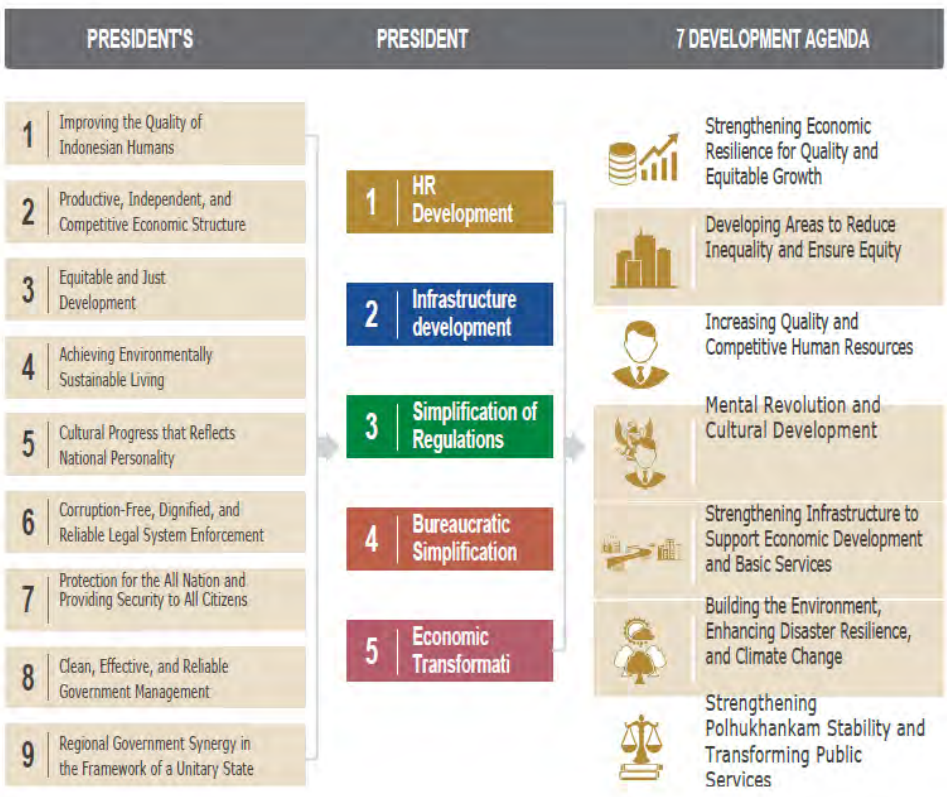

Figure 2-3 President’s directives and seven development challenges in the National Medium-Term Development Plan (RPJMN)[6]

[6] Ministry of National Development Planning of Indonesia, National Medium-Term Development Plan 2020-2024

The macro development targets of the RPJMN also mention the GHG emissions reduction target. In order to achieve the 29% reduction compared to BAU by 2030 as listed in the NDC, the target GHG reduction amount is 27.3% by 2024.

Figure 2-4 Macro development targets in the National Medium-Term Development Plan (RPJMN) 2020-2024[6]

In energy development plans, Indonesia still relies on fossil fuels. The country's energy self-sufficiency rate, which was 75% in 2018, is expected to drop to 28% by 2045. To cover this, the country's goal is to promote the spread of renewable energy as set forth in the General Plan for National Energy (Rencana Umum Energi Nasional 2015-2050: hereinafter, "RUEN") that was formulated in 2015, and to increase the ratio of renewable energy to 23% by 2024. RUEN states the following policy for energy development.

(1) Accelerate the development of renewable energy
(2) Increase the amount of biofuel supplied
(3) Secure energy and promote energy conservation
(4) Increase the supply of energy to industry
(5) Develop NRE (New Renewable Energy) and support industry

When working to achieve the target for increased renewable energy, RUEN also clearly states that focus will be placed on the development of renewable energy derived from oil palm. The related investment amount is expected to be 32 trillion rupiah by 2024.

Furthermore, RUEN clearly states that the target for water infrastructure development is to increase the number of households that can use wastewater treatment facilities to 90%. The related investment amount is expected to be 140 trillion rupiah by 2024.

Regarding decarbonization, the trend of NDC based on the Paris Agreement as well as the RPJMD mentioned above is important. In July 2021, Indonesia announced the latest version of the NDC in accordance with the Paris Agreement and declared its aim for carbon neutrality (the reduction of greenhouse gas emissions to virtually zero) by 2060. Therefore, it is necessary to pay close attention to how the latest trends will impact the political measures and policies of the Indonesian central government, including the current RPJMN.

2） Gorontalo Province Regional Long-Term Development Plan (RPJMD)

As mentioned above, the RPJMN was formulated by the Indonesian national government, and a provincial RPJMD was formulated by each province accordingly.

The Gorontalo Province RPJMD (2017-2022) has the following five development missions, which are in line with the RPJMN for 2015 to 2019.

(1) Realize healthy and sustainable tourism, and management of natural resources: While upholding the principle of protecting the environment and forest areas, maintain the safety of energy and water by targeting the management of natural resources, especially tourism, agriculture, fishing, and marine issues.
(2) Ensure the availability of regional infrastructure: Development of technology that enhances the availability of basic infrastructure equipment, telecommunications equipment, and transportation and shipping equipment, and includes the provision of infrastructure equipment in strategic regions, urban areas, and farming villages.
(3) Improve even more fair and equitable regional welfare: Improve regional welfare by increasing per capita GDP, per capita spending, and income distribution, and guarantee the comprehensiveness and sustainability of that regional welfare.
(4) Improve the quality of human resources: Improve the quality of education, health, and regional cultural development in order to cultivate high quality human resources, reduce poverty, and realize the basic rights of regional society in Gorontalo Province.
(5) Creation of good governance and even more services: Develop creative, innovative, and competitive professional government agencies and maintain regional security, order, and political stability.

The following is a table summarizing the development missions, vision, targets set under the missions, and indicators of target achievement for the RPJMD of Gorontalo Province.

Table 2- 1 Vision, missions, and targets for the RPJMD of Gorontalo Province

No.	Mission	Objective	Target	Indicator	Initial Status (2016)	Target (2022)
Vision: Realizing an advanced, outstanding, and prosperous society in Gorontalo						
1.	Realize management Environmentally-friendly and sustainable tourism and natural resources	Tourism	Increase of tourists	Number of Japanese and foreign tourists	5,923	7,937
				Number of island tourists	566,398	759,023
				Average stay period of tourists	1.52	4
		Strengthening Management Natural resources for social welfare	Increase contribution of agriculture / plantation sector GDP	Contribution rate in agriculture sector GRDP [trillion rupiah]	11,916.05	14,228.39
			Increase availability and consumption of food supplied by agriculture and marine fisheries that affect the welfare of farmers and fishermen	Exchange rate of farmers	105.63	106.40
				Exchange rate Fishermen/cultivator equipment (NTNP)	101.37	102.1
				Availability of PPH score	65.27	66.89
				Consumption PPH score	76.3	85.5
				Exchange rate of farmers Livestock sub-sector (NTPT)	102.62	104.42

		Maintain the carrying capacity	Forest resources Land	Quality indicator Environment	71.06	73.61
		Sustainable natural resources	Sustainable marine/coastal areas and disaster mitigation	Important land area	706,930 ha	700,930 ha
				Disaster risk indicator	0.66 – 1	0.3 – 0.65
2.	Secure the availability of regional infrastructure	Strengthening Regional infrastructure for sustainability and economic activities	Improve the quality and amount of regional infrastructure	Stable road status [%]	41.15%	70%
				Percentage of length of local road network in good condition [km]	209	278
				Digital government indicator	3.75	3.85
3.	Improve even fairer and more equitable regional welfare	Strengthening Happiness Public	Increase Comprehensive and fair regional welfare	Economic growth	6.52	7.27
				Gini coefficient	0.42	0.36
				Inflation rate [%]	1.30	3.30
				Gross capita GRDP	27,654,339.50	28,155,865.91
				Unemployment rate	3.88	2.86
				Income	1.58	2.99
				Undeveloped villages	103	88
4.	Improve the quality of human resources	Quality improvement Personnel	Improve access and quality of education	Human development indicator	66.29	69.62
				Participation rate SMA/MA/SMK	76.13	78.00
				Literacy rate	99.81	100
				Average score	7.12	7.9
			Improve health	Average lifespan	66.59	68

			and nutrition	Total fertility rate	2.60	2.40
			Growth culture and Imtaq	Acquired cultural heritage Domestic and international recognition	3	15
				Ratio of places of worship (mosques) per population unit	0.23	0.25
		Reduce poverty	Reduce poverty rate	Poverty ratio	17.63	14.69
				Residents in poverty [people]	203,831	185,391
			Increased access to drinking water, proper hygiene, and residential areas	Cover ratio for access to proper drinking water	71.59%	83.02%
				Ratio of access to proper hygiene	56.27%	69.41%
				Ratio of reduction for slum regions	-	0%
5.	Outstanding governance and even more services	Even better and more services	Maintenance improvement	Reform indicator	CC	B
				Value of evaluation results Government performance	CC	BB

2.2.2 Environmental issues in Gorontalo Province

In Gorontalo Province, although the economy is growing remarkably, the underdeveloped infrastructure is an issue. In particular, development of the water and sewage infrastructure is lagging behind, and the population increase is causing increasingly serious pollution of rivers and lakes. As of 2018, Manado is the only city on Sulawesi that has a sewage system, which is for only part of the city. Furthermore, according to the PLN Statistics 2019 issued by the State Electric Company (Perusahaan Listrik Negara: hereinafter, "PLN"), the electrification rate in the province is reported to be 97.1%.[7] However, this rate excludes electric companies other than PLN, and there are still non-electrified areas. Also, in electrified areas, the fragile power infrastructure is a barrier to development; for example, there are frequent power outages.

When the government Gorontalo Province became independent from North Sulawesi, it adopted a policy of making corn agriculture the province's main industry and implemented a policy for subsidizing farmers. Consequently, cultivation has expanded not only to plains, but also to areas that are unsuitable for corn cultivation, such as steep slopes in hills and mountainous areas. Moreover, slash-and-burn cultivation has progressed in mountainous areas and caused rapid deforestation. As a result, in addition to the disappearance of CO2 sinks, the decline in the water holding capacity of forests leads to landslides and frequent floods in urban areas. In particular, the densely-populated city of Gorontalo is located in the central basin and is surrounded by hills and mountainous areas, so the terrain is vulnerable to floods and the accompanying impact is enormous. Additionally, it is estimated that 1,500,000 m3 of sediment flows into Lake Limboto (located in Gorontalo Regency and the city of Gorontalo) every year due to erosion of agricultural land and riverbanks. Some people predict that the lake will disappear in 2030 due to the lake bottom being buried in sediment. The impact of sediment inflow is also seen on the coast, where the sediment flowing from slopes pollutes seawater and kills coral reefs[8]. The influx of sediment is also affecting the ecosystem. For example, the water hyacinth, which is thought to have been carried from rivers, has rapidly propagated in Lake Limboto since around 2000. This sudden proliferation of the water hyacinth is viewed as a problem because it hinders the fishing industry and the growth of other plants.

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[7] PLN (June 2020), PLN STATISTICS 2019 (https://web.pln.co.id/statics/uploads/2020/11/Statistik-Inggris-2019.pdf)

[8] Kasamatsu et al., 2020 "Prior Study for the Biology and Economic Condition as Rapidly Environmental Change of Limboto Lake in Gorontalo, Indonesia" (https://iopscience.iop.org/article/10.1088/1755-1315/536/1/012005/pdf)

Slash-and-burn agriculture in mountainous regions

Lake Limboto is becoming shallower due to the inflow of sediment

Rapid propagation of water hyacinth in Lake Limboto

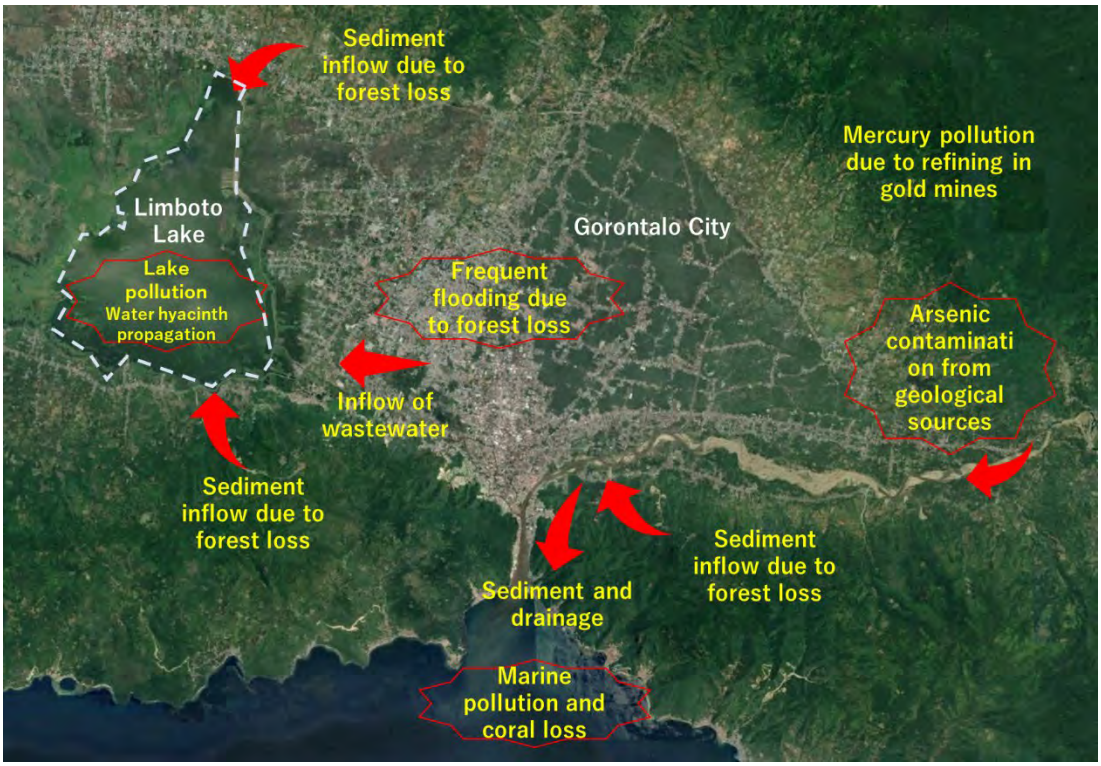
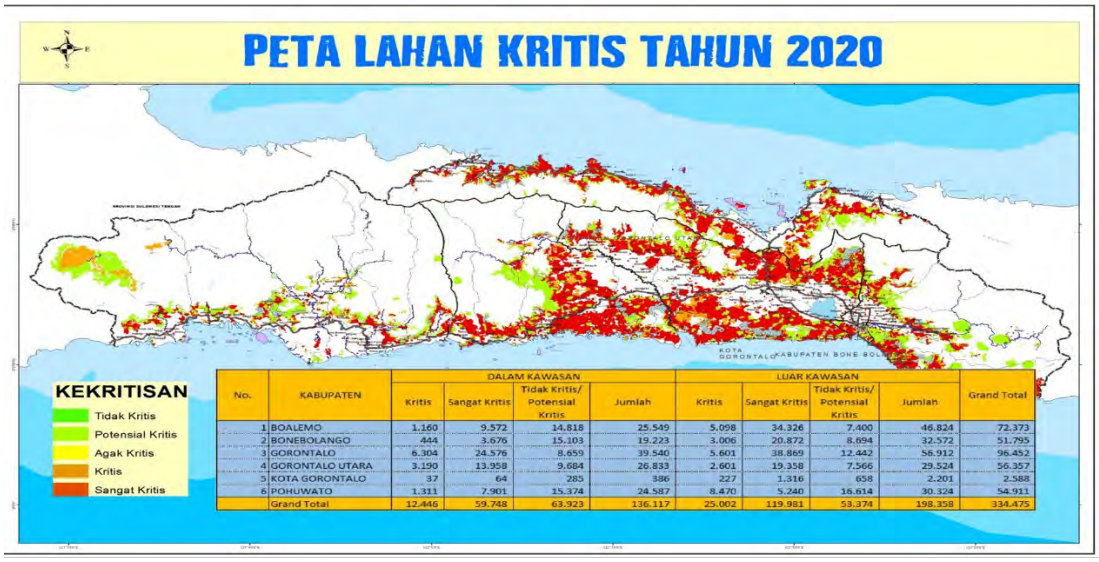


Figure 2-5 Environmental issues and geographic conditions in Gorontalo Province

The government of Gorontalo Province is also concerned about this situation. Figure 2-5 shows only the area around Gorontalo City, but as shown in Figure 2-6, the areas with the above-mentioned problems are spread throughout the state. In the workshop described in detail in section 5.4. Gorontalo Province mentioned that deforestation and other factors have reduced forest water retention capacity and reduced the size of Lake Limboto due to sediment influx, and that the number of critical areas in the province is increasing. Also, the following four major environmental issues were identified and Ehime Prefecture was requested to support the resolution of these issues based on

decarbonization.



No.	KABUPATEN	DALAM KAWASAN				LUAR KAWASAN				Grand Total
		Kritis	Sangat Kritis	Tidak Kritis/ Potensial Kritis	Jumlah	Kritis	Sangat Kritis	Tidak Kritis/ Potensial Kritis	Jumlah	
1	BOALEMO	1.160	9.572	14.818	25.549	5.098	34.326	7.400	46.824	72.373
2	BONEBOLANGO	444	3.676	15.103	19.223	3.006	20.872	8.694	32.572	51.795
3	GORONTALO	6.304	24.576	8.659	39.540	5.601	38.869	12.442	56.912	96.452
4	GORONTALO UTARA	3.190	13.958	9.684	26.833	2.601	19.358	7.566	29.524	56.357
5	KOTA GORONTALO	37	64	285	386	227	1.316	658	2.201	2.588
6	POHUWATO	1.311	7.901	15.374	24.587	8.470	5.240	18.614	30.324	54.911
	Grand Total	12.446	59.748	63.923	136.117	25.002	119.981	53.374	198.358	334.475

*Sumber: BPDASHL Provinsi Gorontalo-2020

Figure 2-6 At-risk areas in Gorontalo Province[2]

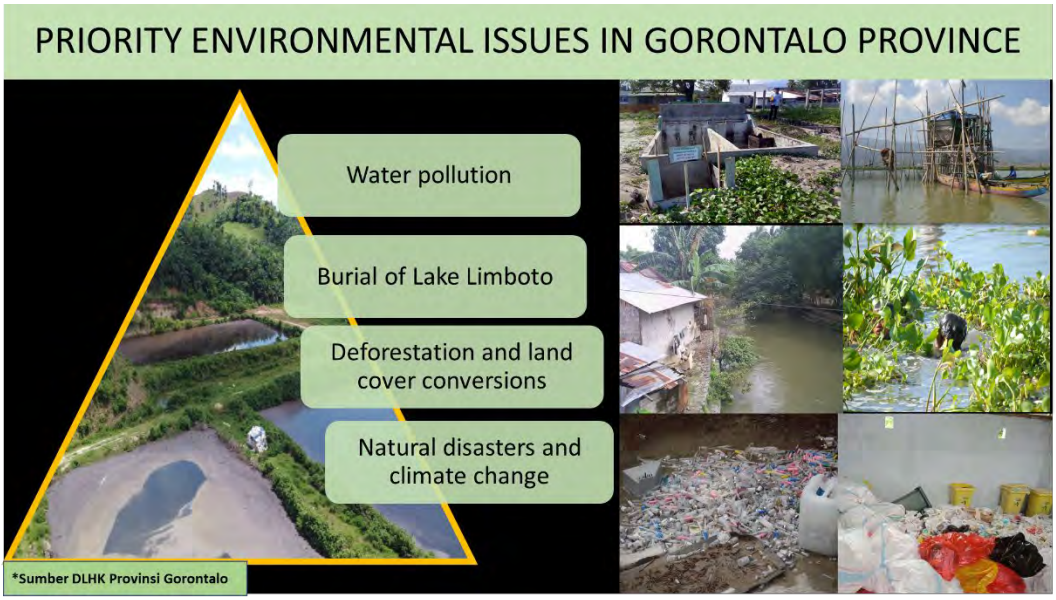


Figure 2-7 Priority environmental issues in Gorontalo Province[2]

At the time of exchange of opinions with BAPPEDA, the public works bureau, environment bureau, and agricultural bureau of Gorontalo Province this fiscal year, we asked about the environmental issues and political measures listed below to reconfirm the issues and needs, and visited related offices to grasp the actual situation.

Figure 2-８ Environmental issues and needs confirmed through the interview with the government of Gorontalo Province

2.３ Background of collaboration with Ehime Prefecture

2.３.１ Background for interaction

The relationship between Ehime Prefecture and Gorontalo Province has been fostered since Ehime University and Gorontalo State University entered into an academic exchange agreement in 2007. In 2013, Ehime Prefecture entered into an “Agreement for Joint Research and Human Resource Cultivation Through Three-Party Collaboration” with Gorontalo State University and North Gorontalo Regency, and then entered into a similar agreement with Gorontalo State University and Gorontalo Province in 2016. In this way, Ehime Prefecture has fulfilled a role of promoting inter-regional collaboration in industry, academia, and government. In 2016, a delegation from Gorontalo Province paid a courtesy call on the deputy governor of Ehime Prefecture. The visit led to deepened mutual understanding between the two regions and confirmation of the cooperative relationship that contributes to development of both regions.

Moreover, significant efforts were made by Mr. Rachmad Gobel, an expert on Japan who currently serves as vice-chairman of the People's Representative Council of the Republic of Indonesia and chairman of the Indonesia and Japan Friendship Association. Mr. Gobel’s family is from Gorontalo Province, which is his base of support. Furthermore, after graduating from Chuo University abroad, Mr. Gobel underwent practical training in Ehime Prefecture at the Toon Plant of Matsushita Kotobuki Electronics Industries. He also met with the current governor of Ehime Prefecture seven times, exchanging opinions on how to use technology held by corporations in Gorontalo Prefecture to improve the environment and industry in Gorontalo Province. Mr. Gobel’s

strong interest in the environmental technology of corporations in Ehime Prefecture led to the realization of presentations on environmental technology being given to the Minister of Environment and Forestry by corporations in Ehime Prefecture, and to business coaching between Ehime corporations and Indonesian corporations. In terms of this project, Mr. Gobel has requested support for the realization of a carbon-free society in Gorontalo Province, and he has promised full support for the implementation of the project.

At the start of this project, we have exchanged opinions twice with the government of Gorontalo Province and received agreement on project contents aimed at solving environmental issues based on decarbonization. The second meeting to exchange opinions featured participation by officials from Gorontalo State University and Ehime University, who agreed to implement the project through industry-government-academia collaboration. Regarding efforts for decarbonization, we have confirmed that each department has plans, but lacks effective implementation ability, and that there is strong interest in including a development plan for decarbonization in the next Regional Long-Term Development Plan (RPJMD). Additionally, it was commented that there are great expectations for the technology of corporations in Ehime Prefecture in regard to water pollution, which is one of the serious environmental issues of Gorontalo Province. Accordingly, Ehime Prefecture has stated that it is possible to provide support for decarbonization policies and technical cooperation for water treatment. Since COVID-19 has made travel difficult, an agreement was reached to continue the frequent exchange of opinions, including discussions held online.

Figure 2-9　Entering into the Three-Party Agreement in 2016

2.3.2 Conclusion of a memorandum for intercity collaboration and cooperation

In 2020, the Indonesian Ministry of Interior issued the "Minister of Interior Ordinance 2020 (No. 25) of the Republic of Indonesia: Procedures for Regional Cooperation with Overseas Local Governments and Regional Cooperation with Overseas Organizations (PERATURAN MENTERI DALAM NEGERI REPUBLIK INDONESIA NOMOR 25 TAHUN 2020) "TENTANG TATA CARA KERJA SAMA AERAH DENGAN PEMERINTAH DAERAH DI LUAR NEGERI DAN KERJA SAMA DAERAH DENGAN LEMBAGA DI LUAR NEGERI"). Consequently, when cooperating with overseas local governments, it is now required to perform various procedures such as submitting a plan, entering into an MOU, and receiving approval from the Indonesian Minister of the Interior.

BERITA NEGARA
REPUBLIK INDONESIA

No.513, 2020 KEMENDAGRI. Kerja Sama Daerah. Pemerintah Daerah di Luar Negeri. Lembaga di Luar Negeri. Tata Cara. Pencabutan.

PERATURAN MENTERI DALAM NEGERI REPUBLIK INDONESIA
NOMOR 25 TAHUN 2020
TENTANG
TATA CARA KERJA SAMA DAERAH DENGAN PEMERINTAH DAERAH
DI LUAR NEGERI DAN KERJA SAMA DAERAH
DENGAN LEMBAGA DI LUAR NEGERI

DENGAN RAHMAT TUHAN YANG MAHA ESA

MENTERI DALAM NEGERI REPUBLIK INDONESIA,

Menimbang : bahwa untuk melaksanakan ketentuan Pasal 35 dan Pasal 42 Peraturan Pemerintah Nomor 28 Tahun 2018 tentang Kerja Sama Daerah, perlu menetapkan Peraturan Menteri Dalam Negeri tentang Tata Cara Kerja Sama Daerah dengan Pemerintah Daerah di Luar Negeri dan Kerja Sama Daerah dengan Lembaga di Luar Negeri;

Mengingat : 1. Pasal 17 ayat (3) Undang-Undang Dasar Negara Republik Indonesia Tahun 1945;
2. Undang-Undang Nomor 39 Tahun 2008 tentang Kementerian Negara (Lembaran Negara Republik Indonesia Tahun 2008 Nomor 166, Tambahan Lembaran Negara Republik Indonesia Nomor 4916);
3. Undang-Undang Nomor 23 Tahun 2014 tentang Pemerintahan Daerah (Lembaran Negara Republik Indonesia Tahun 2014 Nomor 244, Tambahan Lembaran

www.peraturan.go.id

Figure 2-10 PERATURAN MENTERI DALAM NEGERI REPUBLIK INDONESIA NOMOR

Chapter 2, Paragraph 6-(1) of this law specifies the coverage as follows.

a. Cooperation with sister provinces
b. Cooperation sister cities/districts
c. Other cooperation

Paragraph 6-(2) states that cooperation undertaken by Indonesian local governments with overseas local governments in order to focus on cooperation in a specific field falls under category c. as listed above. Based on that classification, Section 9 demands cooperation in the following procedures.

> The inter-regional cooperation (omitted) mentioned in Paragraph 6-(1) must be implemented in the following stages.
>
> a. Concept
> b. Survey
> c. Declaration of intention to cooperate
> d. Creation of a cooperation plan
> e. Approval of DPRD (Regional People's Representative Council)
> f. Verification
> g. Creation of a cooperation document draft
> h. Discussion on a cooperation document
> i. Approval by the minister
> j. Signing of the cooperation document
> k. Implementation of cooperation

In this project, at the kick-off meeting with Gorontalo Province after adoption of the project, the MOU with Ehime Prefecture in regard to this project was referenced. The decision was made to enter into an agreement in order to comply with laws and regulations, and to ensure smooth implementation of the project. As shown below, the agreement was signed on December 15, 2021 by the governor of Gorontalo Province and the governor of Ehime Prefecture. Additionally, a written plan was prepared together with Gorontalo Province and submitted to the Ministry of Home Affairs from Gorontalo Province together with the original MOU, and it was approved.

In addition, the contents of the letter of intent (LOI) to cooperate were discussed by Ehime Prefecture, Gorontalo Province, the Ministry of Home Affairs, and the Ministry of

Foreign Affairs, and the MOU was concluded on September 23, 2022.

Through the LOI and MOU, we reached agreements in the four fields: environmental management, economic & industrial development, agriculture & forestry, and education & training. In each field, we set an action program including the items to be discussed in this project, produced an action plan summarizing expected results, the roles of organizations that will execute it and others, etc., had many discussions with the Ministry of External Affairs, the Ministry of Internal Affairs, Gorontalo Province, and Ehime Prefecture, and made their contents approved by the Ministry of External Affairs and the Ministry of Internal Affairs.

Figure 2-１１　Discussion about the MoU with Ehime Prefecture and Gorontalo Province with the Ministry of External Affairs and the Ministry of Internal Affairs

The action plan describes projects to be commercialized, the support for the formulation of a decarbonization plan in Gorontalo Province, and concrete support from Ehime Prefecture. The following shows the results of cooperation between Ehime Prefecture and Gorontalo Province in this project, which are described in the action plan.

<u>Environmental management</u>

- Information on identification and prediction of major sources of greenhouse gases in Gorontalo Province
- Data for purifying the Limboto Lake
- Results of the study on feasibility of the adoption of wastewater treatment technology for seepage water at the final disposal site (TPA Talmelito)

<u>Economic and industrial development</u>

- Results of the study on feasibility of the adoption of wastewater treatment technology by a business operator that discharges a lot of industrial wastewater

(a coconut processing plant)

- Results of the study on feasibility of biomass power generation by a business operator that consumes a lot of energy (a coconut processing plant)
- Information on products and technologies of enterprises in Ehime Prefecture and Gorontalo Province
- Business matchmaking in both municipalities

Agriculture and forestry

- Forest conservation plan in Gorontalo Province
- Empowerment of famers for conserving forests and important land
- Results of feasibility study on ideal hillside farming

Education and training

- Education of stakeholders about the maintenance and management of water infrastructure systems
- Holding seminars on cacao farming targeted at enterprises and farmers in Gorontalo Province
- Holding seminars on the environment targeted at Gorontalo State University

A ceremony for signing an MOU was held on January 19, 2023 and attended by the governors of Ehime Prefecture and Gorontalo Province as well as the deputy speaker Gobel of the People's Representative Council of Indonesia, when the squad of the mission for the economic exchange between Ehime Prefecture and Indonesia visited Gorontalo Province. This ceremony will be described in detail in Chapter 5.2.

Chapter 3 Field of regional water infrastructure establishment using carbon-free energy

In most areas of Gorontalo Province, human waste and domestic wastewater flow untreated into rivers through gutters, causing water pollution in rivers, lakes, and oceans. As discussed later in this report, there are plans to develop water and sewage infrastructure throughout Indonesia and Gorontalo Province, but the progress of said development is unknown.

In this project, we will focus on wastewater treatment technology and discuss the adoption of septic tanks for the purpose of improving water pollution. We will also consider power generation using the biogas obtained by fermenting the generated septic tank sludge with methane. In Gorontalo Province, we have confirmed the intention to incorporate a decarbonization viewpoint into the development plan, so we will select decarbonization technology for equipment to be installed and consider the realization of carbon-free water infrastructure at the development stage. Therefore, we will consider the use of solar power generation, etc., to generate the electricity required for operating the septic tank and methane fermentation equipment, thus achieving zero emissions. The following diagram shows the currently envisioned flow of regional water infrastructure development using decarbonized energy.

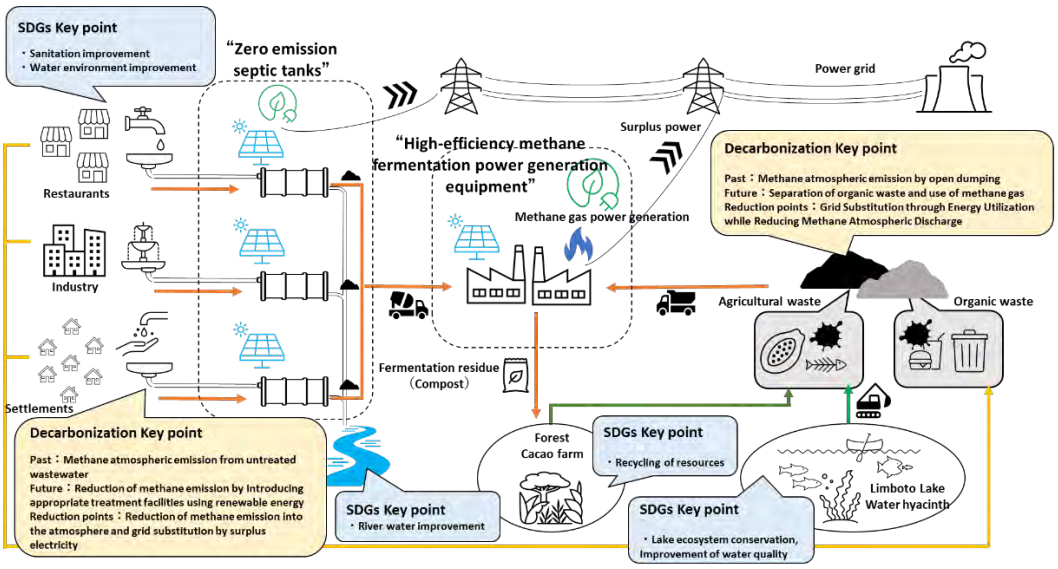


Figure 3-1 Regional water infrastructure development using carbon-free energy: Schematic diagram of reducing CO_2 emissions

Since water infrastructure is a public infrastructure, we expect that water infrastructure will be developed based on the budgets of the national and local governments.

Accordingly, the province has the authority to select technologies and formulate plans, so we can be involved easily. In the project in FY 2021, we studied the policies and plans of Gorontalo Province, Indonesia and discussed the feasibility of installation of septic tanks and methane fermentation equipment, which would become the foundation for water infrastructure development. This fiscal year, we summarized more detailed contents based on the above results.

The following sections 3.1 to 3.4 describe the details and results of the discussions.

3.1 Equipment to be installed

3.1.1 Septic tanks

1） Mechanism of a septic tank

A septic tank is a decentralized (on-site type) domestic wastewater treatment technology/facility developed in Japan. It is equipment that uses a solid-liquid separation function and a microbial treatment function to purify human waste and domestic wastewater.

The general treatment process in a septic tank is as follows. First, the supernatant and solid matter in influent sewage is settled in a sedimentation separation tank. Next, a portion of organic matter is decomposed by anaerobic microorganisms in an anaerobic filter bed tank and the nitrified water returned from the moving bed biofilm tank is denitrified. Then, air is blown in by a blower in the carrier flow tank. The organic substances are decomposed by aerobic microorganisms, and ammonia is nitrified, then the treated water is separated into the sludge and supernatant liquid in the settling tank. Finally, the treated water is disinfected with chlorine in the disinfection tank and then released. The basic structure of a septic tank is shown below.

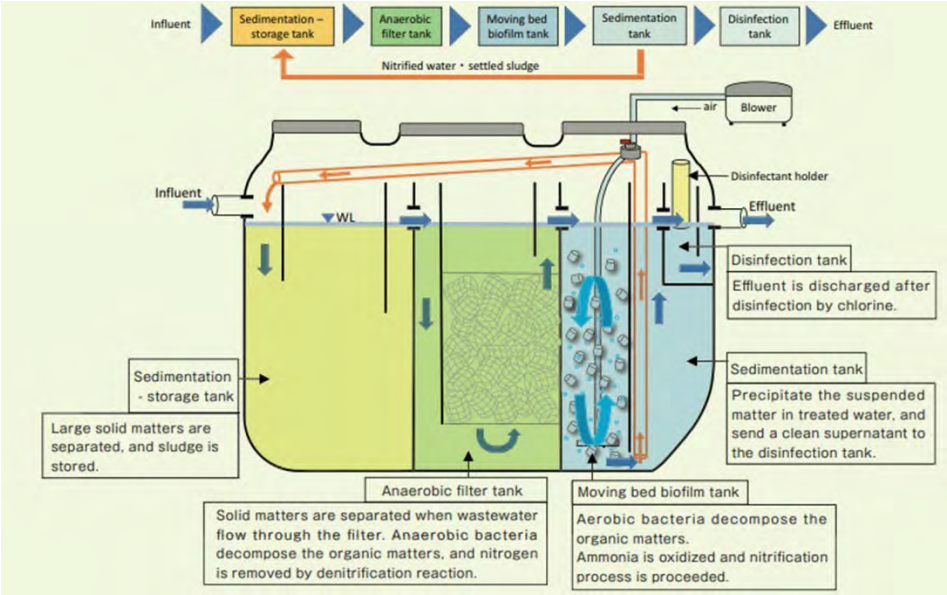
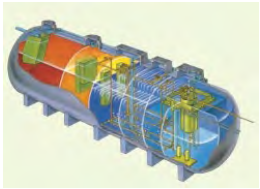


Figure 3-２　Structure and mechanism principle of a septic tank[9]

Furthermore, the size, treatment method, materials of the septic tank body, etc. can be selected according to the purposes of use of buildings, the quantity and quality of the sewage to be treated, the water quality regulation status of the discharge destination, etc. Septic tanks are classified as follows depending on the size of their treatment capacity.

Table 3-１　General classification of septic tanks[9]

Classification	Appearance	Overview
Compact septic tank		Used for detached houses and small-scale wastewater treatment by tanks for up to 50 people (10 m^3 per day for daily average sewage amount). The tank is normally manufactured at a factory from the plastics FRP (fiber reinforced plastic) or DCPD (dicyclopentadien).
Mid-size septic tank		Used for medium-scale wastewater treatment by tanks for 51 to 500 people (100 m^3 per day for daily average sewage amount). The tank is normally manufactured at a factory from the plastic FRP, or installed on-site using reinforced

[9] Ministry of Environment Japan (March, 2019) "Urine Treatment and Decentralized Domestic Wastewater Treatment Systems in Japan" (http://www.env.go.jp/recycle/jokaso/basic/pamph/pdf/wts-jp_full.pdf)

		concrete (RC).
Large septic tank		Used for large assembly processing by tanks for 501 people or more. Then tank is usually installed on-site using reinforced concrete (RC).

In Japan, Article 3 of the Purification Tank Act stipulates that human waste and domestic wastewater shall be treated by a septic tank if a sewerage system or human waste treatment facility is not used. As of the end of 2019, about 7.6 million septic tanks have been installed throughout Japan.[10] Also, in the Export Strategy for Infrastructure Systems 2025[11] formulated in 2020, the installation of septic tanks is listed as one of the actions in each field. We are supporting the overseas deployment of septic tanks (including those of SMEs) for public health and water environment conservation in the Southeast Asian region.

２） Overview of septic tank manufactured by Daiki Axis Co., Ltd.

In this project, we will discuss the introduction of a septic tank manufactured by Daiki Axis Co., Ltd.

Ever since it developed the industry's first lightweight and durable FRP septic tank, Daiki Axis has been developing low-cost and efficient products. For example, in January 2014, at the Eco Mark Award 2013 hosted by the Eco Mark Office of the Japan Environment Association, the company's XE household septic tank became the first septic tank to obtain Eco Mark certification. In addition to achieving the target value of minus 46% as set by the Ministry of the Environment, it realized power saving performance and stable wastewater treatment capacity, and reduced the total capacity to about 85% compared to the conventional product by using recyclable polypropylene. In this way, the XE household septic tank contributes to on-site work reduction and cost reduction. The structure and functions of the company's FRP septic tanks are shown below.

[10] Ministry of the Environment (February 2021) "Press Release Materials" (https://www.env.go.jp/press/109154.html)

[11] Prime Minister's Official Residence (June 2021) "Export Strategy for Infrastructure Systems 2025" (revised in June 2021) (https://www.kantei.go.jp/jp/singi/keikyou/pdf/infra2025.pdf)

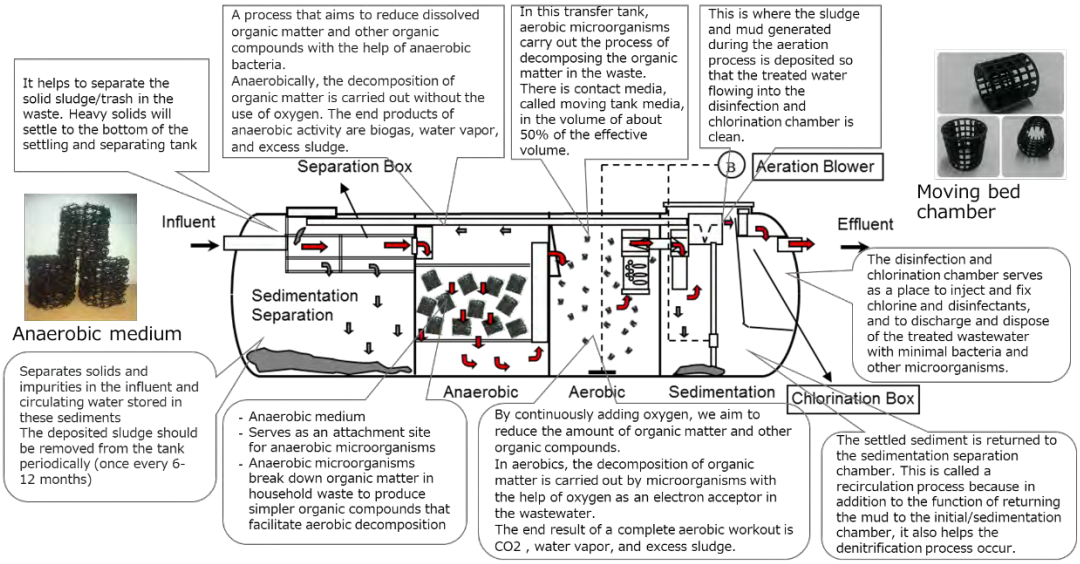


Figure 3-３　Structure and Functions of Daiki-Axis' FRP Septic Tanks[12]

Moreover, since Daiki Axis has an affiliated company in Indonesia and is operating a septic tank installation business mainly in Jakarta in accordance with the above-mentioned Indonesian laws and regulations, the company has a strong technical advantage in introducing septic tanks that meet local issues. The following shows the Indonesian domestic wastewater standards and the treatment performance of the company's septic tanks shown in エラー! 参照元が見つかりません。.

Table 3-２　Treatment Performance of Daiki Axis' Septic Tanks and Indonesian Domestic Wastewater Standards[12]

パラメータ	単位	流入	放流BA（LHKの基準に該当しないもの）	放流BJ（LHKの基準に該当するもの）	基準*
pH	[-]	6 – 9	6 – 9	6 – 9	6 – 9
BOD	[mg / L]	300	20	20	30
COD	[mg / L]	400	100	80	100
TSS	[mg / L]	240	30	20	30
アンモニア	[mg / L]	50	-	10	10
油脂	[mg / L]	40	10	5	5
総大腸菌数	【数/ 100ml】	-	3000	3000	3000

These achievements in Indonesia were reported at the Indonesia-Japan Environmental Week hosted by Japan and the Ministry of Environment and Forestry of the Republic of Indonesia in January 2021.[13] Daiki Axis Co., Ltd. has a track record of installing its

[12] Material provided by Daiki-Axis
[13] Presentation Material from Indonesia-Japan Environmental Week (January 2021) "Introduction of Decentralized Small Scale Waste Water Treatment Technology in Indonesia" (https://www.oecc.or.jp/jprsi/event/envweek/program/files/20210114_sem_2-6_pt_daiki_axis.pdf)

products in facilities of various sizes, some of which are listed below.

Figure 3-4 Examples of Products of Daiki-Axis Installed in Indonesia[12]

	
Compact septic tank (for up to ten people)	Large septic tank (for use at offices, apartments, hotels, etc.)

Figure 3-5 Septic tanks installed in Indonesia by Daiki Axis Co., Ltd.

Furthermore, in this project, from the viewpoint of decarbonization, we consider a system that uses solar power to obtain the power required for the operation of septic tanks. Regarding the solar power system, we will procure solar panels in Indonesia and consider an integrated introduction format in which Daiki Axis handles all stages from installation to management. Since this project has a public nature, there is a high possibility that the equipment will be procured publicly. Although price issues exist, it is possible to create a favorable competitive environment for installation based on the utilization of the JCM facility investment subsidy and Daiki Axis's experience in general contracting business and construction. The company also possesses the experience of the design and construction of septic tanks based on solar power generation equipment in mountainous areas in Japan.

3） Review items for installation

When installing a septic tank, it is necessary to clearly grasp and set the inputs and outputs, to use the set values for selecting products of appropriate size, and examine the feasibility of installing a system. We will review requirements for each of the three stages as follows:[14]。

- Input (conditions for acceptance of domestic wastewater)

  At the time of installing facilities, acceptance conditions are set while considering the actual conditions, process, and output of wastewater treatment. Examples of conditions include wastewater discharge status, wastewater properties, identification

[14] Supervised by Toru Furuichi, edited by the Organic Waste Recycling Association (OWRA) (March 2006) *Biogas Technology and Systems*, p. 76

of substances for which treatment is inappropriate, and acceptance form.

- Process conditions (conditions for setting treatment technology)

These are specific conditions necessary when reviewing the size and installation of the product. These conditions determine the basic performance of facilities that satisfy conditions for input and output, and also take into account regulatory standards and emergency response.

- Output (conditions for using septic tank sludge)

These are conditions necessary for utilizing the septic tank sludge generated as a result of the treatment. In addition to the properties and amount of septic tank sludge, these conditions include the transportation method to the destination, the transportation route, and seasonal variation in the amount.

The following table summarizes the specific contents of the three stages listed above.

Table 3-3 Specific contents of requirements for septic tank installation

Requirement category	Requirement contents	
Input (conditions for acceptance of domestic wastewater)	Discharge status of wastewater	Discharge amount and characteristics of wastewater (daily fluctuations, seasonal fluctuations, discharge types by region), Emission sources (general households, commercial facilities, etc.)
	Properties of wastewater	pH, TSS, BOD, CODcr, NH4-N , TN, TP, N-Hex (or Oil & Grease), etc. Presence or absence of fluctuation in properties (seasonal fluctuations, etc.)
	Identification of substances for which treatment is inappropriate	Type, mixing ratio (%), concentration (mg/L)
	Acceptance form	Method of receipt: Method of piping from homes, etc.
Process conditions (conditions for setting treatment	Conditions of location scheduled for construction	Distance from the main source and difference in height Distance and height difference from treated water discharge destination Site area, topography, geology, climatic

technology)		conditions Legal regulations, surrounding environment, access Conditions for receipt of electricity, water services, etc.
	Processing capability	Processing capacity [m^3 per day] Annual working days [days per year] Capacity of receiving and storing equipment (corresponding to the maximum receipt amount)
	Pollution control standards, etc.	Regulatory standards Existence/absence of requested criteria from local residents, etc.
	Pre-treatment	Necessity of pre-treatment equipment and treatment method
	Treatment method	Separated contact aeration method, anaerobic filter floor contact aeration method, denitrification filter floor contact aeration method, phosphorus removal/denitrification floor contact aeration method, etc. Necessity and quantity of treatment auxiliary materials
	Wastewater treatment	Discharge destination Properties of discharged water: BOD, nitrogen concentration, salt concentration
	Electrical instrumentation specifications	Central monitoring control items (type and number of items), field operation items (type and number of items) Contents of automatic operation control for labor-saving
Output (conditions for using septic tank sludge)	Sludge Generation	Amount generated [m^3 per day or m^3 per month]
	Properties of sludge	pH, TSS, BOD, COD, NH4-N , TN, TP, etc. Apparent specific density [t/m^3], moisture content [%] Presence or absence of fluctuation in properties (seasonal fluctuations, etc.)

	Transportation method for sludge	Sludge carry-out: frequency, quantity, transportation route, distance Annual carry-out plan, management/maintenance system, etc. Carry-out method, carry-out vehicle specifications
	Destination for sludge usage	Usage conditions: Usage destination, usage form, demand amount, properties, seasonal fluctuations in quantity, purchase price (paid or free)

3.1.2 Methane fermentation equipment

1） Mechanism of methane fermentation equipment

The main purpose of the methane fermentation process is to recover methane safely and efficiently from waste biomass such as organic wastewater, sewage sludge, livestock waste, and kitchen waste. This is done using an anaerobic microbial reaction. The process is also intended to reduce the volume of waste sludge.

In general, in order to use methane fermentation equipment, it is necessary to remove foreign substances that are not suitable for fermentation from the received material. It also requires a sorting process by manual sorting, mechanical crushing and sorting, or a combination of both.

Next, a solubilization process may be performed as a pre-treatment to promote fermentation. The post-treatment process requires a methane fermenter for fermenting organic substances, a desulfurization device necessary for utilization of the generated biogas for power generation, a gas holder, a power generation facility, a boiler, a surplus gas combustion device, and other equipment. The type of equipment to be installed for the fermentation residue will differ depending on the purpose of use.

For example, there is a case in which the fermentation residue is sprayed as a whole liquid fertilizer. The equipment required in that case includes a liquid fertilizer storage tank, a liquid fertilizer carrier, and a sprayer for the case where the business operator itself sprays the liquid fertilizer. For some other facilities, solid-liquid separation treatment is performed and the solid part is composted, converted to solid fuel, or dried and then incinerated as industrial waste. The liquid part is treated as wastewater and then discharged into sewage. In this way, the installed equipment will differ depending on the method for treating the fermentation residue. The following diagram shows the basic

structure of the methane fermentation process.

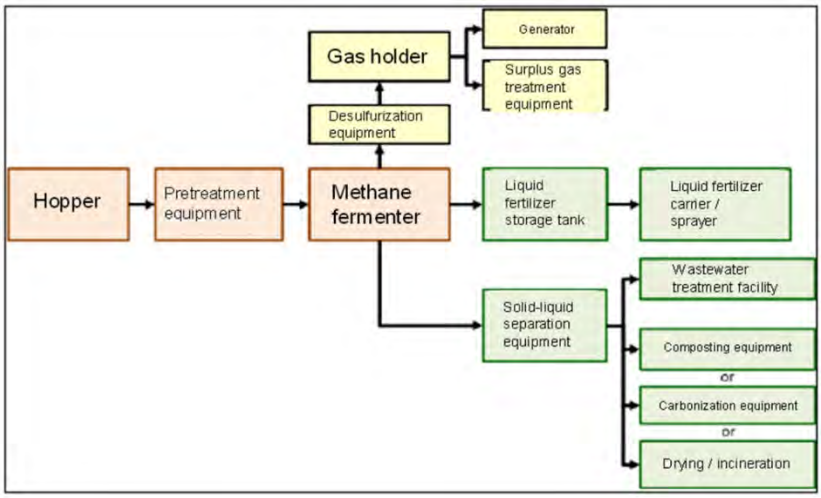


Figure 3-6 Basic structure of the methane fermentation system[15]

Moreover, the type of methane fermentation process varies between discharged water treatment for mainly soluble components and solid waste treatment for mainly solids. Wastewater treatment is classified according to treatment in the methane fermentation tank, such as returning concentrated sludge to the methane fermentation tank (anaerobic contact method, ABR method), using biofilm (anaerobic filter bed method, anaerobic fluidized bed method), or immobilizing bacterial cells (UASB method, EGSB method).[16] On the other hand, solid waste treatment is roughly classified, according to the sludge concentration in the formation tank, into two types: the "wet method" and "dry method." The wet method is divided into a two-phase method, in which treatment is conducted by suspending methane bacteria at a low sludge concentration, and a one-phase method, with two types of medium-temperature fermentation and high-temperature fermentation. On the other hand, the dry method is divided into the horizontal type and the vertical type, both of which are high-temperature fermentation techniques. The following table outlines the UASB method, EGSB method, wet method, and dry method.

Table 3-4 Comparison of methane fermentation technologies[17]

	Wastewater	Solid waste	
Item	UASB method/EGSB	Wet method	Dry method

[15] Japanese Ministry of the Environment "FY2017 Report on Regional Circulation Area and Eco-Town Low Carbon Promotion Project," Okinawa Prefecture, Japan NUS Co., Ltd., p. 101
[16] Edited by Tatsuya Noike (May 2009), "Methane Fermentation", p. 85
[17] NEDO (April 2021), "Part 3: Fundamentals Related to Methane Fermentation Technology." (https://www.nedo.go.jp/content/100932093.pdf)

	method		
Raw material concentration	5 to 8%	2 to 10%	15 to 30%
Treatment overview	Methane bacteria are granulated and fixed and low SS concentration wastewater is treated	Methane bacteria are suspended and treated at low sludge concentration	Treated at high sludge concentration using methane bacteria
Characteristics	· High efficiency · EGSB method: Heavy-duty operation is possible compared to UASB method (the fluidized bed type UASB method is the EGSB method)	· Easy operation management · Treatment using digestive solution is unnecessary (when a liquid fertilizer is utilized)	· Treatment of solids is possible · Increased gas generation amount per raw material unit weight
Main applications	· Food wastewater	· Business/household garbage · Food processing residue · Livestock manure · Sewage sludge	· Municipal solid waste · Solid waste
Implementation record	Large number in Japan (UASB method)	Large number in Japan	Very small number in Japan
Tolerance for non-conforming mix	Small (Liquid waste treatment with low SS concentration)	Small	Large
Wastewater treatment	Some discharge standards require	Required (when liquid fertilizer treatment is	Unnecessary (differs depending

	aerobic treatment	not performed)	on material conditions)
Maintenance of fermentation tanks	Not necessary with proper operation and management	Periodic maintenance required	Almost unnecessary
Contact method for methane bacteria and organic material	Contact depending on wastewater velocity	Agitated inside the fermentation tank	To mix raw materials with drawn sludge and insert into the fermentation tank

The target raw material in this project is the sludge discharged from the septic tank mentioned above. On the other hand, when considering economic efficiency, it is desirable to increase the amount of power generation through methane fermentation gasification by using food waste, etc., with higher fermentation efficiency as the main raw material. Therefore, this project will target biomass resources such as food waste as raw materials for methane fermentation equipment, earn profits from selling electricity, and consider treatment of septic tank sludge by mixing septic tank sludge as raw materials.

We will discuss the adoption of methane fermentation technology of Aiken Kakoki K.K. The company is located in Ehime Prefecture and conducts methane fermentation using solid waste such as agricultural products at domestic food factories. Also, in Indonesia, Aiken Kakoki conducted a pilot test of methane fermentation using wastewater palm oil factories operated by the Indonesian government (Palm Oil Mill Effluent: POME) and confirmed performance (recovered energy amount, methane concentration) as part of the JICA project in FY 2020. Aiken Kakoki's methane fermentation technology is more competitive than other companies' technologies for stirring, and has a high gas recovery rate and a track record of stable removal. The technology will be discussed in detail in the next section.

２） Overview of methane fermentation technology at Aiken Kakoki K.K.

In detail, system price and the investment recoupment period decreased to about 2/3 of those for the conventional EGSB method. In wastewater treatment by the EGSB method described above, Aiken Kakoki K.K. succeeded in developing a self-contained circulating drainage system that dramatically improves the stability, efficiency, and economic efficiency of wastewater treatment, and does not require any external energy. As a result,

this wastewater treatment system is capable of generating profits while treating factory wastewater, and possesses a high advantage as optimal wastewater treatment equipment for emerging countries where effective use of biomass and energy is scarce. Specifically, the system price and investment recovery period have been reduced to about two-thirds compared to the conventional EGSB method.[18] An overview of the system developed by Aiken Kakoki K.K. is shown below.

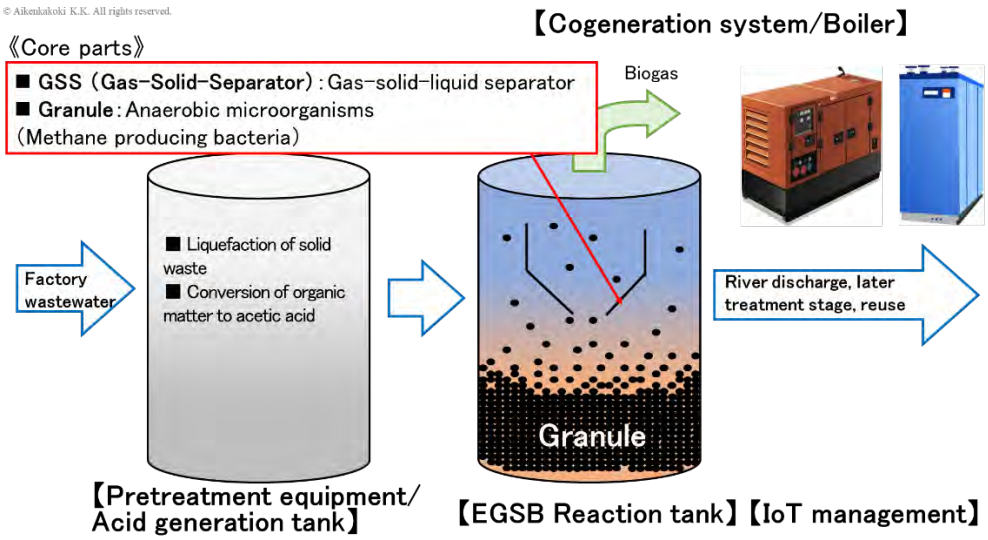


Figure 3-7 Overview of the EGSB system[19]

In the EGSB method, the wastewater treatment capacity and the biogas recovery capacity differ greatly depending on the structure of the three-phase separator (Gas Solid Separator: GSS) in the reaction tank. Although many companies outsource the design of GSS, Aiken Kakoki develops it in house. Therefore, it has accumulated GSS design know-how, and it is possible to design equipment based on the specifications of the entire reaction tank. As a result, Aiken Kakoki has succeeded in increasing the recovery rate of biogas, and it is possible to recover the investment faster than the products of other companies[20]. Additionally, Aiken Kakoki is highly competitive in terms of price because it can handle everything from design to sales to maintenance. After delivering the first unit to a major food factory in 2005, the company has installed a total of 21 units as of 2021. The company's EGSB process results are shown below.

[18] NEDO (November 2021), "Reference Material for NEDO Venture and Emerging Business Matching Meeting" (https://www.nedo.go.jp/content/100939230.pdf)
[19] Material provided by Aiken Kakoki
[20] JICA (June 2020) Feasibility Survey for a Project for Treating Highly Concentrated Effluent with Biogas Recovery at Palm Oil Mill in Indonesia: Work Completion Report, Aiken Kakoki K.K., p, 8

Table 3-５　Installation results of EGSB method at Aiken Kakoki [19]

	水量	原水	処理水	回収エネルギー量		対象排水
	(m3/日)	COD (mg/l)	COD (mg/l)	(Nm3/日)	(kwh/日)	
1	600	5,800	580	1,378	3,740	農産物加工
2	1,000	8,000	1,200	2,992	8,120	製綿洗浄排水
3	650	4,300	430	1,107	2,817	総菜･菓子製造

Aiken Kakoki also possesses experience in energy recovery (methane fermentation by the digestion tank method) equipment using factory residues such as food waste, based on customer needs. By utilizing know-how in areas such as energy efficiency accumulated through wastewater treatment, Aiken Kakoki operates a miniaturized and highly efficient demonstration facility and conducts technical evaluation. The following photograph shows methane fermentation equipment using the digestion tank method at a food factory in Japan.

Methane fermentation equipment using POME at a palm oil mill in Indonesia

Methane fermentation equipment using food residues at a domestic food factory

Figure 3-８　Installed methane fermentation equipment using the digestion tank method[19]

Moving forward, Aiken Kakoki will consider the treatment technology and optimal system design according to the properties of biomass resources as raw materials.

３）　Review items for installation

When installing a septic tank, it is necessary to clearly check and set the inputs and outputs, to use the set values for selecting products of appropriate size, and to verify the feasibility of installing a system. As discussed above, we will review requirements for each of the three stages as described below, based on the assumption that other organic

waste will be used as fermentation raw materials in addition to septic tank sludge.[21]

- Input (conditions for acceptance of organic waste)

At the time of installing facilities, acceptance conditions are set by considering the actual conditions, process, and output of wastewater treatment. Such conditions include waste discharge status, waste properties, identification of substances for which treatment is inappropriate, and collection form.

- Process conditions (conditions for setting treatment technology)

These are specific conditions necessary when designing equipment. These conditions determine the basic performance of equipment that satisfies conditions for input and output, and also follows regulatory standards and emergency response.

- Output (conditions for using recycled resources)

These are conditions necessary for utilizing the recycled materials and energy (electricity/heat) generated through the treatment. In addition to the shape, properties, and amount required of recycled materials, these conditions also include items such as the transportation method to the usage destination, the transportation route, and seasonal variation in the demand amount.

The following table summarizes the specific contents of the three stages listed above.

Table 3-6 Specific contents of requirements for methane fermentation tank installation[22]

Requirement category	Requirement contents	
Input (conditions for acceptance of domestic waste)	Discharge status of waste	Discharge amount and characteristics of septic tank sludge and organic materials (daily fluctuations, seasonal fluctuations, discharge form by region) and emission sources (general households, commercial facilities, etc.)
	Properties of waste	【Septic tank sludge】 pH, TSS, BOD, CODcr, NH4-N, T-N, T-P, T-K, VS, C/N ratio, nutrients, N-Hex (or Oil & Grease), etc. 【Organic waste】

[21] Supervised by Toru Furuichi, edited by the Organic Waste Recycling Association (OWRA) (March 2006) Biogas Technology and Systems, p. 76

[22] Supervised by Toru Furuichi, edited by the Organic Waste Recycling Association (OWRA) (March 2006) Biogas Technology and Systems, p. 77

		Apparent specific density (t/m^3), moisture content (%), pH, TSS, BOD, CODcr, NH4-N, T-N, T-P, T-K, VS, C/N ratio, nutrients Presence or absence of fluctuation in waste quality (seasonal fluctuations, etc.)
	Identification of substances for which treatment is inappropriate	Type, mixing ratio (%), concentration (mg/L)
	Collection form	Collection container/bag type: Bag, bucket/container Number of collection days/delivery days (tons per week), annual delivery plan, etc. Specifications of collection vehicles and vehicles that carry in waste
Process conditions (conditions for setting treatment technology)	Conditions of location scheduled for construction	Distance from the main source and distance and height difference from treated water discharge destination Site area, topography, geology, climatic conditions Legal regulations, surrounding environment, access Conditions for receipt of electricity, telephone, water services, etc.
	Processing capability	Processing capacity (tons per day) Annual working days (days per year) Capacity of receiving and storing equipment (for the maximum receipt amount)
	Operating time by process	Pre-treatment, fermentation equipment, etc. (hours per day)
	Pollution control standards, etc.	Regulatory standards Existence/absence of requested criteria from local residents, etc.
	Pre-treatment	Necessity of pre-treatment equipment and treatment method
	Treatment method	EGSB, UASB, Anaerobic fermentation

		(methane fermentation: high-temperature method, medium-temperature method) Necessity and quantity of processing auxiliary materials
	Number of treatment equipment series	Single series, multiple series
	Use of treatment products (resources)	Properties, usage method, and usage amount of products (biogas, compost, livestock feed, carbide) Treatment of surplus products
	Disposal of substances for which treatment is inappropriate	Method of disposal of substances for which treatment is inappropriate
	Digested liquid treatment	Use or non-use as liquid fertilizer; discharge destination in the case of discharge Properties of discharged water: BOD, nitrogen concentration, salt concentration
	Electrical instrumentation specifications	Central monitoring control items (type and number of items), field operation items (type and number of items) Contents of automatic operation control for labor-saving
Output (conditions for using septic recycled materials)	Biogas usage	Use of power generation: Power supply destination, power supply method, power supply capacity, power sale (power sale unit price, etc.) Heat utilization: Usage destination, usage conditions, heat supply amount, supply medium (hot water, steam) Direct usage: Supply conditions, degree of purification, supply method, supply amount, supply unit price
	Digested liquid usage	Usage destination conditions: Usage destination, usage form, demand amount,

	(liquid fertilizer usage)	properties, seasonal fluctuations in demand amount, purchase price (paid or free)
	Distribution of recycled materials	Sales channels, transportation routes, transportation methods, etc., for recyclable materials

Moving forward, after selecting candidate sites for equipment installation, the installation site will be selected based on the above requirements. The current candidate sites for installation will be described in detail in the next section.

3.2 Selection of additional potential sites and estimation of the effects of installation

This project aims to introduce wastewater treatment using a septic tank and methane fermentation equipment for organic waste, based on the model of Gorontalo City, where wastewater treatment problems are particularly serious in Gorontalo Province, with a view to spreading it throughout the province in the future. On the other hand, since it is not realistic to install septic tanks on a large scale in Gorontalo Province, where the development of sewerage systems is lagging behind, we have been carefully considering the process for gradually disseminating septic tanks for single or multiple facilities since the last financial year. The same is true for methane fermentation facilities, and we plan to first consider installing such facilities at factories that can stably supply a certain amount of organic waste.

In addition, in consideration of economic efficiency, we set the policy to utilize biomass resources such as food waste as raw materials for methane fermentation facilities and earn profit from the sale of electricity, while disposing of the sceptic tank sludge by mixing it as raw materials, and in the last fiscal year we proposed a model plan to combine wastewater treatment using septic tanks and waste treatment using methane fermentation facilities.

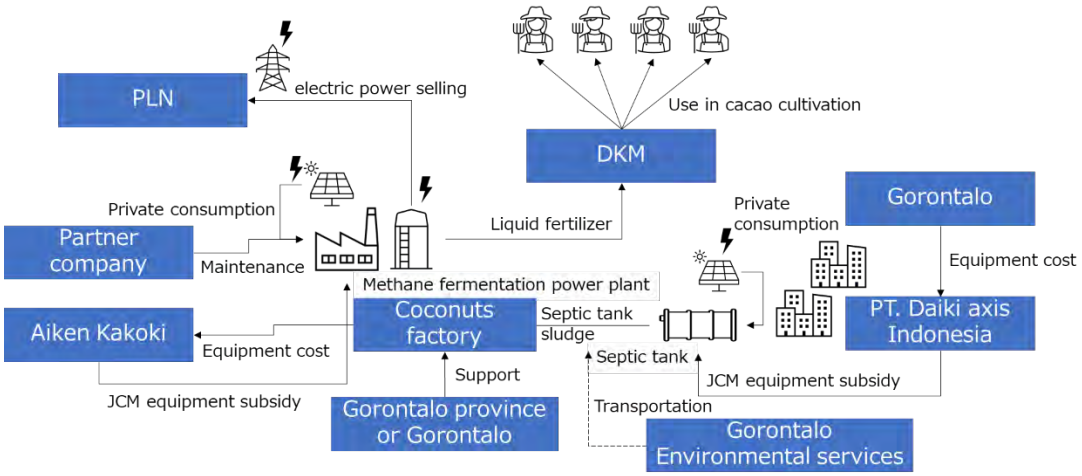


Figure 3-9 Proposed model for the project in the last financial year

In this financial year's project, based on the above-mentioned policies, we collected information on potential sites through an exchange of opinions with the Gorontalo provincial government, and examined the possibility of adopting them.

3.2.1 Septic tanks

In considering the installation of septic tanks, in the last fiscal year, BAPPEDA of the

Gorontalo Province requested support for a total of eight student dormitories, three in Bone Bolango Regency, two in Gorontalo Regency, and three in Gorontalo City, as facilities with high wastewater treatment needs. Currently, wastewater is processed at each separate facility, but in discussions with BAPPEDA, we were assured of its intention to consider intensive processing using the Japanese technology in the future. The following is a detailed description provided by BAPPEDA of the Gorontalo Province regarding the student dormitories with high needs for wastewater treatment.

SMA TERPADU WIRA BHAKTI GORONTALO 	MAN INSAN CINDEKIA GORONTALO 	MA SWASTA HUBULO GORONTALO 
371 students	346 students	467 students
Water source: Tap water, well water	Water source: Well water	Water source: Well water
Waste management: Environmental services in Bone Bolango and incineration	Waste management: Environmental services in Bone Bolango	Waste management: Environmental services in Bone Bolango
Water Sanitation Management: Inflow into irrigation canals	Water Sanitation Management: Inflow into irrigation canals	Water Sanitation Management: Inflow into rivers

MADRASAH ALIYAH AL-ISLAM 	MADRASAH ALIYAH AL-FALAH 
108 students	187 students
Water source: Well water	Water source: Tap water
Waste management: Environmental services in Gorontalo	Waste management: Independently managed
Water Sanitation Management: Inflow into irrigation canals	Water Sanitation Management: Inflow into irrigation canals

PONDOK PESANTREN ALKHAIRAAT	PONDOK PESANTREN AT TANWIR MUHAMMADIYAH	MADRASAH ALIYAH AL-HUDA
		
966 students	172 students	265 students
Water source: Well water	Water source: Tap water	Water source: Well water
Waste management: Incineration and direct disposal	Waste management: Environmental services in Gorontalo city	Waste management: Incineration and direct disposal
Water Sanitation Management: Breaking	Water Sanitation Management: Inflow into irrigation canals	Water Sanitation Management: Inflow into irrigation canals

Figure 3-１０　Overview of student dormitories with wastewater treatment needs in Gorontalo Province[2]

The following show the results of visits as part of this financial year's project to the potential sites including the above-mentioned student dormitories.

１）　Student dormitories

The Boarding school Pondok Pesantren Hubulo is an Islamic boarding school with a total of 424 male and female students, plus teachers and their six families living in them. The female and male dormitories are housed in different buildings, and domestic wastewater and human waste are discharged separately.

In the case of the female dormitory, human waste is treated with a conventional septic tank common in Indonesia installed underground, and domestic wastewater is collected in one place with a drainage channel, stored in a reservoir, and then discharged into the river.



Figure 3-１１　Wastewater treatment in the female dormitory (left: human waste treatment (septic tank); right: domestic drainage channel)

Compared to the female dormitory, the male dormitory did not have proper drainage channels, and all domestic wastewater and human waste were stored in one reservoir that was emitting a strong stench. When the bottom of one reservoir becomes clogged due to the accumulation of sludge and could not store any more wastewater, they would build a new reservoir in another place, the situation about which the school staff expressed great concern.

Figure 3-１２　Wastewater treatment in the male dormitory (left: drainage channel; right: reservoir)

２）　Areas surrounding the Lake Limboto

The Lake Limboto is the largest lake in Gorontalo Province, straddling the city of Gorontalo and Gorontalo Regency, and is also a symbol of Gorontalo Province, which also plays an important role as a source of income for fishing, flood prevention, water resources and tourism. A total of 23 rivers, 5 large and 18 small, flow into the Lake Limboto.

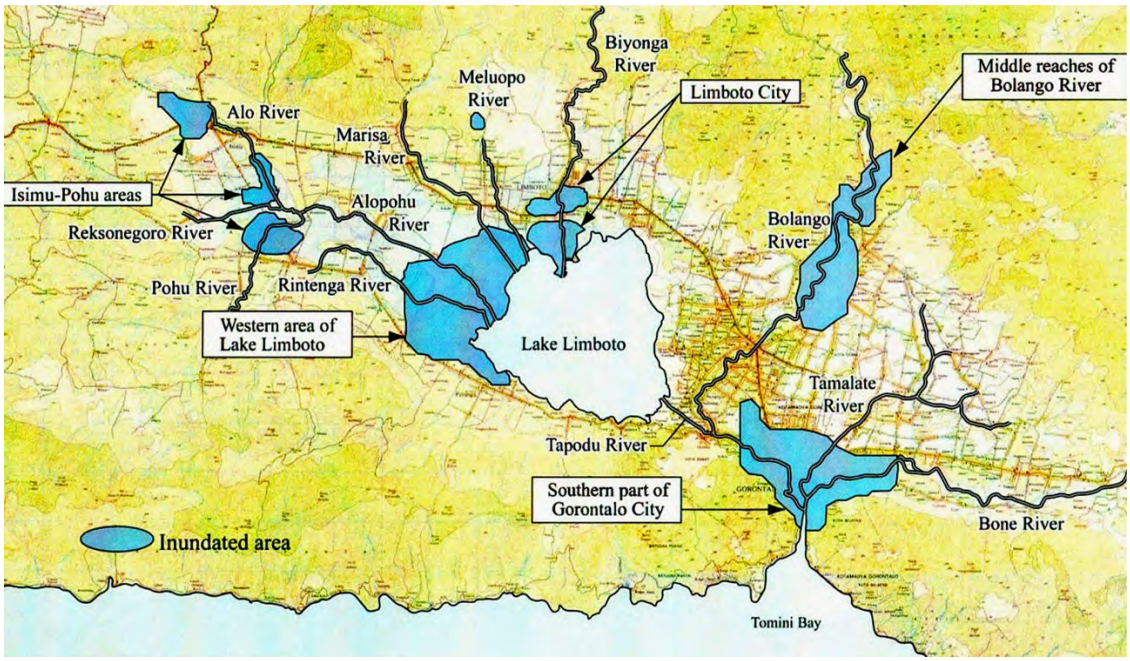
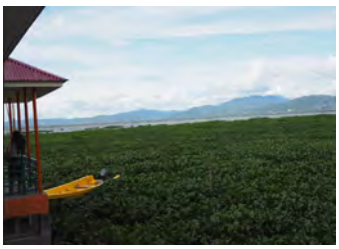


Figure 3-１３　The Lake Limboto and rivers flowing into the lake

On the other hand, in recent years, the lake has been greatly affected by environmental issues Gorontalo Province faces, such as the inflow of sediment due to the loss of forests and the proliferation of water hyacinth due to ecosystem destruction. Through the interviews with the Gorontalo Provincial Department of Public Works, we learned that untreated wastewater from households is flowing into the Lake Limboto and that ongoing aquaculture in the Lake Limboto is to be banned as a measure against water pollution.

Inflow of household wastewater

Mass of garbage flows in via the rivers



Overgrowing water hyacinths

Figure 3-１４　Environmental issues in the Lake Limboto

According to the Gorontalo Provincial Department of Environment and Forestry, water quality tests of the Lake Limboto are conducted every year, and the very high concentration of *E. coli* is presenting a challenge, and the concentration was apparently particularly high in 2022.

Among the rivers flowing into the Lake Limboto, there are concerns about pollution by domestic wastewater of the Biyonga River, one of the larger rivers that flow in from the north of the lake, as there are many houses in its basin. In the Biyonga River, water quality analysis has been carried out at three points in its basin. While there are locations with high *E. coli* concentrations as in the Lake Limboto, there are also water supply facilities in the basin to utilize the river for drinking water, and we received comments that countermeasures here are a high priority during the meeting with the Gorontalo Provincial Departments of Public Works, River Management, Watershed Management, and Environment and Forestry.

Figure 3-１５　Meeting with the Gorontalo Provincial Departments of Public Works, River Management, Watershed Management, Environment and Forestry (January 2023)

In consultation with those departments, we visited several locations in the Biyonga River basin, especially the areas that are thought to be responsible for a particularly high volume of household wastewater, as potential sites for the installation of septic tanks. In addition to the points where drainage channels flow directly into the river from each household, there were also points where drainage channels were constructed to some extent, where the channels of surrounding households join together before wastewater flows into the river.

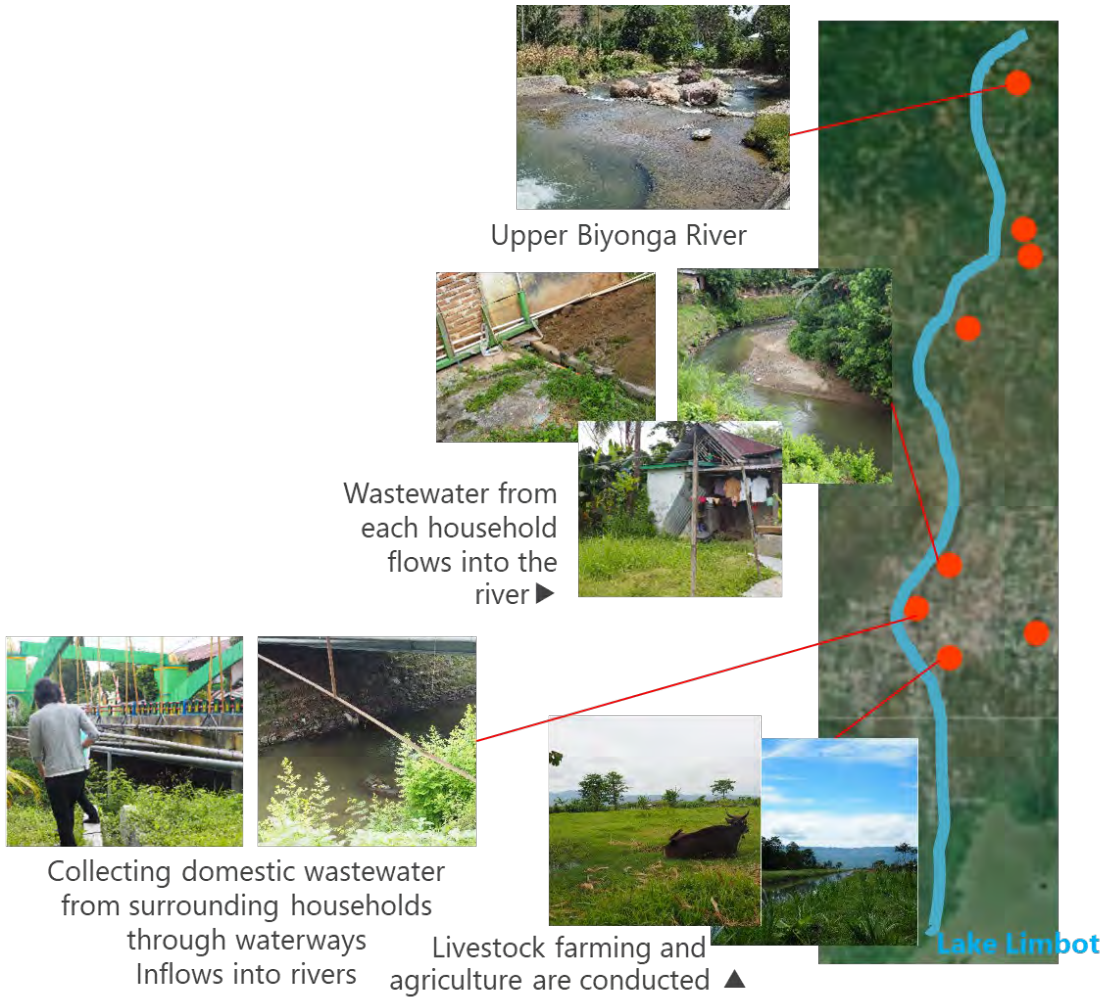


Figure 3-１６ Results of the survey on potential sites in the Biyonga River basin

It is assumed that the closer the areas to the Lake Limboto, the greater the impact of domestic wastewater on the lake, therefore it would be easier to evaluate the effect of a septic tank in those areas. On the other hand, in the vicinity of the Lake Limboto, livestock farming and agricultural activities are conducted in the riverbeds, and it is assumed that the impact of livestock wastewater and agricultural wastewater on the lake is also highly significant.

In selecting sites, it is essential to grasp the true conditions based on data analysis of water quality, but there is no such analysis agency in Gorontalo Province, and currently the samples are sent to Manado or Makassar for analysis. The Gorontalo Provincial Department of Public Works said that it plans to establish a research institute and expects support from Ehime Prefecture and the Ehime University for the installation of water quality analysis equipment, etc.

【CO_2 emission reduction】

As mentioned above, this project is aimed at the province-wide introduction of wastewater treatment facilities with septic tanks, but at this initial stage, we are considering installing single facilities or area-limited installations. Therefore, this year, we are planning to designate a village located in the basin of the Biyonga River that flows into the Lake Limboto as a demonstration site, and a septic tank provided by Daiki Axis Co., Ltd will be installed to treat wastewater. In addition, we explored a model in which the power to run a septic tank is supplied by solar power and calculated the CO_2 reduction effect.

We assumed the installation of a large septic tank (BJ-30) capable of processing 30 m^3 per day in a village with 25 households and an average of 4 people per household. The power consumption of the facility is about 1,000W, and annual power consumption is 6,570 kWh/year, under the assumption that it will operate 24 hours a day, 365 days a year: a model supplying this power with solar panels is being considered. The CO_2 emission coefficient for electricity in Indonesia is 0.533t CO_2/MWh according to the "FY2019-2021 Mechanism for Measures to Reduce Carbon Dioxide Emissions (Equipment Subsidy Projects as part of Joint Crediting Mechanism Fund Support Projects) Appendix 4," and it is possible to reduce CO_2 emissions by about 3.501 tons per year from the 6,570 kWh generated by the above estimate.

In addition, the installation of a septic tank is expected to have the effect of reducing greenhouse gases that were previously released into rivers and generated by natural decomposition. For this reduction calculation method, please refer to "5.D.1 Decomposition of domestic wastewater in nature"[23] among the greenhouse gas emission and absorption calculation methods compiled by the Ministry of the Environment. This methodology is based on the 2006 IPCC guideline "Chapter 6 Wastewater treatment and discharge"[24], and methane emissions associated with the natural decomposition of domestic wastewater can be calculated by the following formula.

$$E = EF \times \sum (A_i)$$

E : 生活排水の自然界における分解に伴う CH_4 or N_2O 排出量［kg-CH_4］or［kg-N_2O］
EF : 2006 年 IPCC ガイドラインのデフォルト排出係数［kg-CH_4/kg-BOD］or［kg-N_2O/Kg-N］
A_i : 公共用水域に未処理で排出される生活雑排水・汚泥（種類 i）中の有機物量もしくは窒素量［kg-BOD］or［kg-N］

[23] Ministry of the Environment, "5.D.1 Decomposition of domestic wastewater in nature" (https://www.env.go.jp/earth/ondanka/ghg-mrv/methodology/material/methodology_5D1_4_2020.pdf)
[24] 2006 IPCC Guidelines Vol6 Wastewater treatment (https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_6_Ch6_Wastewater.pdf)

In accordance with the guidelines, 0.6 [kgCH_4/kg-BOD] is used as the default value for domestic wastewater. The default value of 0.1 for "Sea, river and lake discharge" in "Untreated system" in Table 6.3 of the same guideline is used as the methane conversion coefficient. As a result, the CH_4 emission factor is calculated to be 0.06 [kg-CH4/kg-BOD]. In addition, the BOD (biochemical oxygen demand) load of domestic wastewater in Japan is 13 g/person/day of human waste and 27 g/person/day of miscellaneous wastewater – a total of 40 g/person/day. When this figure is applied, the CH_4 emission reduction due to the introduction of septic tank equipment will be 131.4kg-CH_4/year, or 3.285t-CO_2/year when converted into a CO_2 emission reduction (global warming potential of CH_4: 25).

In contrast to the reference CO_2 emissions described above, project CO_2 emissions include emissions from transportation when transporting generated septic tank sludge from the septic tank to the methane fermentation facility, but since it is difficult to predict this at present, we have assumed it as ignorable. In other words, it is estimated that a total of 6.786t-CO_2 can be reduced per year.

【Cost-effectiveness】

Regarding the above-mentioned area-limited demonstration project, we intend to use the demonstration budget of the Ministry of the Environment's "Model Project for Improving the Water Environment in Asia" rather than the JCM equipment subsidy program, to install septic tanks, verify the effects associated with them, and consider systems packaged with solar power generation. On the other hand, when installing septic tanks in the entire area of the densely populated city of Gorontalo, we are considering the use of the JCM equipment subsidy program for solar power generation facilities related to CO_2 reduction, and this time we estimated the cost-effectiveness of such a project.

The population of the city of Gorontalo is about 200,000, and assuming the installation of the above-mentioned large septic tanks (BJ-30) that can treat 30 m^3 per day, about 1,300 units are expected to be installed. Since the annual power consumption of 1,300 septic tanks is 2,847,000kWh, in order to obtain these powers, an installed capacity of 1,625 kW is required, considering that the utilization rate of solar power generation equipment is about 20%. The cost is 150,000 yen per kW when the procurement of Japanese panels is assumed, so the total cost is 243.75 million yen. Since the solar power generation business already has a track record of multiple JCM equipment subsidy programs, the subsidy rate will presumably be 30%. In this case, the subsidy amount would be about 73.12 million yen.

Using the above-mentioned estimated results of CO_2 emission reductions in wastewater

treatment for a total of 100 people, and referring to the "Appended Table of the Ministerial Ordinance on the Durable Years of Depreciable Assets" of the Ministry of Finance, the statutory service life of 17 years for "other equipment other than machinery and devices made mainly of metal" is applied for solar panels, and the statutory useful life of 12 years for "water supply or sewerage industry equipment" is applied for septic tanks. As a result of estimating the total reduction in emissions during the depreciation period, including the effect of reducing greenhouse gases generated by natural decomposition, a reduction of 42,879t-CO_2 is expected. From the above, the installation of septic tanks will reduce the cost by 1,705 yen per ton.

3.２.２ Methane fermentation facility

As mentioned above, as a result of the study in the project last fiscal year, we are now planning to examine the other types of organic wastes than septic tank sludge as a raw material for methane fermentation facilities. In terms of the needs from Gorontalo Province, our support for the utilization of wastes as an energy source is also eagerly anticipated, and accordingly we researched the biomass resources that can be used in Gorontalo Province in the last fiscal year's project.

As of 2020, the amount of waste generated in Gorontalo Province was 543 tons per day, so an estimated 198,032 tons of waste is generated per year. The amount of waste generated in each municipality of the province and the waste classification of the entire province are shown below.

name	Total amount of waste/day	Total amount of waste/year
Gorontalo	157t	57,408t
Gorontalo city	143t	52,320t
Bone Bolango	67t	24,379t
Pohuwato	64t	23,208t
Boalemo	60t	22,035t
North Gorontalo	51t	18,682t

Figure 3-１７ Waste generation and classification in Gorontalo Province

The amount of generated organic waste that can be used as raw materials for methane fermentation facilities is 128,721 tons per year, and in the current fiscal year's project, we have been collecting data on companies that produce a large amount of organic waste.

In addition, the 2021 Local Government Work Plan (RKPD) of Gorontalo Province lists the following industries for each municipality in the province[25].

Table 3-７ Industries in Gorontalo Province

Name of municipality	Industry
Gorontalo Regency	Coconut processing, sugar production, seaweed processing
North Gorontalo Regency	Seashell crafts, fish processing, bamboo crafts, embroidery, palm fibers
Gorontalo City	Food processing, handicrafts, apparel

[25] PROVINSI GORONTALO (Sep. 2021) "BAB II GAMBARAN UMUM KONDISI DAERAH" (https://bappeda.gorontaloprov.go.id/institution/file_share/BAB-II_179_637.pdf)

Of these, coconut processing and sugar production are mentioned as particularly developed industries in Gorontalo Regency and the names of several companies are also mentioned. The fact that sugarcane and coconut are cited as the plantation crops with the highest production in Gorontalo Province suggests the province's strong focus on these crops from both the agricultural and processing industries' perspectives. For this reason, cooperation and support from Gorontalo Province can be expected for the installation of methane fermentation facilities. The outline and location of each plant are shown below.

Figure 3-１８　Locations of a coconut processing plant and a sugar factory

The suitability of the generated raw materials is also cited as the reason why the installation of methane fermentation equipment in these factories is highly feasible. Since the wastewater generated when processing coconuts and manufacturing sugar has a high sugar content, which activates fermentation by microorganisms, generating a large amount of methane gas, hence more electricity can be obtained. In Japan, at the food factories whose operation decreased due to COVID-19, the above-mentioned methane fermentation equipment of Aiken Kakoki K.K. was utilized to generate profits from power generation and selling electricity by treating wastewater with a high sugar content that had been stored, and in some cases, it helps the factories stay afloat while the income from the main business has dropped. Although it is somewhat dependent on the power demand and power grid of Gorontalo Province, the above-mentioned system is certainly worth considering.

In the field survey of this fiscal year's project, we contacted the coconut processing

plant mentioned above and proceeded with discussions on the installation of the methane fermentation facility as follows.

１） Coconut Processing Plant (PT. Royal COCONUT)

PT. Royal COCONUT was established in 2007 and produces a variety of processed coconut products. The company is headquartered in Jakarta, with offices in Surabaya, factories in North Sulawesi and Gorontalo Provinces, and 66,800 hectares of coconut plantation forest around its factories in Gorontalo Province.

The company's products are also exported mainly to European and Middle Eastern countries. For example, about 50,000 tons of coconut flour was exported to Taiwan, China, the Netherlands, Portland, Africa, Russia, etc. in 2020, and in the six months from January to June 2022, about 3,000,000 tons of products were exported, earning revenues of about 800 million yen.

According to the company, 27% of the amount of coconut processed becomes wastewater, and together with washing water, about 350 to 400 m^3 of wastewater is generated daily.

The current wastewater treatment flow is as follows.

Figure 3-１９ Current wastewater treatment flow at PT. Royal COCONUT (created by Aiken Kakoki K.K.)

Wastewater analysis is carried out regularly, but analysis values fluctuate greatly from day to day, and the reason for this is presumed to be that the water sampling analysis is carried out in conditions where there is no control tank hence the concentration is not

uniform. On the other hand, a certain level of COD concentration was detected although concentration level varied, so Aiken Kakoki K.K. said that an energy recovery system utilizing oil-water separation (EGSB) is feasible. The technology proposed by Aiken Kakoki K.K. is shown below.

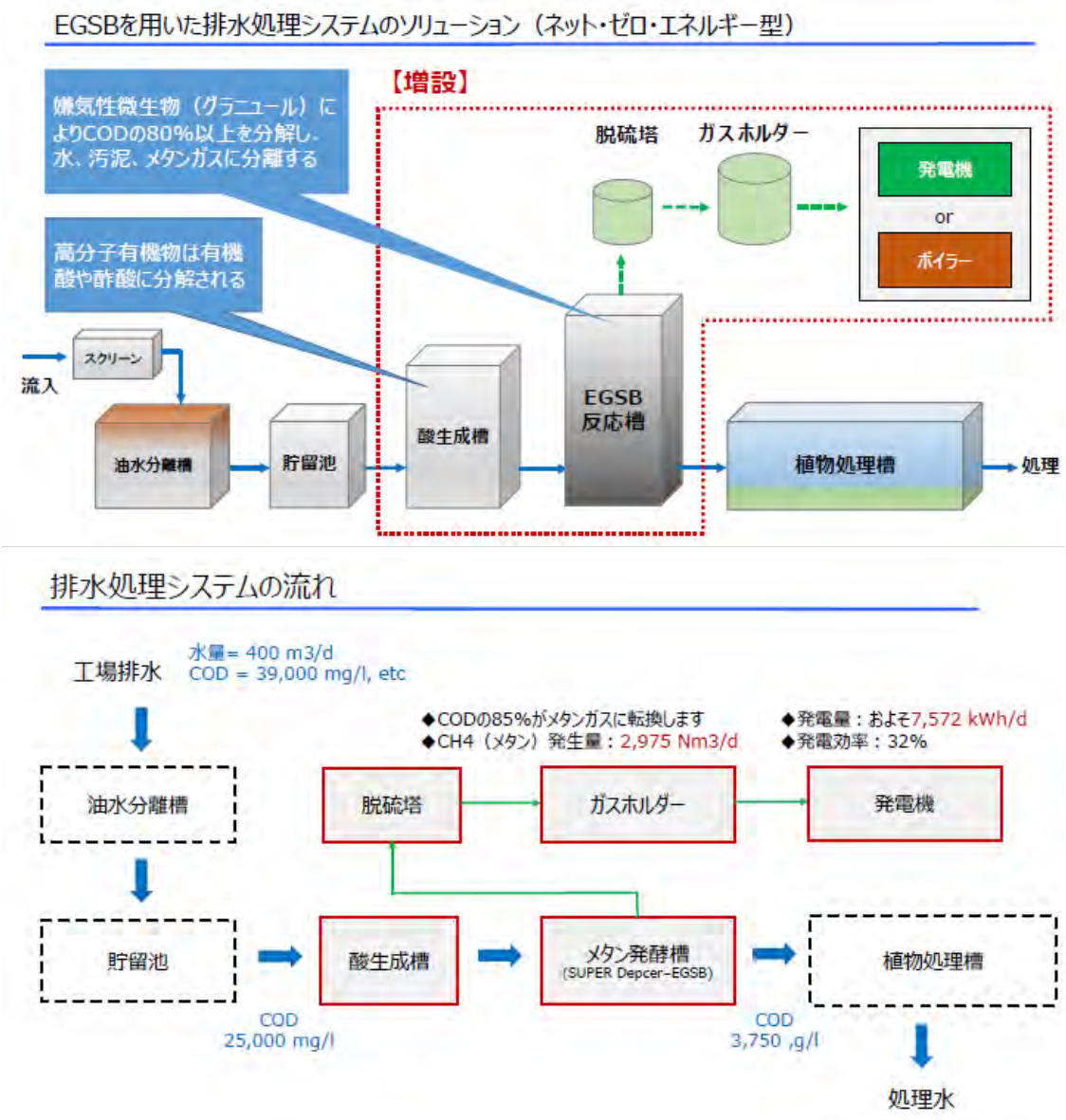


Figure 3-２０　System proposed by Aiken Kakoki K.K. to PT. Royal COCONUT

【Benefits】

The current specifications at PT. Royal Coconut are shown below.

(data) item	value
Plant effluent	400m3/day
Inflow raw water COD concentration (*COD concentrations utilize maximum actual values)	39,000 mg/L
COD concentration of water entering treatment tank	25,000 mg/L
Current power usage (including wastewater treatment facilities)	865kva/day
Current electricity usage	Approx. 3 million yen/month

According to Aiken Kakoki, the above-mentioned wastewater treatment system would reduce the COD of PT. Royal COCONUT's high-concentration wastewater from 25,000 mg/L to 3,750 mg/L. In addition, 7,572 kWh/day of electric power can be generated from 400 m^3 of wastewater per day, which is about nine times the power used by the entire existing plant, and even if wastewater treatment equipment and plant operation power are used, surplus power of 5,187 kWh/day would be available. If this is simply divided by the per capita electricity consumption in Indonesia (1,084 kWh/year/person)[26], it could supply enough electricity to 400-500 households of 4 people. The recovered energy can also be used as boiler fuel, but since PT. Royal COCONUT uses coconut shells as boiler fuel, we are also looking into it as alternative electricity at the factory as well as retail electricity.

【CO_2 emission reduction】

Currently, as an MRV methodology for anaerobic treatment of organic waste and the use of biogas, we have the MRV methodology (VN_AM004) from the case in Ho Chi Minh City, Vietnam: "Methane Fermentation of Organic Waste and Cogeneration in the Wholesale Market"; however, its target organic waste is solid waste. Therefore, there has been no registered project regarding methane fermentation in wastewater treatment, and it is necessary to develop MRV methodologies for project development.

The low-carbon effect of methane fermentation facilities is derived from the reduction of greenhouse gases that would be generated by natural decomposition if the wastewater containing a large amount of organic matter is released into rivers and other places. For this reduction calculation method, please refer to "5.D.2 Decomposition of industrial wastewater in nature" of the greenhouse gas emission and absorption calculation methods

[26] THE WORLD BANK, Electric power consumption (kWh per capita) - Indonesia https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=ID

compiled by the Ministry of the Environment.[27] This methodology conforms to the 2006 IPCC guideline "Chapter 6 Wastewater treatment and discharge24," and methane emissions through the natural decomposition of industrial wastewater can be calculated using the following formula:

$$E = EF \times (A_1 + A_2)$$

E : 産業排水の自然界における分解に伴う CH_4 or N_2O 排出量［kg-CH_4］or［kg-N_2O］
EF : 2006 年 IPCC ガイドラインのデフォルト排出係数［kg-CH_4/kg-BOD］or［kg-N_2O/Kg-N］
A_1 : 産業排水処理施設から公共用水域に直接排出される未処理排水中の有機物量もしくは窒素量［kg-BOD］or［kg-N］
A_2 : 産業排水処理施設から公共用水域に直接排出される処理後排水中の窒素量［kg-N］

Using the default value of methane conversion factor 0.1 for "sea, river and lake discharge" in "untreated system" in Table 6.3 of the guideline, the CH_4 emission factor is calculated to be 0.06 [kg-CH_4/kg-BOD].

In addition, the amount of organic matter or nitrogen in the untreated wastewater discharged directly from an industrial wastewater treatment facility to the public water body (A_1) is set at the default value of 5.5 [kt-BOD] (2018) for the food manufacturing industry; on the other hand, the amount of nitrogen in the treated wastewater discharged directly from an industrial wastewater treatment facility to the public water body (A_2) is assumed to be discharged directly into the public water area untreated in the current case, therefore it is excluded from this calculation. The amount of water discharged at the PT. Royal COCONUT plant is approximately 400 m^3 per day, or 146,000 tons per year. When this figure is applied, the CH_4 emission reduction due to the installation of methane fermentation equipment will be 48,180,000 kg-CH_4/year, which is estimated to amount to a total reduction of 1,204,500t-CO_2/year when converted into CO_2 emission reduction (global warming coefficient of CH_4: 25), and this is the reference emission.

Regarding project emissions, according to interviews with PT. Royal COCONUT, the amount of electricity consumed at the existing plant including wastewater treatment facilities is 865 kVA/day, so annual power consumption is 315,725 kWh (kVA = kWh), When this is multiplied by the power grid emission factor of 0.533 t-CO2/MWh in Indonesia, we obtain 168 t-CO_2/year. In addition, the power consumption through the installation of wastewater treatment facilities by Aiken Kakoki K.K. is 1,570 kWh/day, resulting in an annual power consumption of 554,800 kWh/year and a CO_2 emission reduction of 295 t-CO_2/year. Assuming that the operating power of the methane

[27] Ministry of the Environment "5.D.2 Decomposition of industrial wastewater in nature" (https://www.env.go.jp/earth/ondanka/ghg-mrv/methodology/material/methodology_5D2_3_2020.pdf)

fermentation facility will be obtained from methane gas power generation, total emission reduction of the project is expected to be 1,204,500 t-CO_2/year which is equivalent to the methane suppression effect of emission to the atmosphere, and if the statutory service life of 12 years ("water supply or sewerage equipment") is applied, the expected reduction in emissions during the depreciation period is 14,454,000t-CO_2.

【Cost-effectiveness】

In the JCM Equipment Subsidy Scheme, either 50% of the equipment that contributes to the reduction of CO_2 emissions or the estimated emission reduction cost of 4,000 yen/t-CO_2, whichever is lower, is applied for the first project in any given country.

Methane fermentation facilities are usually constructed with EPCs that meet the installation conditions, and in order to calculate the cost, it is necessary to finalize the design conditions and produce a schematic design before making an estimate. As reference, for facilities of the same size, the cost could vary considerably between 70 million and 2.2 billion yen. Here, we assume the highest cost of 2.2 billion yen. Based on the above-mentioned emission reductions, the cost-effectiveness is 152 yen, and after applying the assumed subsidy rate of 50%, this will come down to 76 yen. Therefore, as a JCM equipment subsidy project, this project as a whole can be considered sufficiently cost-effective.

２） Coconut Processing Plant (PT. Trijaya Tangguh)

PT. Trijaya Tangguh is one of the two largest coconut processing plants in Gorontalo Province along with PT. Royal COCONUT. Founded in 2006, around the same time as PT. Royal COCONUT, the company is headquartered in Surabaya and has a factory in Gorontalo Province. It mainly produces coconut milk and coconut water.

Like PT. Royal COCONUT, the company’s products are also exported mainly to European and Middle Eastern countries.

Figure 3-２１　PT. Trijaya TANGGUH

About 500 m^3 of wastewater is generated per day, and the monthly electricity bill is about 5 million yen. The current wastewater treatment flow is similar to that of PT. Royal COCONUT and is as follows.

Figure 3-２２　Current wastewater treatment flow in PT. Trijaya TANGGUH (created by Aiken Kakoki K.K.)

Wastewater analysis is carried out regularly, but the analysis value fluctuates greatly from day to day as seen at PT. Royal COCONUT, and the reason for this is presumed to be that the water sampling analysis is carried out in conditions where there is no control tank, hence the concentration is not uniform. On the other hand, a certain level of COD concentration is being detected although the concentration level varies, so Aiken Kakoki K.K. has said that an energy recovery system utilizing oil-water separation (EGSB) is feasible. In the future, as with PT. Royal COCONUT, we plan to proceed with detailed

data collection and system proposals in parallel.

3.２.３ Other (Final disposal site)

Regarding the leachate from final waste disposal sites, we have received a request for assistance from the Gorontalo Provincial Department of Public Works regarding the proposal for treatment technology.

TPA Talmelito, a final disposal site of Gorontalo Province, is located in Gorontalo Regency and receives waste from Gorontalo City (70%), Gorontalo Regency (20%) and Bone Bolango Regency (10%).

Below is the outline of the waste collection flow in Gorontalo Province. Each household pays a collection fee (5,000 rupiah/month) to the primary sorting station (TPS) operated by the Gorontalo Provincial Department of Environment, and TPS collects waste from the fee-paying households. Recyclable plastic, cardboard, and other waste are sorted by TPS, and other waste is transported to the final disposal site. The types of waste sorted by TPS are as follows.

type	Price
PET1 (thick)	4000Rp/kg
PET2	3000Rp/kg
Aqua (plastic bottle of drinking water Aqua)	4000Rp/kg
Splite (green plastic bottle)	3000Rp/kg
AleAle (juice cup)	3000Rp/kg
Ingect (oil container)	3500Rp/kg
Bucket (engine oil container)	3000Rp/kg
PP (rigid plastic)	3000Rp/kg
Sembur (plastic bottle cap)	3000Rp/kg

Figure 3-２３ Waste sorted by TPS and their selling prices

On the other hand, there are a certain number of households that do not pay their collection fees, and for households located on the main street including these households, waste left in front of each household is collected by trucks owned by the Gorontalo Provincial Department of Environment and transported directly to the final disposal site.

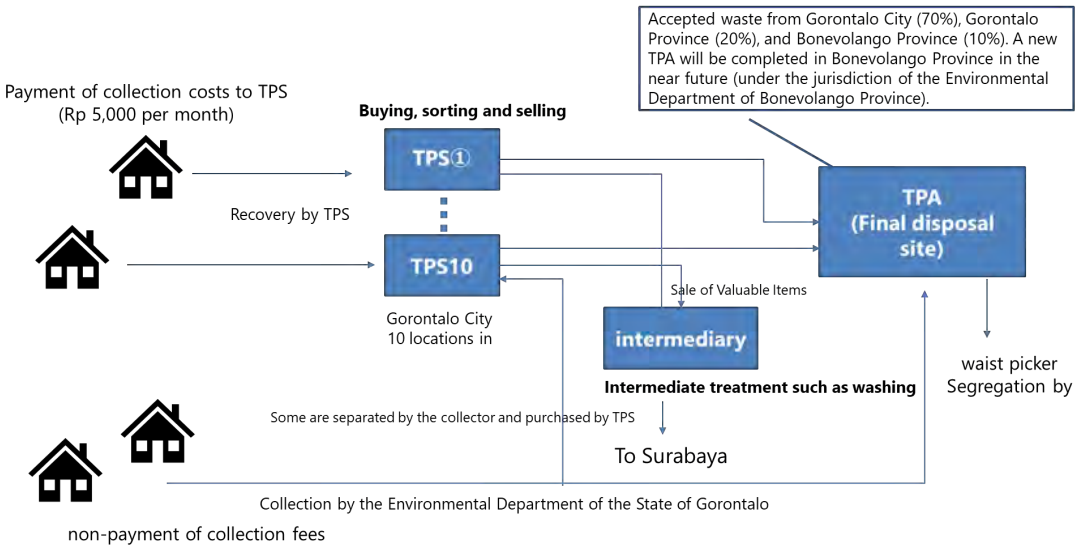


Figure 3-２４　Waste collection and treatment flow in Gorontalo Province

According to the Department of Environment and the Department of Public Works of Gorontalo Province, there are many sites that are not functioning due to financial difficulties that emerged only three months after the start due to insufficient fee collection, and it is assumed that there is a lot of uncollected waste outside the above-mentioned system. According to the statistical data from the Gorontalo Provincial Department of Environment, as of 2020, the amount of waste generated in Gorontalo Province was 543 tons per day and the annual amount is estimated to be up to 198,032 tons. The amount of waste generated by municipalities in the province and the waste classification of the province as a whole are shown below.

name	Total amount of waste/day	Total amount of waste/year
Gorontalo	157t	57,408t
Gorontalo city	143t	52,320t
Bone Bolango	67t	24,379t
Pohuwato	64t	23,208t
Boalemo	60t	22,035t
North Gorontalo	51t	18,682t

Household waste	75%	148,524t/year
Organic waste	65%	128,721t/year
Inorganic waste	35%	69,311t/year
Plastic waste	11%	21,783t/year
Office waste	1%	1,980t/year

Figure 3-２５　Waste generation and classification in Gorontalo Province2

There are a total of four landfill sites, three of which have already been filled and decommissioned. Currently, only the disposal site shown in pink in the figure below is in

use.

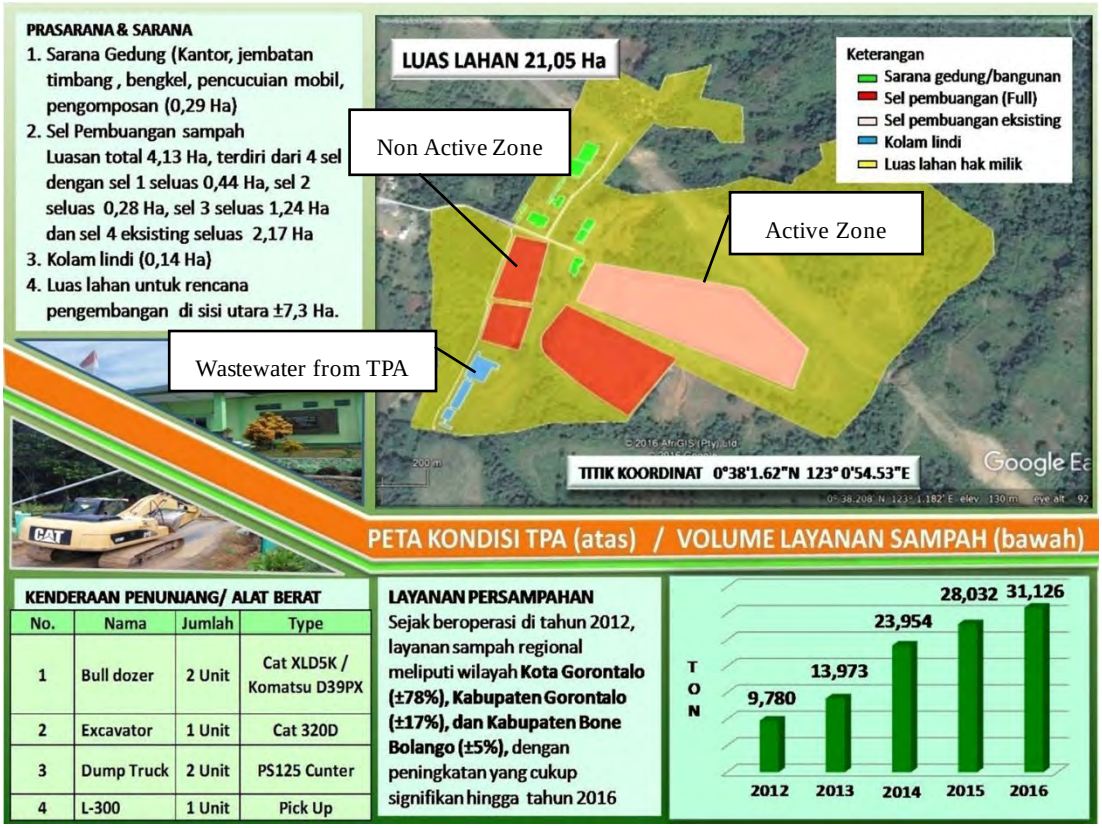


Figure 3-２６ Outline of final disposal sites (TPA Talmelito)

The amount of waste transported to the final disposal site is about 100 tons per day, and the landfill areas originally designed to be usable for three years are being filled in less than a year. When we visited there in August 2022, about 80% of the disposal site was full, but by the time we returned in January 2023, the ditches were filled, and the site was almost full. Currently, there are plans to construct a new landfill site with the aim of starting construction in 2025, and the critical situation with the landfill sites is one of the issues at the final disposal site.

August 2022　　January 2023

Figure 3-２７　Conditions at the final disposal site

Another major challenge is the leachate from three landfill sites that were decommissioned in November 2021. According to the Gorontalo Provincial Department of Public Works, the leachate from the final disposal site overflows during rainfall and flows into rivers, causing damage such as the death of livestock in the vicinity, and countermeasures are urgently needed. Currently, they have no treatment system, and the leachate is discharged into the river as it is after aeration only.

Water quality tests are conducted 2 to 3 times a year and they use the same analysis laboratory as PT. Royal COCONUT, so samples are sent to Manado in 24 hours after sample collection. The amount of leachate generated per day is 52 m^3.

Figure 3-２８　Current final disposal site leachate treatment flow

On November 10, 2022, Aiken Kakoki K.K. visited the final disposal site and confirmed the quality of leachate and the structure of the treatment tank. As a result, the company concluded that appropriate treatment is possible using the company's technology, and on January 20, 2023, and it proposed a system that could be constructed

at the final disposal site.

Figure 3-２９ Discussion between Aiken Kakoki K.K. and the Gorontalo State Public Works Department (January 2023)

According to Aiken Kakoki K.K., two systems with different initial costs, running costs, and operations can be recommended. The first is a technology that separates water and sludge naturally in an installed tank and then performs sand filtration and removal with a coconut carbon filter. The second is the membrane separation activated sludge method (MBR system), which is a technology that utilizes installed membranes capable of 1/1,000 mm filtration. Since it is impossible to treat wastewater containing mercury, it is necessary to separate waste items such as electric lights and batteries containing mercury at landfill sites. The leachate in question this time is wastewater from a disposal site that has already been decommissioned and landfill treatment has been completed, and it is assumed that waste items containing mercury were also deposited without being separated. If mercury contamination is likely, ion exchange treatment is required in addition to the membrane treatment in the second system, and it is necessary to examine the adopted technologies and effects based on the analysis results of leachate in the future.

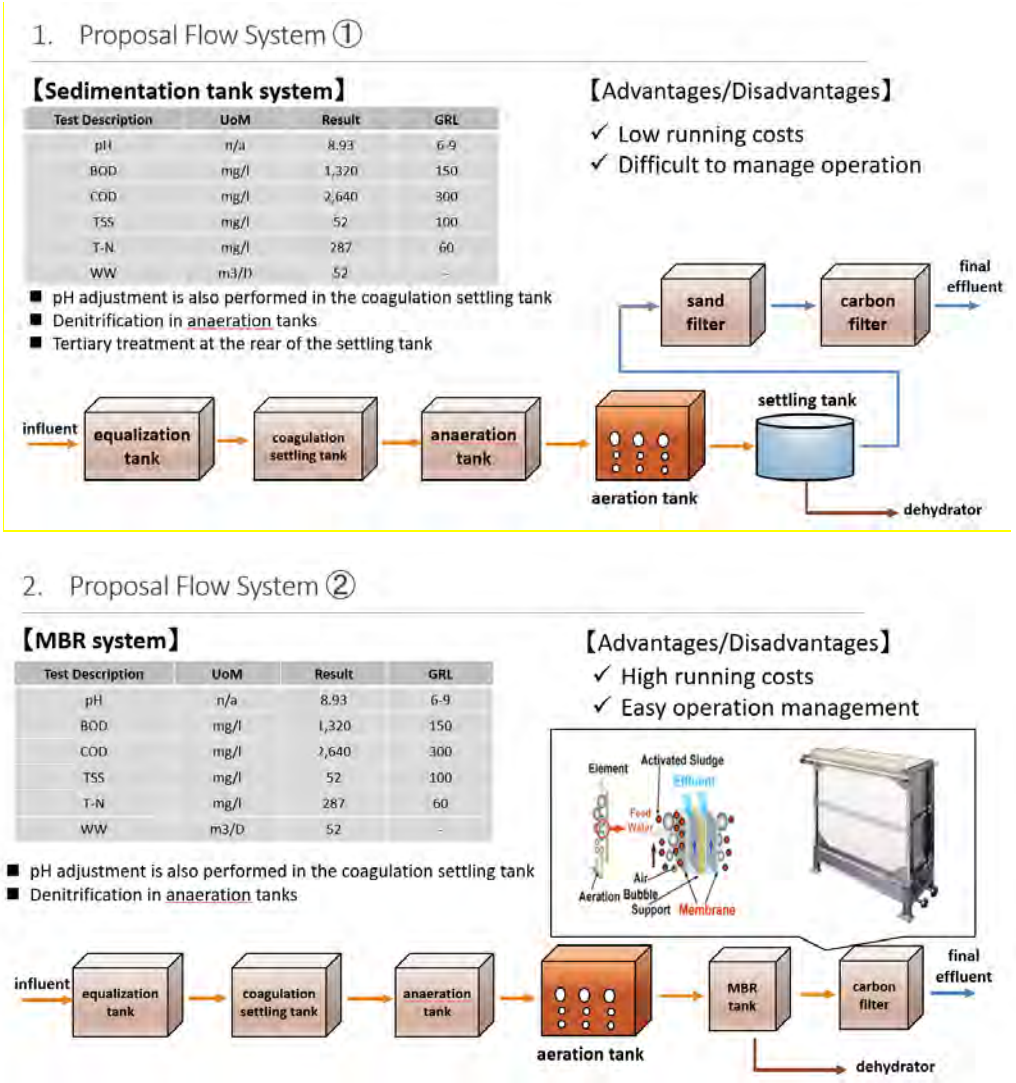


Figure 3-３０　Diagrams of the systems proposed by Aiken Kakoki K.K.

Although the above-mentioned technology will not lead to a reduction in CO_2 emissions, we plan to consider introducing it as part of a package as a zero-emission device, while covering the electricity for the installation of equipment by solar power generation. In addition, we intend to utilize the JCM facility subsidy project for the facilities related to CO_2 reduction.

3.3 Selecting commercialization sites and formulating the introduction plan

3.3.1 Septic tanks

As mentioned above, in Gorontalo Province, water and sewerage infrastructure is underdeveloped, and it would take time to construct a system for collecting wastewater from multiple households in a single location. Therefore, we will first consider a plan to install a septic tank in a limited facility or area.

In addition, as septic tanks are public infrastructure, they would be maintained based on national and local government budgets. In order to sustain water quality improvement, it is essential to develop regulations and provide education and training on facility management, along with the introduction of technology.

According to the survey results of the project in the previous fiscal year, the Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan: hereinafter referred to as KLHK) promulgated a ministerial ordinance on new domestic wastewater standards in Indonesia in August 2016 (Ministry of Environment and Forestry Ordinance No. 68 (P.68/Menlhk/Setjen/Kum.1/8/2016) [28]). The standard value of ammonia is stricter than that of Japan, and advanced treatment including denitrification is required. Additionally, the "homes" listed as the target facilities in these standards refers to housing complexes such as apartments, and there is currently no standard for drainage from a single house.

Table 3-8 Domestic wastewater standards in the Ministry of Environment and Forestry Ordinance No. 68 (2016)

Parameters	Units	Maximum allowance*
pH	-	6-9
BOD	mg/L	30
COD	mg/L	100

[28] MENTERI LINGKUNGAN HIDUP DAN KEHUTANAN REPUBLIK INDONESIA P.68/Menlhk/Setjen/Kum.1/8/2016(https://sustainability.ipb.ac.id/wp-content/uploads/2020/01/Permen-LHK-No-68-tahun-2016-tentang-Baku-Mutu-Air-Limbah-Domestik.pdf)

TSS	mg/L	30
Oil & Grease	mg/L	5
Ammonia	mg/L	10
Total Coliforms	Total/100mL	3,000
Discharge	L/person/day	100

*Subject facilities are as follows: apartments, lodges, lodgings, hospitals, educational institutions, offices, markets, restaurants, conference halls, leisure facilities, homes, industrial facilities, decentralized wastewater treatment facilities, sludge treatment facilities, centralized wastewater treatment facilities, airports, train stations, and prisons

Regarding the problem that drainage from single homes cannot be covered by the current standard, with the verification results of demonstration experiments related to the introduction of septic tanks, we will consider lobbying the central government through Gorontalo Province regarding the need to revise regulations so that drainage from single homes is also covered.

In fact, in October 2022, KLHK visited Daiki Axis Indonesia, toured the company's factory and equipment, and gained an understanding of the characteristics of the septic tank and the company's high technological capabilities. On the other hand, regarding the differences between the company's septic tanks and those currently used in Indonesia, we have received comments that they would like us to first verify the effects of installing our septic tank through a demonstration experiment. For this reason, we will plan and implement a demonstration experiment with a view to making proposals not only to the Gorontalo provincial government, but also to the central government of Indonesia.

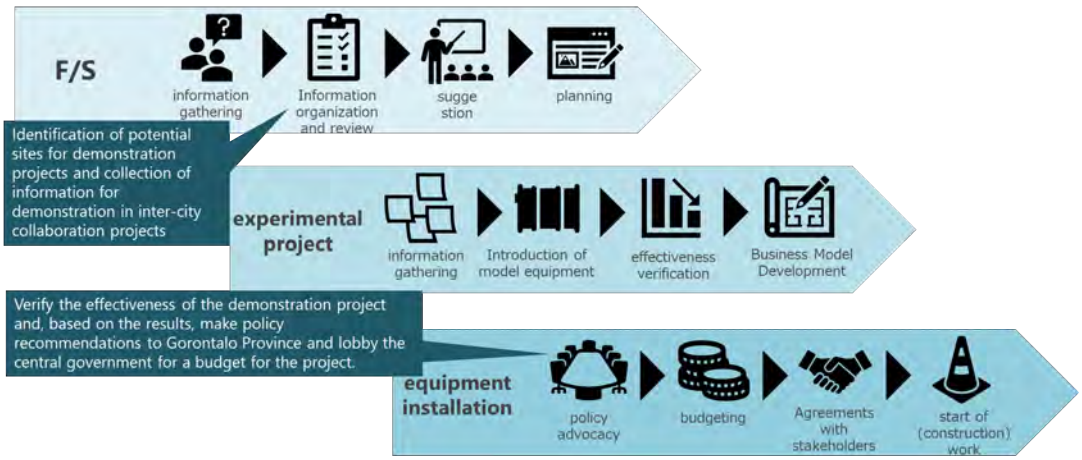


Figure 3-３１　Introduction plan (Septic tank)

In selecting sites for the demonstration project, we considered the priority of the measures of the Gorontalo provincial government and the Indonesian central government, and chose residential areas and markets located around the Lake Limboto, which are considered to have a large contribution to the Lake Limboto, as candidates, and will continue to formulate a demonstration experiment plan.

Villages around the Lake Limboto

Drainage channels at the markets

Figure 3-３２　Potential sites for the demonstration project

The following is assumed for the implementation system of the demonstration project. Regarding the demonstration budget, we will have "Asian water environment improvement model project" of the Ministry of the Environment as a candidate, and plan to obtain budgets for feasibility study, demonstration, and formulating a commercialization plan.

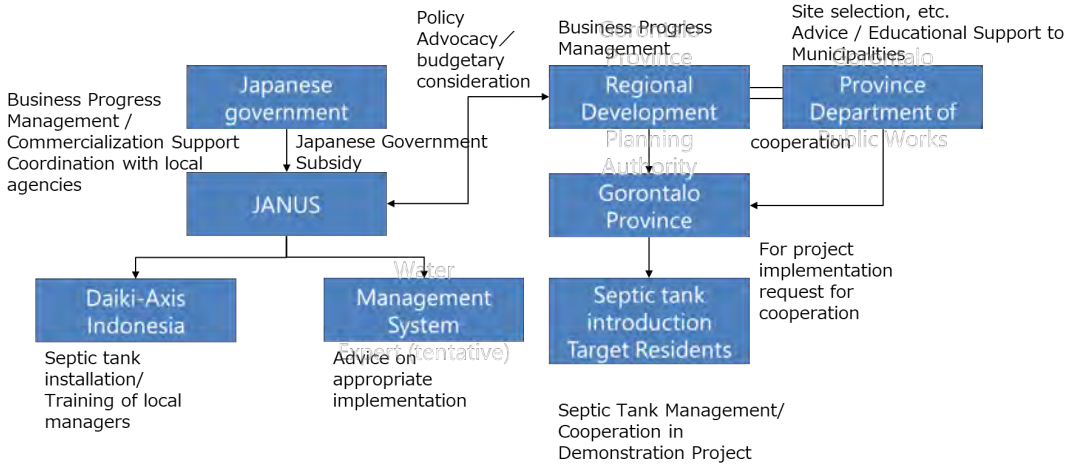


Figure 3-３３　Implementation system (Septic tank)

3.３.２ Methane fermentation facility

It has been confirmed that PT. Royal COCONUT has a very high interest in wastewater treatment and energy recovery. As mentioned above, they also regularly analyze wastewater, and we collected the data during the field survey in January. As the retention time of wastewater in the treatment tank is about one month, analysis is currently conducted once a month. Through interviews and site visits, it became clear that water is currently sampled at two locations, the inlet and the outlet shown in the figure below, and analyzed.

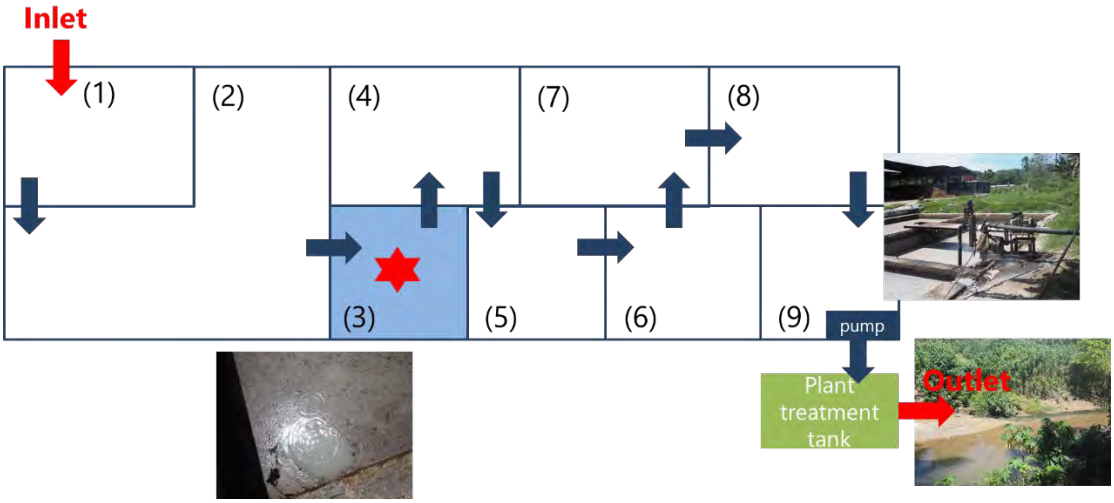


Figure 3-３４ Current wastewater flow and sampling points

With the current analysis data, test results are inconsistent, making it difficult to conduct a more detailed examination. Therefore, in addition to sampling water from the inlet and the outlet, it is necessary to sample water from the locations marked with ★ in the above figure. In addition, according to Aiken Kakoki K.K., since the temperature of the wastewater is important for the installation of the company's proposed system, we have asked them to measure the water temperature and also requested their cooperation in acquiring data. We have agreed with PT. Royal COCONUT to cooperate in data acquisition, and collected data since February. Requests to PT. Royal COCONUT are summarized below.

- Water sampling locations: In addition to the inlet and the outlet, the intermediate tank is added.
- Inspection items: In addition to the previous items, water temperature is added.
- Confirmation of the sampling method: To take pictures of the sampling process

- Obtaining estimates from analysis laboratories
- Providing data on factory operating hours and the production volume of products

Figure 3-３５ Exchange of opinions with PT. Royal COCONUT (January 2023)

In the next fiscal year's project, we plan to continue discussions with PT. Royal COCONUT and the Gorontalo provincial government, and proceed with designing detailed equipment and estimating equipment costs based on the acquisition and analysis of analytical data.

In addition, aiming to involve the JCM equipment subsidy project in 2025, based on the results of the examination in the next fiscal year's project, we will create a plan to subsidize 50% of the equipment cost related to the installation and recoup the remaining 50% by selling electricity, planning to reach an agreement with PT. Royal COCONUT.

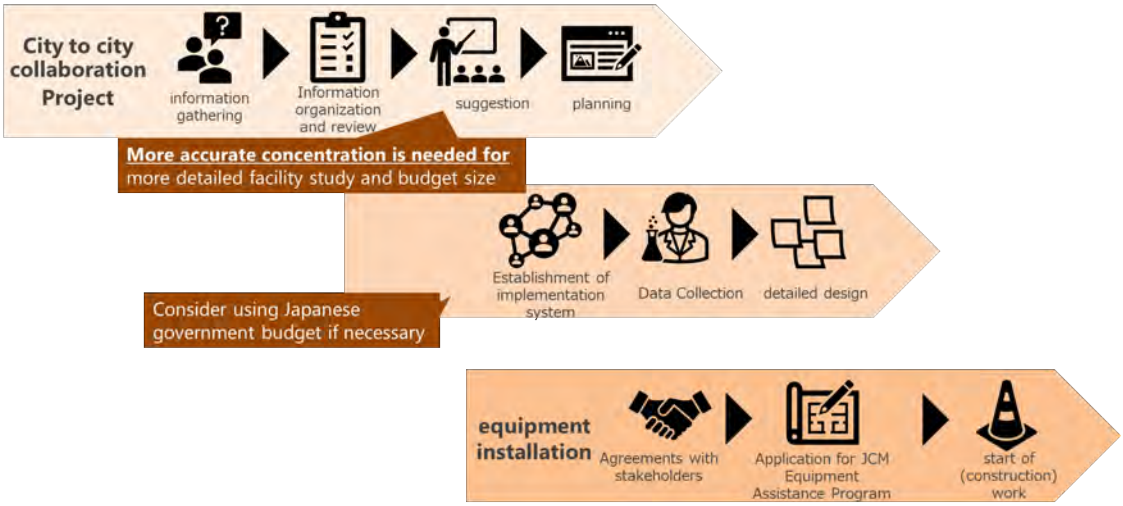


Figure 3-３６　Introduction plan (Methane fermentation facility)

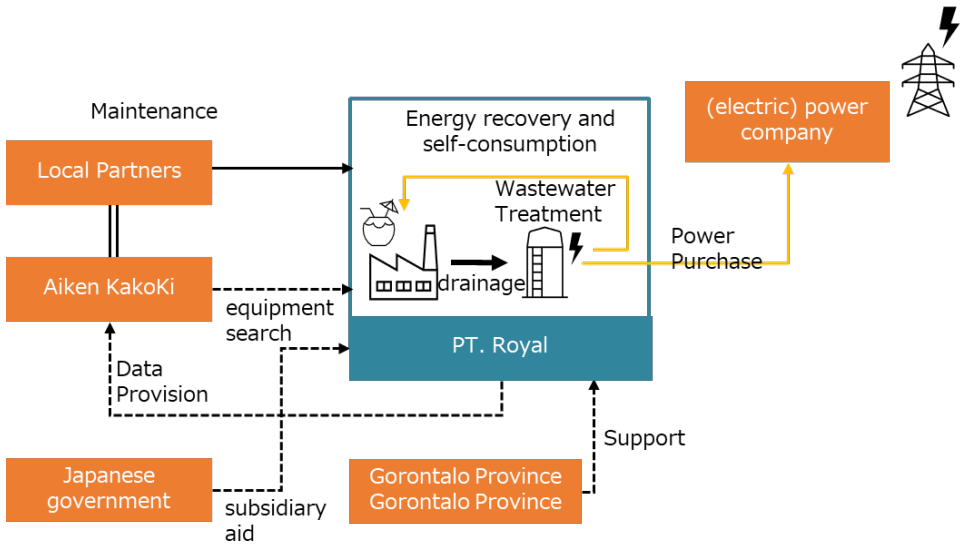


Figure 3-３７　Implementation system (Methane fermentation facility)

3.３.３ Other (Final disposal site)

Regarding leachate from a final disposal site, it is difficult to directly connect to the JCM equipment subsidy project as the introduction of wastewater treatment equipment is not expected to have a CO_2 reduction effect. On the other hand, as mentioned above, we will consider using renewable energy to supply the electricity necessary for equipment operation and also discuss the utilization of the JCM equipment subsidy project for equipment related to CO_2 reduction.

In addition, since the final disposal site is public infrastructure managed by the Gorontalo Provincial Public Works Department, we expect budgetary measures from the local government. The Gorontalo Provincial Public Works Department commented that it would be possible to propose adding the equipment installation cost for this project to the 2024 budget plan, as Ehime Prefecture and Gorontalo Provincial Government have signed an MoU for the city-to-city collaboration project, and the associated action plan includes “Consideration on the introduction of treatment technology for leachate at a final disposal site.” In the near future, we will hold interviews on the detailed schedule related to the budget application and proceed with consideration according to the schedule.

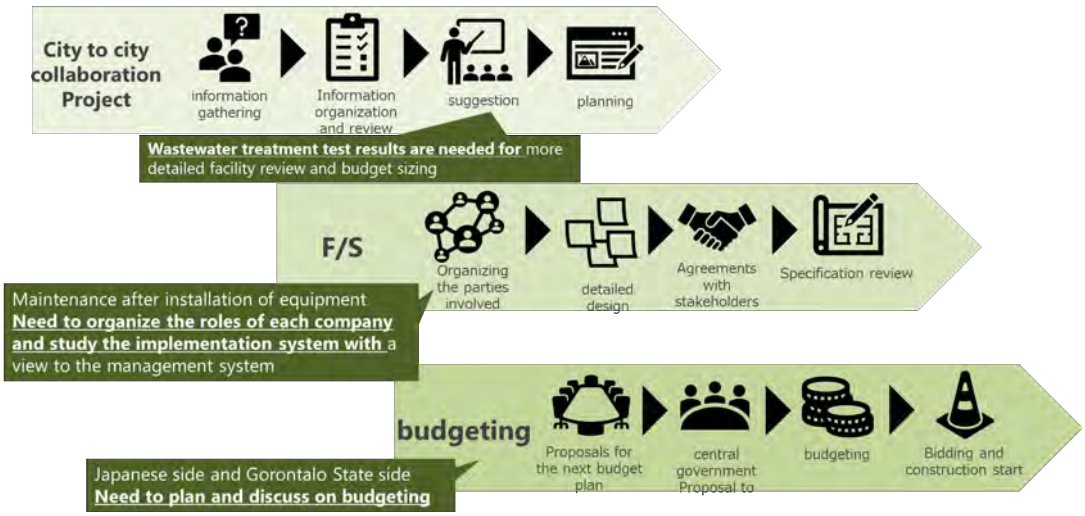


Figure 3-３８ Introduction plan (Final disposal site)

In addition, as it is assumed that the technology to be introduced will be determined by bidding when installing the equipment, we will acquire leachate analysis data, carry out detailed design, estimate the initial cost, and examine specifications related to bidding within 2023. The plan is to proceed with discussions with the local government with the aim of submitting a budget application for 2024. In the detailed study, we will consider the use of feasibility study budgets such as the "Project for Supporting International

Expansion of Japan's Recycling Industry" of the Japan Research Waste Foundation.

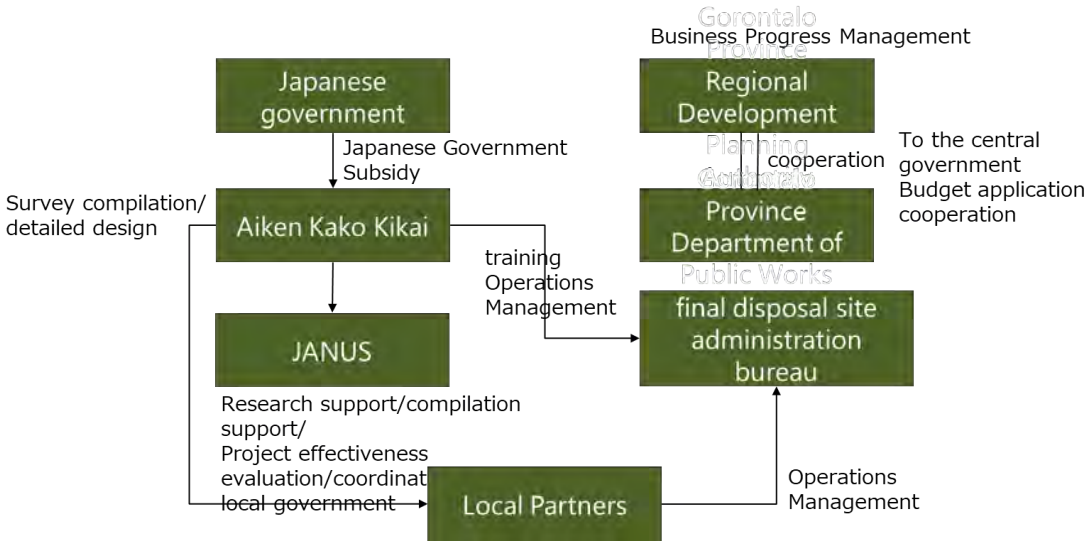


Figure 3-３９　Implementation system for feasibility study (Final disposal site)

Figure 3-４０　Exchange of opinions with the Public Works Department of Gorontalo Province (July 2022)

3.4 Organizing information and negotiating for building a project implementation system

Concerning the development of the project implementation system, we are proceeding with discussions with the parties involved as shown in the table below.

Table 3-9 Status of discussions on developing a project implementation system for each project

Project	Party involved	Discussion details (Plans included)
Septic tank	Public Works Department of Gorontalo Province	• Requested cooperation in the demonstration experiment and reached an agreement • Continue discussions on potential sites
	Central Government Ministry of Environment and Forestry	• Introduce septic tanks of Daiki Axis Co., Ltd. • Request policy support for the spread of septic tanks
Methane fermentation facility	PT. Royal COCONUT	• Had the prefectural governor Nakamura conduct sales promotion • PT. Royal COCONUT expressed interest in the company's wastewater treatment and energy use • Requested cooperation in providing data and designing details, and reached an agreement • Scheduled to start acquiring and sharing necessary data in February
	Energy and Mineral Resources Department of Gorontalo Province	• Plan to discuss the utilization of surplus electricity from PT. Royal COCONUT • Plan to request access to PLN
	PLN	• Discussions on the selling price of electricity
Other (Wastewater treatment facility)	Public Works Department of Gorontalo Province	• Reached an agreement that Gorontalo Province will bear the budget • Continue discussions to formulate a budget plan for FY 2024

Regarding the adoption of septic tanks, as mentioned above, we expect that they will be installed based on the budgets of the national and local governments since they are public infrastructure. As we have reached an agreement with the Gorontalo provincial government to verify the effects of septic tanks through a demonstration experiment, we will proceed with formulating a plan for a demonstration experiment after continuing discussions with Gorontalo Province's Public Works Department, the River Management Department, etc.

As for the adoption of methane fermentation equipment, we will create an implementation system for the JCM equipment subsidy application. The amount of power that is expected to be obtained through energy recovery is very large, and we will consider

selling surplus power from the factory's operating power to PLN. Along with that, we plan to make contact with Gorontalo Province's Energy and Mineral Resources Department and PLN.

Concerning the adoption of wastewater treatment equipment for final disposal sites, we are considering the budgetary measures from the Gorontalo provincial government and the utilization of the JCM facility subsidy project for CO_2 emission reduction equipment. Through discussions with the Public Works Department, we have reached an agreement that Gorontalo Province will bear the budget. Therefore, we will work with Gorontalo Province on the procedures for obtaining the budget while conducting interviews on detailed schedules for the budget application for 2024.

Chapter 4 Field of sustainable forest utilization by cocoa cultivation

In Gorontalo Province, rapid deforestation is progressing due to reclamation by excessive slash-and-burn farming in areas other than those suitable for cultivation, in parallel with the growth of agricultural GDP. The results of analysis of the LANDSAT images taken in 1991, 2000, and 2010 indicate deforestation at an annual rate of 0.68% (from 2000). As indicated by the brown areas in the following photographs, it can be confirmed that deforestation expanded from 2010 to 2018. According to the Gorontalo Province Regional Action Plan (RAD), the current deforestation rate is about 13,216 ha per year. This accounts for 1.6% of the total forest area (826,000 ha), and the rate of decrease is increasing. There is concern over the possibility that deforestation will not only decrease CO_2 absorption, but also reduce the water holding capacity of forests, which will cause landslides and frequent floods in urban areas.

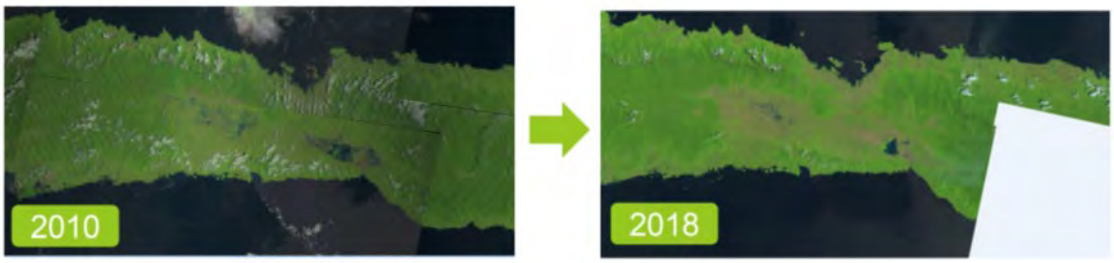


Figure 4- 1 Satellite images showing the shrinkage of forest

Kanematsu Corporation, a co-operator of this program, has been promoting cacao cultivation in the western region of Boalemo Regency since 2011. This cacao cultivation is an alternative to corn cultivation, which is a type of slash-and-burn agriculture. Through these activities to suppress the expansion of agricultural land through slash-and-burn agriculture and to conserve forests, Kanematsu Corporation has been involved in the REDD+ project aimed at establishing sustainable agriculture by forming bilateral credits and earning revenue from the sales.

This project aims to expand the REDD+ business implemented by Kanematsu Corporation throughout all of Gorontalo Province. In FY 2021, we conducted a survey on policies and plans in Gorontalo Province, Indonesia, which is the basis of forest conservation, and selected candidate areas for REDD+ projects. This fiscal year, we summarized more details based on the survey results.

The items discussed this fiscal year and the results are shown below.

4.1 Trend of Carbon Trading in Indonesia

In Indonesia, the Ministry of Environment and Forestry Regulation No. 21 of 2022 on carbon trading was issued in October, but details of its implementation have not been made public. We have to wait for the publication of guidelines on approval mechanisms and procedures, including methods for setting baselines that serve as the basis for estimating the CO_2 reductions, the possibility of transferring carbon credits to overseas markets, and credit allocation between local governments and businesses.

The current ministerial regulation covers the forest sector and clearly states that provincial governments will implement the policies. Therefore, forest conservation projects in Gorontalo Province are expected to meet the requirements for carbon trading.

4.2 Extraction of potential sites and estimation of project effects

4.2.1 Extraction of potential sites

In last year's project, we identified the deforestation and degradation situation in Gorontalo Province and then selected candidate areas for the REDD+ project. The watershed areas, which included areas where the forest coverage rate is 70% or higher as of 2018 and areas where deforestation has not progressed, were the target areas of the REDD+ project. Potential sites are shown in the figure below.

Figure 4-2 Target areas of the REDD+ project, including watershed areas in Gorontalo Province

We formulated a business plan for promoting the REDD+ project this fiscal year. In the business plan, we first extracted the deforested area for each year and each period from the past forest data and organized the forest coverage changes from 2008 to 2017. Like in last year's project, we visited the sites to confirm the forest utilization conditions and excluded hotspots such as areas with oil palm plantation development in northern Pohwat and timber concessions in northern Gorontalo from the potential sites.

The location and area of deforestation that occurred during the baseline period (2008-2017) are as follows.

Figure 4.1-2: Deforestation Area/Map of period 2008-2012 in Gorontalo Province

Table 4.1-2: Area of historical deforestation

Year	Area of deforestation (ha)
2008	1,011
2009	5,602
2010	845
2011	1,700
2012	1,382
2013	1,392
2014	2,805
2015	5,819
2016	4,012
2017	3,731
Average deforestation/year (2013-2017)	3,552

Figure 4- 3 Deforestation map (2008-2012) (left) and deforestation area (ha) (2008-2017) (right)

4.2.2 Estimation of the project's effect

This project aims to expand the results of the REDD+ project that Kanematsu Corporation has implemented in Boalemo Province. In last year's project, we found that significant deforestation had occurred in the Pohwato, Boalemo, and Gorontalo prefectures, located in the western part of Gorontalo province. Thus, we have selected them as our target areas. The estimated amount of GHG emission reduction for these sites and the estimated project cost are shown below.

[Estimated amount of GHG emission reduction (absorption)]

Using the above-mentioned GHG emission reduction amount for the fiscal year 2017 as a baseline, we estimated the emission reduction amount in this project.

The GHG emission reduction amount due to crop conversion from corn to cacao was calculated using the following formula.

$$ER = RE - (PE + DE)$$

$$ER_{credit} = ER * (1 - df)$$

ER	Emissions reductions [tCO_2/yr]
DE	Displacement of emissions [tCO_2/yr]
ER_{credit}	Emissions reductions to be credited [tCO_2/yr]
df	Discount factor

The forest area in Gorontalo Province was 767,022 ha in 2000. However, a survey revealed that the area decreased by 58,995 ha between 2000 and 2011.

For emissions in the case where the project was not implemented (reference emission level: RE), please refer to the Gorontalo Province Greenhouse Gas Emission Reduction Plan (RAD-GRK) prepared by the Indonesian Ministry of Environment and Forestry and the Gorontalo Provincial Government. Specifically, we use the Business As Usual value of GHG emissions in the state's forestry sector. Since the annual GHG emissions of the forest sector in Gorontalo Province is 1,078,347t-CO_2, the reference emission level (RE) of Boalemo Province is 123,600t-CO_2. Based on the calculation of the amount of GHG emissions avoided due to changes in the forest area within the scope of the project from the land cover classification map data, the amount of emissions reduced (ER) is 120,214 t-CO_2 as the deforestation of the area almost stopped from the fiscal year 2016 to the fiscal year 2017.

Assuming that the above results in Boalemo Province are achieved in the three prefectures in Gorontalo Province on the same scale, the amount of emissions that could be reduced by applying the project is estimated to be 360,642t-CO_2/year.

[Cost]

In terms of the implementation of the REDD+ project mentioned above, the project has an annual operating cost of 80 million yen, of which 40 million yen is covered by the budget of the Boalemo Prefecture government and 40 million yen by subsidies from the Environment Ministry. A two-year demonstration project was implemented.

This project assumes that the duration of the REDD+ project is four-year, including the period of the inter-city collaboration project, and expects to conduct a survey of the same scale as the above-mentioned demonstration project in each of the three prefectures of Gorontalo province. In this case, about 200 million yen is estimated to be necessary for the project cost per year. We plan to proceed with commercialization upon understanding Gorontalo Province and the cities/prefectures' budgetary measures from the perspective of the CO_2 emissions reduction initiatives and sustainable farming,

[Expectations for improvement of farmers' livelihoods through the implementation of the project]

The farmland area of corn in Gorontalo Province is about 63,450 ha, and its annual production is 320 tons. Since there are 45,896 farm households, farmland area per household is 1.38 ha, and yield is 4.9 t/ha. Assuming that the selling price is 4,200 Rp/kg, the sales from one harvest will be 28,400,400 Rp. Corn can be harvested three times a year in Gorontalo province, resulting in annual sales of 85,201,200 Rp.

On the other hand, the farmland area for cocoa farming is about 1,674 ha, and its yield is 0.19 t/ha. Assuming its selling price is 33,000 Rp/kg, annual sales will be 8,652,600Rp. With a target of 0.40 t/ha, which is close to Indonesia's average cocoa yield of 0.47 t/ha, annual sales will be 18,216,000 Rp.

According to current estimates, the annual sales of corn farming are higher. However, in the next fiscal year, we will compare the sales of cocoa farming in Indonesia with the price trends in the world cacao market and with the sales of African cacao beans, which have problems with child labor and improve the added value of the project to discuss how much we can increase the income of cacao farmers in Gorontalo Province.

Figure 4-4 Regions where corn and cacao farming coexist

4.3 Organizing information and negotiating for building a project implementation system

In this fiscal year, we are holding discussions on the project plan with BAPPEDA in Gorontalo Province and the governments of each prefecture, where the project target areas are located, to gain their understanding of the project.

Figure 4-5 Exchanging opinions with Gorontalo Province Development Planning Department and DKM (July 2022)

In addition, in collaboration with DKM, which is a local counterpart private company, we are implementing educational activities for cacao farmers and supporting the purchase of cacao beans through a new value chain aimed at improving the livelihoods of poor farmers. We are also conducting discussions regarding expanding the project further.

Figure 4-6 Cacao farm visit (left) and cacao plantation visit (right) (January 2023)

In the next fiscal year, we plan to finalize the business plan and develop a system that promotes long-term forest conservation, including considering measures to conduct forest patrols to prevent unnecessary deforestation.

Chapter 5 Intercity collaborative activities

5.1 Overview of intercity collaborative activities

In terms of this year's city-to-city collaboration project, most of the meetings were online. However, as the impact of the novel coronavirus has decreased, we were able to conduct field surveys from July 24 to July 31, from January 8 to 10, and from January 18 to 25. In addition, Ehime Prefecture officials visited Gorontalo Province twice, and concluded an LoI and MoU for the city-to-city collaboration project with Gorontalo Province, which is a great achievement. Like in the previous fiscal year, through online tools such as remote meetings and e-mails, as well as face-to-face meetings when present on-site, we obtained the local stakeholders' understanding of the survey and activities and also collaborated with our local counterparts, which are the Gorontalo Provincial Government, Gorontalo University, and DKM, to collect information and review the project. The main activities are summarized below.

Table 5-1 Overview of intercity collaborative activities

Date	Activity	Participants
June 7, 2022	Pre-kickoff meeting	Ministry of the Environment, Japan NUS Co., Ltd.
June 10, 2022	Discussions on LoI for city-to-city collaboration projects between Ehime Prefecture and Gorontalo Province	Indonesian Central Government, Ministry of Home Affairs, Ministry of Foreign Affairs, Ministry of Finance, Ministry of Environment and Forestry, Ministry of Public Works, Gorontalo Development Planning Agency, DKM, Kanematsu Corporation, Japan NUS Co., Ltd.
June 14, 2022	Discussing the division of responsibility for this year's survey	Kanematsu Corporation, Japan NUS Co., Ltd.
June 16, 2022	Discussing the division of responsibility for this year's survey	Aiken Kakoki K. K., Japan NUS Co., Ltd.
June 17, 2022	Discussing the division of responsibility for this year's survey	Daiki Axis Co., Ltd., Japan NUS Co., Ltd.
June 23, 2022	Discussions on REDD+ projects with the Forestry Agency	Forestry Agency, Kanematsu Corporation, Japan NUS Co., Ltd.
July 24-31, 2022	Field survey	Japan NUS Co., Ltd.

August 8, 2022	Discussions regarding the concluded MoU between Ehime Prefecture and Gorontalo Province for the City-to-City Collaboration Project	Ministry of Home Affairs, Central Government of Indonesia, DKM, Japan NUS Co., Ltd.
September 7, 2022	Business trip report, the trip to Ehime Prefecture, and future activity discussion	Ehime Prefecture, Japan NUS Co., Ltd.
September 8, 2022	Business trip report and future activity discussion	Aiken Kakoki K. K., Japan NUS Co., Ltd.
September 16, 2022	Business trip report and future activity discussion	Ehime University, Japan NUS Co., Ltd.
October 24, 2022	Discussions regarding the concluded MoU between Ehime Prefecture and Gorontalo Province for the City-to-City Collaboration Project	Gorontalo Development Planning Agency, Japan NUS Co., Ltd.
November 1, 2022	Discussions on traveling to Aiken Kakoki K. K.	Gorontalo Development Planning Agency, Ehime Prefecture, Aiken Kakoki K. K., Japan NUS Co., Ltd.
November 9, 2022	Discussions between Aiken Kakoki K. K. and the Gorontalo Development Planning Agency regarding the introduction of methane fermentation equipment	Gorontalo Development Planning Agency, Ehime Prefecture, Aiken Kakoki K. K., Japan NUS Co., Ltd.
November 28, 2022	Business trip report by Aiken Kakoki K.K.	Aiken Kakoki K. K., Japan NUS Co., Ltd.
December 6, 2022	Discussions regarding the concluded MoU between Ehime Prefecture and Gorontalo Province for the City-to-City Collaboration Project	Gorontalo Development Planning Agency, Ehime Prefecture, Japan NUS Co., Ltd.
December 19, 2022	Discussions on the introduction of methane fermentation equipment with coconut processing plants	PT. Royal, Gorontalo Development Planning Agency, Ehime Prefecture, Aiken Kakoki K. K., Japan NUS Co., Ltd.
December 22, 2022	Discussions regarding the concluded MoU between Ehime Prefecture and Gorontalo Province for the City-to-City Collaboration Project	Indonesian Central Government, Ministry of Home Affairs, Ministry of Foreign Affairs, Ministry of Environment and Forestry, Ministry of Public Works, Ministry of Justice, Ministry of Trade, Ministry of Energy and Mineral Resources,

		Gorontalo Development Planning Agency, Japan NUS Co., Ltd.
December 29, 2022	Discussions regarding the concluded MoU between Ehime Prefecture and Gorontalo Province for the City-to-City Collaboration Project	Gorontalo Development Planning Agency, Ehime Prefecture, Japan NUS Co., Ltd.
January 8-10, 2023	Field survey	Japan NUS Co., Ltd.
January 18-25, 2023	Field survey	Japan NUS Co., Ltd.
February 1, 2023	Ministry of the Environment Final Report	Ministry of the Environment, Ehime Prefecture, Japan NUS Co., Ltd.

5.2 Field Survey

The field survey was conducted from July 24 to 31, 2022, from January 8 to 10, 2023, and from January 18 to 25, 2023. The destinations and itinerary are shown below.

Figure 5-1 Main destinations in Gorontalo province

Table 5-2 Travel itinerary from July 24 to 31, 2022

day (of the month)	Hours.	Outline of Activities	destination
July 23.		Transfer (NRT-JKT)	
July 24		Move (JKT-GRT)	
July 25.	09.00	Meeting with Gorontalo Provincial Government	Department of Development Planning of the State of Gorontalo
	13.00		Department of Environment and Forestry, Gorontalo Province
	16.20		Department of Agriculture, Gorontalo Province
July 26	09.00	Site Inspection	Agricultural Cooperative and Coconut Oil Factory (IKM Centra Kelapa Kabupaten Gorontalo)
	13.00		Student dormitory (boarding school Pondok Pesantren Hubulo)
	14.30		Student dormitory 2 (boarding school MAN Cendekia)
July 27.	08.00	Meeting with Gorontalo Provincial Government Site Inspection	Primary sorting station in Gorontalo (TPS)
	08.45		Department of Public Works, Gorontalo Province
	10.00		Final disposal site (TPA Talumelito)
	12.30		Hospital (Rumas Sakit Ainun)
	14.00		Lake Limbot
	16.00		Septic tank in Gorontalo
July 28.	10.00	Meeting with Gorontalo Provincial Government Site Inspection	Department of Development Planning of the State of Gorontalo
	15.00		sugar refinery
July 29.	AM	Site Inspection	Marine debris survey
	15.00		Tulaboro Village
July 30		Site Inspection	Hungayono Inspection
July 31		Move (GRT-JKT)	
August 8	9:30	interview	Ministry of Home Affairs
August 12	8:30	interview	DKM Company
	15:00	Site Inspection	PT. DAIKI AXIS INDONESIA

Table 5-3 Travel itinerary from January 8 to 10 and from January 18 to 25, 2023

day (of the month)	Outline of Activities	destination
January 8	Move (JKT-GRT)	Inspection of Fort Otanaha Whale Shark Observation
January 9	Preparation for Ehime Economic Exchange Mission	Discussion with the Department of Development Planning of the State of Gorontalo Visit to Bank Indonesia Discussion with PT. Royal COCONUT
January 10	Move (GRT-JKT)	
January 18	Ehime Economic Exchange Mission	
January 19	Ehime Economic Exchange Mission	
January 20	Site Inspection	Discussion with the Department of Public Works of the State of Gorontalo Inspection of final disposal site Visit to a plastic recycling facility Discussions with Gorontalo State Department of Environment, Department of Public Works, Department of River Management, and Department of Watershed Management
January 21	Site Inspection	Inspection of cacao plantations
January 22.	Site Inspection	Inspection tour of Lake Limbot
January 23.	Site Inspection	Visiting the Biyonga River Basin
January 24	Site Inspection	Discussion with PT. Royal COCONUT
January 25.	Movement (GRT-DPS)	

Details of individual discussions and surveys are stated in the related sections of this report. In this section, we will introduce the discussions with the Gorontalo Development Planning Agency, which are related to this work in general.

On July 25, 2022, we held a discussion with the Gorontalo Development Planning Agency, which is the counterpart of this project. First, we contacted Ehime Prefecture online, and they explained the preparation status of the LoI related to the city-to-city collaboration project between Ehime Prefecture and Gorontalo Province. After that, officials from various departments of the Gorontalo Development Planning Agency also participated in a discussion on the environmental and development issues in Gorontalo Province.

The Department of Infrastructure commented on the domestic and industrial wastewater treatment issues in Gorontalo Province, confirming their high expectations toward Daiki Axis septic tanks and Aiken Kakoki's wastewater treatment technology. In addition, as waste treatment is an issue, there was a request to assist with this matter by introducing Japanese treatment technology. The planning department also requested support for solving issues related to the agricultural sector, such as the treatment of agricultural waste and alternatives for corn farming with agriculture that enhances the water retention capacity of forests.

In addition to technical expectations, the Gorontalo Development Planning Agency mentioned that they have high expectations toward Ehime Prefecture's support for the education of government officials, private companies, and residents, especially education on water infrastructure management. As for decarbonization, the Gorontalo Development Planning Agency stated that there is a lack of plan formulation know-how and requested that Ehime Prefecture to share the process from data collection to formulation. Thus, we

were able to confirm their specific needs regarding this issue.

On July 28, we visited the Development Planning Agency again, shared the matrix table through which we organized the needs in Gorontalo province by field, explained the subsequent examination process, and then requested the collection of necessary data. Since then, we have been continuing to exchange data and share study results through the Development Planning Agency.

Ehime Prefecture's policy sharing and support for Gorontalo province's plan formulation for decarbonization are stated in the action plan related to the conclusion of the MoU. In the next fiscal year, we plan to provide opportunities for discussions pertaining to the formulation of decarbonization plans by the Ehime Prefectural Environment Department and the Gorontalo Provincial Government and to proceed with reviewing specific policy transfers.

Figure 5-2 Exchange of opinions with the Gorontalo Development Planning Agency (July 2022)

5.3 Ehime Prefecture's Economic Exchange Mission to Indonesia

Ehime Prefecture has collaborated with the Ehime Federation of Chambers of Commerce and Industry to send overseas missions to Southeast Asia seven times. This is the 8th mission. In this mission, Governor Nakamura of Ehime Prefecture accompanied us on visits to Indonesian government agencies, promoted Japanese products and industries targeting local economic organizations, built relationships with them, and conducted business matching meetings. He also visited Gorontalo Province for this project, and Ehime Prefecture and Gorontalo Province signed a memorandum of understanding related to the city-to-city collaboration project. The schedule of the economic exchange mission is as follows.

Table 5-4 Itinerary of Ehime Prefecture's Economic Exchange Mission to Indonesia

Date	Time	Destination
Sunday, January 15	18:30	Mission team send-off party
	Overnight stay	Jakarta (Pullman Jakarta Indonesia)
Monday, January 16	9:00	Exchange with former international students (inside the hotel)
	10:00	Minister of Commerce Zulkifli
	12:00	Lunch meeting with Mitsubishi Corporation
	13:30	Visit to Plaza Indonesia
	15:30	Business meeting with the Indonesian Chamber of Commerce and Industry (KADIN)
	18:30	Exchange meeting with the Ehime Kenjinkai (Ehime Prefecture Club) in Indonesia
	Overnight stay	Jakarta (Pullman Jakarta Indonesia)
Tuesday, January 17	10:00	Meeting with former Trade Minister Mohammed Lutfi
	12:00	Lunch meeting with PT Bank BTPN Tbk (Sumitomo Mitsui Banking Corporation)
	14:00	Meeting with Minister of State-Owned Enterprises Eric Tohir
	16:00	Meeting with Mr. Agus Gumiwan Kartasasmita, Minister of Industry
	Overnight stay	Jakarta (Anara Airport Hotel)
Wednesday, January 18	7:05	≪Soekarno-Hatta International Airport≫ Departure <GA644>
	11:10	≪Jalaluddin Airport≫ Arrival
	12:30	Lunch (Airport VIP)
	14:00	Visit to Anggrek Port
	18:30	Banquet hosted by Gorontalo Provincial Government
	Overnight	Gorontalo Province (Aston Gorontalo Hotel)

	stay	
Thursday, January 19	7:00	Whale shark watching tour
	9:30	MOU Signing Ceremony with Gorontalo Province
	13:00	Top officials promoting Japanese products and industries to PT ROYAL COCONUT
	15:00	Visit to the organic fertilizer farming center
	16:30	Otanaha Fortress Visit
	19:00	Dinner (Botubarani Beach)
	Overnight stay	Gorontalo Province (Aston Gorontalo Hotel)
	11:55	≪ Jalaluddin Airport ≫ Departure <GA646>
	13:50	≪Soekarno-Hatta International Airport≫ Arrival
	16:00	Meeting with Deputy Minister of Environment and Forestry
	21:30	≪Soekarno-Hatta International Airport≫ Departure <NH585>

At the business meeting with the Indonesian Chamber of Commerce and Industry on January 16, Governor Nakamura introduced the city-to-city collaboration project with Gorontalo Province, Daiki Axis Indonesia, and Aiken Kakoki K.K.'s technology. On the 20th, he met with the Deputy Minister of Environment and Forestry and also introduced the city-to-city collaboration project.

Figure 5-3 Governor Nakamura introducing the city-to-city collaboration project at a business meeting with the Indonesian Chamber of Commerce and Industry (January 16, 2023)

From the 18th to the 20th, 38 Ehime Prefecture Economic Exchange Mission members, including companies from the prefecture and members of the Chamber of Commerce and Industry, visited Gorontalo Province and received a warm welcome from the Gorontalo Government. On the 19th, Governor Nakamura and Gorontalo's governor held an MoU

signing ceremony for the city-to-city collaboration project in the presence of Vice-President Gobel of the People's Representative Council. On the same day, the mission members also visited PT. Royal COCONUT, a candidate site for the installation of methane fermentation equipment by Aiken Kakoki K.K. During the visit, we proposed Aiken Kakoki K.K.'s technology, and Governor Nakamura promoted the sales of Japanese products and industries.

Figure 5-4 MoU signing ceremony for the city-to-city collaboration project (January 19, 2023)

During his visit, Mr. Nakamura, Governor of Ehime Prefecture, felt great expectations toward the economic development potential of Gorontalo Province and the introduction of environmental technologies by companies from Ehime Prefecture. He also stated that Ehime Prefecture plans to expand the economic exchange further with Gorontalo Province and strengthen cooperation to solve environmental and developmental issues.

Through this visit to Gorontalo Province as part of the Ehime Prefecture's Economic Exchange Mission to Indonesia, the cooperation between Ehime Prefecture and the Gorontalo Provincial Government has been further strengthened. Based on this collaboration, Ehime Prefecture intends to accelerate its efforts in this project.

脱炭素社会の実現でインドネシアと協力

01月19日　19時06分

愛媛県の中村知事はインドネシアを訪問しています。
１９日は東部にある州の幹部と面会し、脱炭素社会の実現に向けて協力することで一致しました。

愛媛県の中村知事は県内企業の関係者などおよそ８０人と今月１５日から２０日までの日程でインドネシアを訪問しています。
１９日は東部の島にあるゴロンタロ州を訪れ、地元の幹部などと環境問題や経済協力について意見交換を行いました。
そして、脱炭素社会の実現に向けた取り組みで協力することで一致し覚え書きを交わしました。

Penjagub Gorontalo – Gubernur Ehime Teken MSP Kerja Sama

January 19, 2023

Penjabat Gubernur Gorontalo Hamka Hendra Noer (tiga kiri) dan Gubernur Ehime Tokihiro Nakamura (dua kiri) menandatangani Memorandum Saling Pengertian (MSP) di Kantor BI Perwakilan Gorontalo, Kamis (19/1/2023). Kerja sama dua provinsi beda negara itu meliputi manajemen lingkungan, pembangunan ekonomi dan industri, pertanian dan kehutanan serta pendidikan dan pelatihan. (Foto: Fadil – Diskominfotik).

Figure 5-５　Coverage by various media sources

Chapter 6 Summary

6.1 Results of this fiscal year's city-to-city collaboration project

Due to the subsiding of the novel coronavirus impact, we were able to go to the field to conduct a field survey this fiscal year. Like in the previous fiscal year, we successfully conducted interviews and obtained the information and data necessary for examination through frequent remote meetings, e-mails, and other online communication tools. In addition, regarding the MoU conclusion between Ehime Prefecture and Gorontalo Province, the LoI conclusion, action plan formulation, and the MoU conclusion ceremony strengthened cooperation between the two municipalities.

This city-to-city collaboration project is expected to be implemented over three years. In this fiscal year, which is the second year, we were able to reach an agreement with the local government and related parties on the specifics of the project, the detailed examination for commercialization, and the steps for future commercialization. In addition, through exchanging opinions with Gorontalo provincial government departments, we were able to grasp the issues facing the Gorontalo government regarding decarbonization. The following is a summary of the results.

Table 6-1 Summary of results of the city-to-city collaboration project for this fiscal year

Project candidate		Results
Local water infrastructure development	Septic tank	・ Selection and inspection of candidate sites for the installation of septic tanks ・ Collection of data on the water quality of the Lake Limboto and water quality data of rivers flowing into the Lake Limboto ・ Agreement with the local government on steps for installation
	Methane fermentation facility	・ Selection of candidate sites for the installation of methane fermentation equipment ・ Confirming interest in wastewater treatment and energy use in coconut processing factories ・ Collection of data on wastewater from coconut processing factories and discussions on future data collection ・ Estimating the installation results, the business feasibility evaluation, and the CO_2 emission reduced ・ The Governor of Ehime Prefecture promoted the adoption of Japanese methane fermentation equipment at candidate sites
	Other	・ Grasping the needs related to the treatment of leachate at final disposal sites ・ An on-site inspection by Aiken Kakoki K.K. confirmed that wastewater treatment is possible. ・ A proposal for system installation by Aiken Kakoki K.K. ・ Confirmation of budget scale for installation and agreement on budgeting by local government
Sustainable forest use		・ Understanding the actual land use conditions at the candidate sites for implementing the project and reflecting it in the plan ・ Business cooperation agreement between Gorontalo provincial government and Ehime prefectural government and reaching a business understanding

Decarbonization policy formulation support	・ Grasping the local government's needs for decarbonization policy formulation ・ Inclusion of policy formulation support items in the action plan for the city-to-city collaboration project
Other	・ Concluding the LoI for the concluded MoU on the city-to-city collaboration project (September 2022) ・ Formulation of action plans for the city-to-city collaboration project ・ Held an MoU signing ceremony for the city-to-city collaboration project (January 2023)

6.2 Issues related to commercialization

In this fiscal year, issues related to the project implementation system, economic efficiency, and the JCM equipment subsidy project requirements became apparent as the project materialized. Since tackling these issues is linked to the formulation of the decarbonization project, we have reached an agreement in cooperation with the Gorontalo provincial government to consider a breakthrough solution plan next year.

The issues for each project and the plan for the next fiscal year are shown below.

Table 6-2 Issues in commercialization and next year's plan

Project		Issues	Plan for next fiscal year
Local water infrastructure	Septic tank	・ Difficulty in setting up a demonstration project site for the introduction of septic tanks	・ To collaborate with Gorontalo Provincial Public Works Department and collect information on potential sites ・ Survey of past cases ・ Considering applying for a demonstration budget such as the ones for “Model Projects for Improving Water Environment in Asia”
	Methane fermentation	・ Lack of data on wastewater ・ Determining where to use surplus electricity after the installation of methane fermentation equipment	・ Requesting the collection of necessary data ・ Consulting with Gorontalo ESDM and PLN
	Other wastewater treatment	・ Insufficient data for detailed design ・ Hurdles in central government budget application	・ Considering the use of FS budgets, such as applying for "Projects promoting the overseas expansion of Japan's recycling industry" and collecting necessary data ・ Sharing the central government budget request schedule

Sustainable forest use	・ Gaining an understanding of cocoa farming ・ Cooperation with prefectural governments, cities, etc.	・ Building a system for sustainable forest use ・ More detailed planning
Decarbonization plan formulation support	・ Understanding of Gorontalo Province planning status ・ Insufficient coordination for decarbonization with departments of Gorontalo Province	・ Discussions on decarbonization plans with departments of Gorontalo Province ・ Collaboration with the Ehime Prefecture Environment Department
Other	・ Lack of analytical institutions in Gorontalo province ・ Initiatives by Ehime prefecture and technology sharing by companies in the prefecture	・ Discussions with Ehime University and considering support through collaboration with Gorontalo University ・ Planning to invite Gorontalo Province officials to Ehime Prefecture

6.3 Policy for the city-to-city collaboration project for the next fiscal year

The implementation details and plans for each future study theme are expected to be as follows.

Table 6-3 Contents and plans for each future study theme

Case Details	2021	2022	2023	2024
(1) Regional water infrastructure development			Obtaining budgets for demonstration projects	
septic tank	Organizing Technology Organize considerations for introduction	Selection of additional potential sites Introduction plan formulation	Study on transfer of water quality control and analytical technology	
Methane Fermentation Facilities	Organizing Technology Organize considerations for introduction	effectiveness verification Introduction plan formulation	detailed design decision-making making a deal (e.g. on a credit card)	Application for JCM Equipment Assistance Program start of (construction) work
final disposal site		Requests for assistance from the local community Proposal of wastewater treatment system to the site	data collection detailed design Budgeting support by local government	Budgeting by the State of Gorontalo Bidding and construction start
(2) Sustainable forest use	Potential Area Identification	effectiveness verification systematization		commercialization
(3) Support for decarbonization planning	Ehime Policy Sharing WS held Identification of local issues	Identification of more detailed policy issues MOU/LOI concluded for the realization of a decarbonized society Ehime Economic Exchange Mission	More detailed policy sharing Planning Support	Declaration of Decarbonization

In the next fiscal year, we will implement the surveys in the “plan for next fiscal year” shown in Table 6-2 above. The next fiscal year will be the third and final year of the three-year project, so we will focus on preparing for the JCM equipment subsidy

projects and demonstration projects for each theme.

One of the achievements of this year's project was the strengthening of cooperation between the local governments of Ehime Prefecture and Gorontalo Province, and it is a relationship that is expected to continue beyond the period of the city-to-city collaboration project. Based on this collaboration, we aim to increase the achievements of this city-to-city collaboration project as much as possible and expand the range of our initiatives. In addition, from May next year, the novel coronavirus will be downgraded to category 5 under the Infectious Diseases Act. Thus, it is expected that travel restrictions will almost disappear. Therefore, based on the collaboration built this year, we would like to formulate projects for each theme through frequent trips.

In addition, as a city-to-city collaboration project, we plan to provide recommendations in response to the specific issues related to decarbonization in Gorontalo Province, which we have identified this year, based on the initiatives and plans for decarbonization in Ehime Prefecture. Next fiscal year, we are considering inviting related parties from Gorontalo Province to Ehime Prefecture to have an opportunity to introduce them to the state of Ehime Prefecture and the technologies of the companies in the prefecture.

(End)

Attachments

Attachment 1: Outline of the Project (English version)

Attachment 2: Proposed Action Plan for Cooperation between Gorontalo Province and Ehime Prefecture toward the Realization of a Carbon Free Society (Indonesian version)

Attachment 3: Report on the field survey in July

Attachment 4: Report on the Results

Collaboration Project in Gorontalo province with Ehime prefecture

AGENDA

1. Outline
2. Introduction of related stakeholders
3. Introduction of the programs
   - ① Feasibility study of regional water infrastructure development by decarbonized energy
   - ② Feasibility study of sustainable forest use through cacao cultivation
4. Schedule
5. Reference

1. OUTLINE

Hubungan antara Prefektur Gorontalo dan Ehime

- Maret 2007 Universitas Ehime dan Universitas negeri Gorontalo Menyetujui "Kerjasama Akademik"
- Mei 2013 Menyelesaikan "Memorandum of Understanding for Joint Research and Human Resource Development through Tripartit Collaboration" oleh Universitas Ehime, Universitas negeri Gorontalo dan Kabupaten Gorontalo Utara.
- November 2016 Menyelesaikan "Memorandum of Understanding on Joint Research and Human Resource Development through Tripartit Collaboration" oleh Universitas Ehime, Universitas negeri Gorontalo dan Provinsi Gorontalo.
- 2016 Delegasi Gorontalo melakukan kunjungan kehormatan ke Wagub Ehime

⬇

Bertujuan untuk memperkuat kerjasama antar pemerintah daerah

Konferensi web antara prefektur Ehime dan BAPPEDA, Gorontalo

Perjanjian kerjasama antar universitas

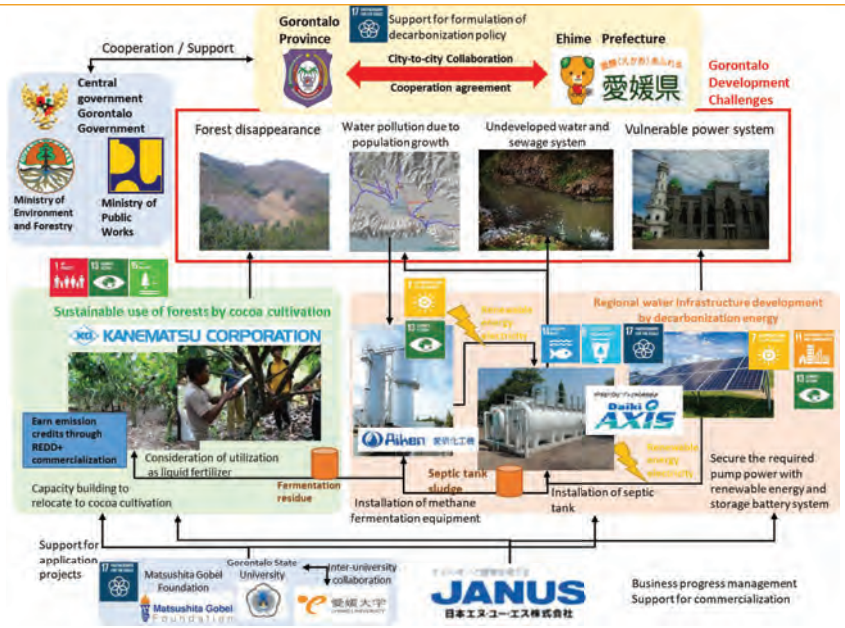
Kunjungan ke prefektur Ehime

Action plan (draft)

SECTOR	PROGRAM	OBIJECTIVE
Environmental Management	Policy making for the Carbon Neutrality Declaration of Gorontalo Province	● Gaining knowledge about Ehime Prefecture's environmental policy ● Planning of reduction for major emission sources ● Inclusion of development plans based on decarbonization in RPJMD ● Review of RAD-GRK
Economic development and Industry	Feasibility study of regional water infrastructure development by decarbonized energy	● Economic evaluation and estimation of greenhouse gas reduction effects ● Building relationships with stakeholders and designing systems for introduction ● Construction of project implementation system and financing scheme ● Establishment of monitoring system
Agriculture and Forestry	Feasibility study of sustainable forest use through cacao cultivation	● Economic evaluation and estimation of greenhouse gas reduction effects ● Building relationships with stakeholders and designing systems for introduction ● Development of sales channels
Education and Training	Environmental education	● Capacity building of local companies about maintenance and management of water infrastructure system ● Capacity building of local companies about cacao cultivation ● Environmental education for students of Gorontalo State University

These programs are going to be implemented in the “city-to-city collaboration project (the budget by Ministry of the Environment Japan)” in Gorontalo province in order to formulate JCM projects which contribute to GHG gas emission reduction.

1. Policy making for the Carbon Neutrality Declaration of Gorontalo Province
2. Feasibility study of regional water infrastructure development by decarbonized energy
3. Feasibility study of sustainable forest use through cacao cultivation
4. Environmental education



2. INTRODUCTION OF STAKEHOLDERS

-Ehime Prefecture

-Kanematsu Corporation

-Daiki Axis Co., Ltd.

-Aiken Kakoki K. K.

-Japan NUS co., ltd.

Ehime Prefecture

2. INTRODUCTION OF STAKEHOLDERS

■ Ehime Prefecture formulated the Ehime Prefecture Action Plan for Global Warming Countermeasures in February 2020, which sets the basic policies of "realization of a low-carbon business style," "promotion of low-carbon energy," and "creation of regions with low environmental impact". In order to realize these basic policies, various measures are being implemented from the perspective of the SDGs.

■ Ehime Prefecture has been promoting international cooperation at the private level such as organizing business matching events with Indonesia, Thailand, Vietnam and Taiwan.

■ The relationship with Gorontalo province began in March 2007. After that, Ehime University, Gorontalo University and Gorontalo Province signed a "Memorandum of Understanding on Joint Research and Human Resource Development through tripartite collaboration" to deepen regional cooperation, and to promote educational and academic exchanges.

Kanematsu Corporation

KANEMATSU CORPORATION

- Kanematsu Corporation, a trading company established in 1889, provides services in a wide range of business areas. In recent years, the company has expanded into the environmental business.
- Since 2011, Kanematsu has conducted feasibility studies for forest conservation projects (REDD+ projects) in Brazil and Indonesia with the aim of conserving forests and combating global climate change.

2. INTRODUCTION OF STAKEHOLDERS

Daiki Axis Co., Ltd.

- Daiki Axis Co., Ltd. was established in 2005 and is headquartered in Ehime prefecture. The company is engaged in wastewater treatment, housing equipment, and biodiesel fuel businesses.
- In 1998, the company established PT. DAIKI AXIS INDONESIA in Indonesia as a base for Southeast Asia, and has been engaged in the design, construction, manufacture, sale, and maintenance of sewage treatment systems, grey water and filtration systems, etc., mainly in Jakarta.

Aiken Kakoki K. K.

■Aiken Kakoki K. K. is a manufacturer of water treatment equipment founded in 1983 and headquartered in Ehime Prefecture.
■In addition to water treatment systems, the company has been working for many years on energy recovery from wastewater and solid waste as a biomass system.
■The company has implemented feasibility study for treatment system of highly concentrated effluent with Biogas Recovery at Palm Oil Mill in Indonesia.

2. INTRODUCTION OF STAKEHOLDERS

Japan NUS Co., Ltd.

■ We provide consulting on the environment and energy field, and have a track record of adopting and implementing JCM projects and City-to-City collaboration in the past.
■ Founded in 1971, 175 employees
■ The track record in Indonesia are as follows
- 2014 JCM Feasibility Study "3.7 MW Run-of-river Small Hydropower"
- 2018 JCM project of CNG mixed combustion of public transportation in Semarang City, Indonesia
- 2019 Infrastructure development research project for JCM project (Banda Aceh and Tobintingi City)
- 2020 City-to-city collaboration to realize a zero carbon society

JGC Holdings Co., Ltd.

JGC Global Co., Ltd.
Oil and gas business
Infrastructure business

JGC Indonesia

JGC Corporation

Japan NUS Co., Ltd.

JGC HOLDINGS CORPORATION

■ EPC (design, procurement, construction) of various plants in Japan and overseas. Over 20,000 projects have been carried out in 80 countries around the world, and they have received world's highest level evaluation from customers all around the world, including Japanese oil companies, oil majors, and national oil companies.
■ Founded in 1928, 7,607 employees
■ Since JANUS and JGC Global are the same JGC group, we have the advantage of being able to provide consistent services from consulting to EPC. JGC Global also has a branch in Indonesia, where can provide additional support system including EPC.

3. INTRODUCTION OF THE PROGRAMS

① Feasibility study of regional water infrastructure development by decarbonized energy

② Feasibility study of sustainable forest use through cacao cultivation

① Feasibility study of regional water infrastructure development by decarbonized energy

① Feasibility study of regional water infrastructure development by decarbonized energy

Current problems

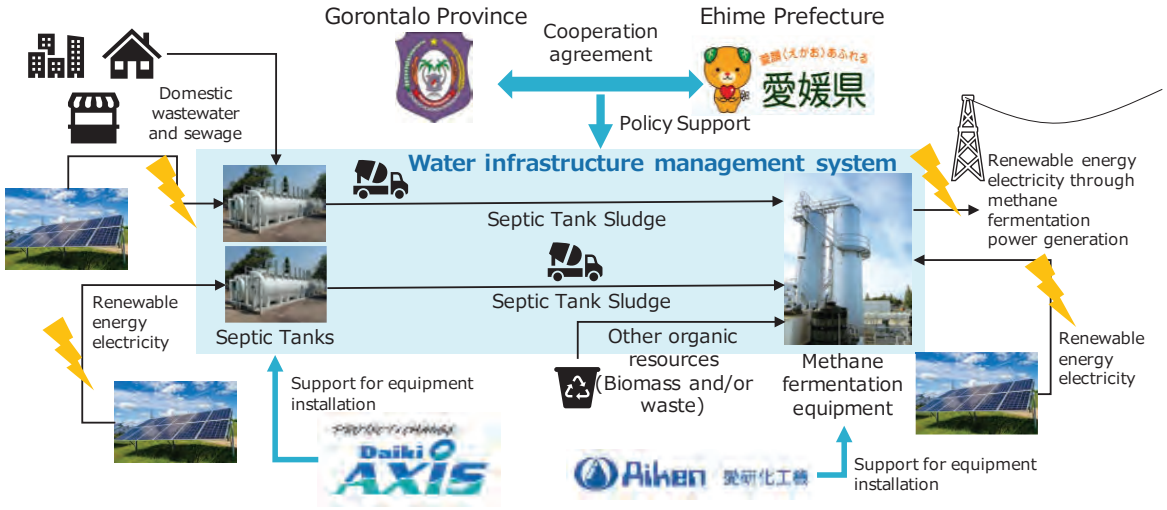
- Water pollution in rivers and lakes due to population growth
- Inadequate sewerage systems
- Fragile power infrastructure



Expected results from the Project

- Achievement of the target for the sewerage penetration rate in RPJPN
- Construction of septic tank maintenance and management system
- Installation of equipment with zero CO2 emissions through the use of renewable energy
- Improvement of water pollution and reduction of fuel cost by gas conversion

Structure of the Project



3. INTRODUCTION OF THE PROGRAMS

② Feasibility study of sustainable forest use through cacao cultivation

② Feasibility study of sustainable forest use through cacao cultivation

Current problems

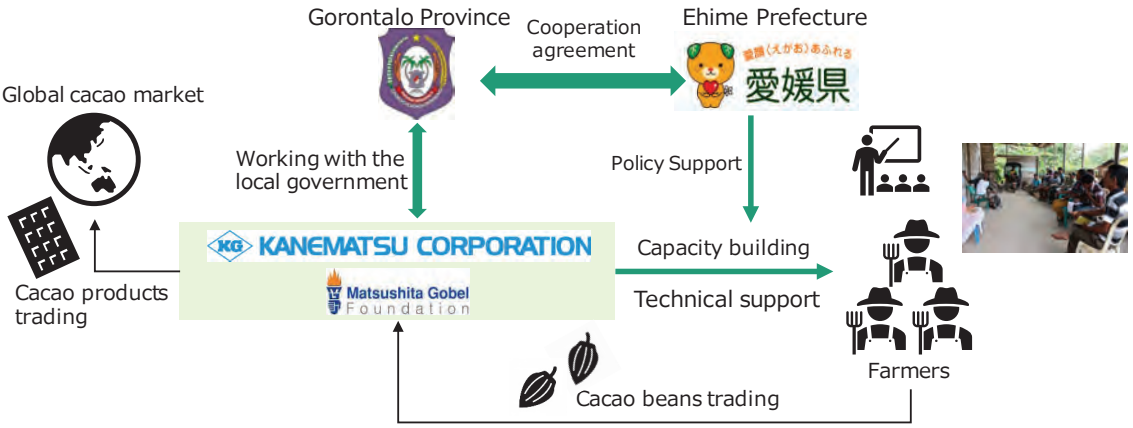
- Deforestation due to slash-and-burn agriculture
- Landslides and floods due to reduced water retention capacity of forests
- Ecosystem destruction due to sediment inflow into rivers and oceans



Expected results from the Project

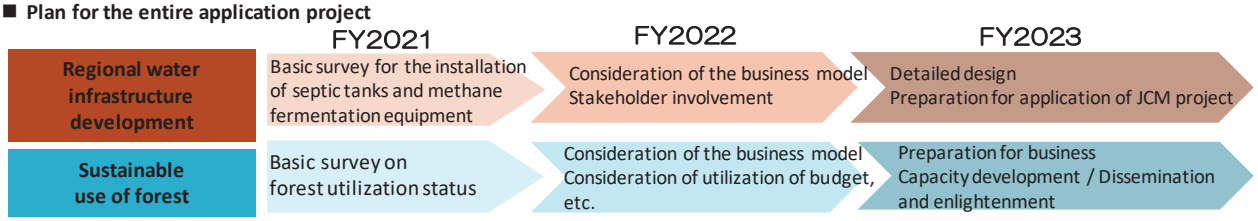
- Forest conservation through conversion to cocoa cultivation
- Activities to increase productivity by adding value to agricultural products
- Capacity building of local people

Structure of the Project



4. SCHEDULE

■ **Plan for the entire application project**



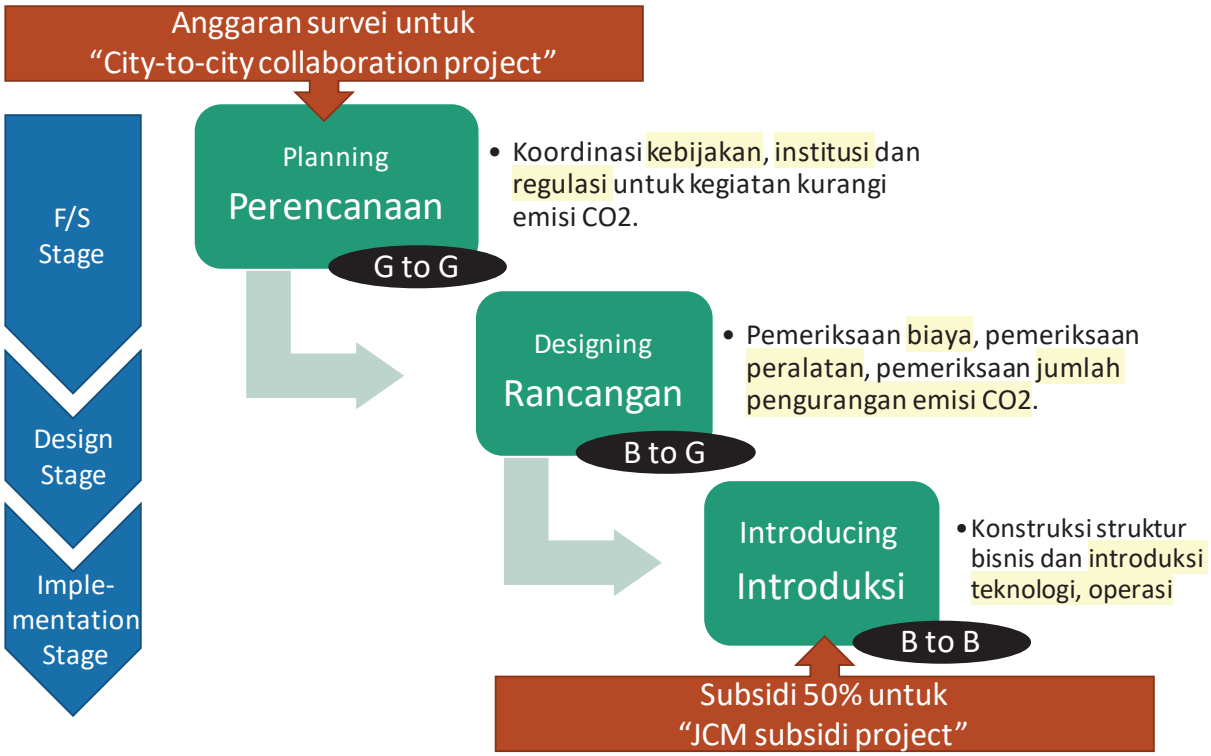
■ **Implementation plan for support, cooperation, project studies between Ehime Prefecture and Gorontalo Province**

Action / year	FY2021	FY2022	FY2023
Kick-off meeting	▲ Communication of the Implementation plan	▲ Progress check	▲ Progress check
Communication about Ehime Prefecture's environmental policy	▲ Introduction of Global Warming Prevention Plan of Ehime prefecture	▲ More detailed policy introduction	▲ Review of decarbonization plan of Gorontalo province
Policy development support	▲ Understanding decarbonization plan of Gorontalo province	▲ Exchange of views on policies related to water infrastructure development	▲ Exchange of views on forest conservation-related policies
Field survey support	Potential site survey support ↔	Field survey ↔ ▲ Detailed study of water infrastructure development	▲ Detailed study support Support for construction progress check
Stakeholders' involvement support	Introduction/coordination support of application projects ↔	▲ International consortium formation support (Water infrastructure development)	▲ Capacity development / dissemination and enlightenment (Sustainable use of forest)
Online seminars held	▲ Workshop	▲ online tour	▲ online tour
Business matching held	● Companies in Ehime prefecture facility introduction	● Companies in Ehime prefecture facility introduction	● Companies in Ehime prefecture facility introduction
Results and progress report	▲ FOD * including government officials	▲ FOD * including government officials	▲

▲ **Conducted an online meeting with the partner country**
● **Conducted in Japan (Ehime Prefecture) and introduced online to the local government.**
FGD * Focus Group Discussion

5. REFERENCE

Skema pengurangan emisi CO2 oleh pemerintah Jepang



Skema pengurangan emisi CO2 oleh p

-Prefektur Ehime bekerjasama dengan Gorontalo
-Memanfaatkan anggaran pemerintah Jepang
-Membuat proyek yang membantu mengurangi emisi CO2 di Gorontalo

Matriks rencana kerja sama antara pemerintah daerah di Provinsi Gorontalo (Republik Indonesia) dan Prefektur Ehime (Jepang) untuk mewujudkan masyarakat bebas karbon.

Bidang Kerjasama	No	Program Kegiatan	Output	Outcome	OPD Gorontalo/Ehime	Peran Para Pihak		Estimasi Waktu Pelaksanaan	Sumber Pendanaan
						Ehime	Gorontalo		
Manajemen lingkungan	1	Fasilitasi kegiatan pengelolaan lingkungan untuk menurunkan emisi gas karbon	• Informasi tentang sumber-Sumber utama emisi gas rumah kaca di Gorontalo dan proyeksi emisi di masa yang akan datang • Akuisisi data untuk pembersihan Kawasan Danau Limboto • Dokumen Study Kelayakan tentang pengenalan teknologi pengolahan air limbah untuk lindi pada Tempat Pembuangan Akhir Talumelito.	• Tersusunnya arah kebijakan dekarbonisasi di Gorontalo • Tersusunnya gambaran umum tentang pencemaran dan penanganan Danau Limboto • Tersusunnya informasi pengolahan sampah dan desain perencanaan, pengembangan sistem penanganan limbah di TPA Talumelito • Terbukanya peluang memperoleh bantuan melalui anggaran pemerintah Jepang lainnya	• Dinas Lingkungan Hidup dan Kehutanan Provinsi Gorontalo. • BAPPPEDA Provinsi Gorontalo • Dinas PU Provinsi Gorontalo dan TPA Talumelito • Koperasi Syariah ElMadani • Departemen Lingkungan Ehime • Prefektur Ehime (Shikoku) • JANUS • Perusahaan di Prefektur Ehime	• Menyediakan informasi kebijakan Lingkungan Hidup dan pemanfaatannya di Provinsi Gorontalo. • Berbagi pengalaman dan aksi dalam mengatasi sumber emisi • Bantuan dalam penyusunan dokumen perencanaan. • Proposal desain kelembagaan untuk mengoptimalkan teknologi, dan pengembangan SDM • Koordinasi deklarasi dekarbonisasi. • Perencanaan bisnis. • Persiapan proposal dan formulir pembiayaan lainnya	• Memberikan informasi tentang sumber utama emisi. • Persiapan rencana pengembangan program dekarbonisasi dalam dokumen perencanaan. • Koordinasi dengan pemerintah pusat • Fasilitasi rapat • Pendampingan di lapangan • Koordinasi dengan pelaku usaha lokal (koperasi)	Januari 2023 – Januari 2026.	• Kementerian Lingkungan Hidup Jepang (JPY 5.000.000) • Provinsi Gorontalo (Rp 30.000.000)
Pembangunan ekonomi dan industri	2	Studi kelayakan penerapan teknologi dan pengembangan bisnis serta promosi untuk permasalahan ekonomi, dan industri di Wilayah Gorontalo.	• Dokumen studi kelayakan tentang pengenalan teknologi pengolahan air limbah untuk pelaku usaha yang membuang air limbah industri dalam jumlah besar yang berdampak pada pencemaran lingkungan (industri pengolahan kelapa). • Dokumen studi kelayakan tentang pasokan energi biomassa untuk pelaku usaha padat energi (industri pengolahan kelapa). • Data dan informasi produk dan teknologi perusahaan di Ehime dan Gorontalo • Terlaksananya kegiatan *business matching*	• Tersedianya desain fasilitas, estimasi, perencanaan, dan pengembangan sistem pengolahan air limbah • Terbukanya peluang memperoleh bantuan melalui anggaran pemerintah Jepang lainnya • Meningkatnya kualitas produksi perusahaan lokal di wilayah Gorontalo • Stimulasi ekonomi melalui promosi.	• Dinas PU Provinsi Gorontalo • BAPPPEDA Provinsi Gorontalo • Dinas Koperasi, UMKM, Perindustrian dan Perdagangan Provinsi Gorontalo • Perusahaan lokal di Gorontalo • Koperasi Syariah ElMadani • Perusahaan di Prefektur Ehime • JANUS	• Identifikasi dan pengumpulan informasi • Proposal untuk desain kelembagaan dalam mengoptimalkan teknologi, mengembangkan sumber daya manusia, perusahaan lokal serta mendukung adopsi teknologi • Perencanaan bisnis • Persiapan proposal dan formulir pembiayaan lainnya • Pengenalan produk dan teknologi perusahaan di Ehime • Merencanakan dan menyelenggarakan kegiatan *business matching*	• Penyediaan informasi tentang lokasi potensial • Koordinasi dengan perusahaan lokal, stakeholder terkait dan pemerintah pusat • Pendampingan di lapangan • Pengenalan produk dan teknologi perusahaan di Gorontalo • Dukungan administrasi untuk kegiatan *business matching* • Persiapan rencana pengembangan program dekarbonisasi dalam dokumen perencanaan.	Januari 2023 – Januari 2026.	• Kementerian Lingkungan Hidup Jepang (JPY 5.000.000) • Provinsi Gorontalo (Rp 20.000.000)

Pertanian dan kehutanan	3	Studi kelayakan tentang metode konservasi hutan yang berkelanjutan.	• Dokumen perencanaan konservasi hutan di lahan kritis wilayah Gorontalo • Pemberdayaan petani dalam konservasi hutan dan lahan kritis • Dokumen studi kelayakan konsep pertanian di lahan miring	• Meningkatnya pemahaman masyarakat tentang konservasi hutan dan lahan kritis • Meningkatnya pemahaman tentang langkah langkah konservasi hutan dengan menggunakan skema seperti REDD+ • meningkatnya pengetahuan masyarakat tentang budidaya kakao	• Dinas Lingkungan Hidup dan Kehutanan Provinsi Gorontalo • Dinas Pertanian Provinsi Gorontalo • BAPPPEDA Provinsi Gorontalo • Kanematsu (department store) • JANUS	• Survey lokasi • Usulan rancangan kelembagaan untuk mendukung pemanfaatan hutan lestari • Pengembangan kapasitas perusahaan lokal dan pengembangan distribusi penjualan	• Penyediaan informasi tentang lokasi potensial • Koordinasi dengan petani, stakeholder terkait, perusahaan lokal dan pemerintah pusat. • Pendampingan di lapangan • Persiapan rencana pengembangan program dekarbonisasi dalam dokumen perencanaan.	Januari 2023 – Januari 2026	• Kementerian Lingkungan Hidup Jepang (JPY 4.000.000) • Provinsi Gorontalo (Rp 20.000.000)
Pendidikan dan pelatihan	4	Pendidikan lingkungan hidup untuk mendukung pembangunan yang berkelanjutan.	• pelatihan kepada para pemangku kepentingan dalam pemeliharaan dan pengelolaan sistem infrastruktur air • seminar konservasi hutan untuk pelaku usaha lokal dan petani tentang budidaya kakao.	• Meningkatnya keahlian dalam pengelolaan fasilitas infrastruktur air. • Meningkatnya pemahaman tentang pentingnya konservasi hutan • Meningkatnya pengetahuan dan kesadaran	• Dinas PU Provinsi Gorontalo • BAPPPEDA Provinsi Gorontalo. • Dinas Lingkungan Hidup Provinsi Gorontalo • Dinas Pertanian Provinsi Gorontalo	• Penyediaan informasi dan pengetahuan teknis kepada perusahaan yang terlibat dalam sistem infrastruktur air. • Penyediaan informasi dan pengetahuan teknis tentang pentingnya konservasi hutan • Memberikan informasi dan bertukar	• Mengidentifikasi pemangku kepentingan • Memberikan informasi dan mengkoordinasikan kegiatan pelatihan • Memfasilitasi pertemuan atau *Focus group discussion* • Persiapan rencana pengembangan	Januari 2023 – Januari 2026	• Kementerian Lingkungan Hidup, Jepang (JPY 1.000.000)- Provinsi Gorontalo (Rp 25.000.000)
			• Seminar pendidikan lingkungan hidup untuk Perguruan Tinggi di Gorontalo.	menjaga lingkungan di kalangan akademisi	• Perguruan Tinggi di wilayah Gorontalo • Prefektur Ehime (Shikoku) • Perusahaan di Prefektur Ehime • Kanematsu (department store) • JANUS • Universitas Ehime	pandangan dengan mahasiswa di Perguruan Tinggi di wilayah Gorontalo.	program dekarbonisasi dalam dokumen perencanaan.		

Gorontalo Business Trip Report

July 24 - July 31, 2022

Japan N.U.S. Ishiguro, Hiki, Seki

1

ITINERARY

2

Schedule

day (of the month)	Hours.	Outline of Activities	destination
July 23.		Transfer (NRT-JKT)	
July 24		Move (JKT-GRT)	
July 25.	09.00	Meeting with Gorontalo Provincial Government	Department of Development Planning of the State of Gorontalo
	13.00		Department of Environment and Forestry, Gorontalo Province
	16.20		Department of Agriculture, Gorontalo Province
July 26	09.00	Site Inspection	Agricultural Cooperative and Coconut Oil Factory (IKM Centra Kelapa Kabupaten Gorontalo)
	13.00		Student dormitory (boarding school Pondok Pesantren Hubulo)
	14.30		Student dormitory 2 (boarding school MAN Cendekia)
July 27.	08.00	Meeting with Gorontalo Provincial Government Site Inspection	Primary sorting station in Gorontalo (TPS)
	08.45		Department of Public Works, Gorontalo Province
	10.00		Final disposal site (TPA Talumelito)
	12.30		Hospital (Rumas Sakit Ainun)
	14.00		Lake Limbot
	16.00		Septic tank in Gorontalo
July 28.	10.00	Meeting with Gorontalo Provincial Government Site Inspection	Department of Development Planning of the State of Gorontalo
	15.00		sugar refinery
July 29.	AM	Site Inspection	Marine debris survey
	15.00		Tulaboro Village
July 30		Site Inspection	Hungayono Inspection
July 31		Move (GRT-JKT)	
August 8	9:30	interview	Ministry of Home Affairs
August 12	8:30	interview	DKM Company
	15:00	Site Inspection	PT. DAIKI AXIS INDONESIA

3

INTERVIEW RECORD

4

Gorontalo Province

BAPPEDA

- participant
  - BAPPEDA Ms. Tity
  - Department of Economic and Natural Resources Mr. Max
  - Department of Public Works Ms. Surasuri
  - Research Department Ms. Ivana
  - Ms. Wiwik, SDGs
  - Mr. Kishimoto, Ehime
- Contents
  - In addition to wastewater treatment, waste disposal is also an issue; TPS and waste banks are not functioning.
  - Water pollution in Lake Limbot is also serious due to the inflow of household wastewater.
  - Environmental education for government officials and the private sector is also lacking.
  - I would like to know the process to develop a GHG emission reduction plan. I would like to know the type of data required and how to collect it.
  - Education to water management organizations is also needed.

5

Gorontalo Province

Department of Environment and Forestry, Gorontalo Province

- participant
  - BAPPEDA Ms. Tity
  - Mr. Nasruddin, Director of Environmental Planning and Research
  - Department of Economic and Natural Resources Mr. Max
  - Research Department Ms. Ivana
- Contents
  - Organic waste generation sites include sugar mills, coconut oil factories, and tempeh production plants.
  - Hospitals, hotels, and student dormitories may be effective candidate facilities for septic tank installation. For domestic wastewater, drainage channels need to be constructed.
  - I would like to know the optimum treatment volume for septic tanks and methane fermentation facilities.
  - The TPS is also not functioning due to lack of budget.
  - Industrial waste (garbage from companies) is collected by contractors, while general waste (household garbage) is collected by the Department of Environment and Forestry.
  - During the development of the RAD-GRK, the Department of Environment and Forestry compiled data on waste.

6

Gorontalo Province

Department of Agriculture, Gorontalo Province

- participant
  - BAPPEDA Ms. Tity, Ms. Ivana
  - Director of Agriculture Ms. Nui

- Contents
  - Please tell me about plants suitable for landslide control.
  - There is also a need for support for cacao and coconut exports.
  - Production is declining due to the current situation of not being able to replant cacao and take countermeasures against pests.
  - I would like to know if there is any automated harvesting technology to harvest coconuts efficiently.
    (Lack of labor force due to heavy workload)
  - Coconuts and oranges (old trees) need to be replanted, but the technology is lacking.
  - Lack of education and technology for farmers. Farmlands are large and inefficiently cultivated.
  - Rice straw and wastewater are generated as agricultural waste. Rice straw is currently being burned.
  - Fossil fuels are used to heat sugar mills, and there is interest in using agricultural waste as an energy source.

7

Gorontalo Province

Department of Public Works, Gorontalo Province

- Jurisdiction over final disposal sites in Gorontalo City, Gorontalo Province, and Bonevolango Province
- Three challenges facing the Department of Public Works
  - **Four final disposal sites are full** and would like to know if they can be reused.
    The reservoirs for storing **leachate are** also overflowing and need to be addressed.
  - **Septic tanks** exist, but are not used due to difficulties in management and treatment, and lack of understanding of the system.
  - **Pollution of Lake Limbot is also a** problem.
- On the island of Java, Pultamina has a methane fermentation facility that uses septic tank sludge as feedstock. (BAPPEDA)
- Leachate is believed to flow into Lake Limbot. (BAPPEDA)

▲There are a total of five final disposal sites, four of which are full.

8

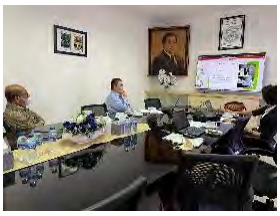
Ministry of Home Affairs

- Cooperation between Gorontalo Province and Ehime Prefecture
  - Cooperation between Gorontalo State and Ehime Prefecture also requires permission from the Ministry of Foreign Affairs
  - Regarding the Action Plan, please also add the following
    - funding scheme
    - Cooperating organizations on the Gorontalo side
- About CLOMA
  - CLOMA activities should be coordinated with CMMAI
  - Easier to sign MOUs with local governments and conduct surveys

9

DKM

- Actual condition of medical waste disposal in Gorontalo
  - Only 120 of the 2,880 hospitals have treatment facilities
  - Currently planning to build a facility that will be able to process medical waste from all of North Sulawesi
  - Currently, facilities that cannot be processed are being sent to Makassar.
  - Processing cost is very expensive at 53,000 Rp/kg
  - Gobel also takes medical waste disposal very seriously



- Access to Coconut Processing Plant
  - Scheduled to be accessed through the Governor of Gorontalo Province, Mr. Nelson.

10

PT. DAIKI AXIS INDONESIA

- Friday, August 12, 2022, 15:00-16:30
- Visit to PT. Daiki Axis Indonesia factory in Cikande
- Student Residences in Gorontalo
  - It is difficult to ascertain the actual situation and consider treatment for items that allow rainwater to enter the building.

- Regulation making and subsidies by the government are important.
- Indonesia's current Septic tank is flooded when it rains.
- Cheap Indonesian-made Septic tanks (10,000-20,000 per tank) tend to be introduced
- Possibility to consider wastewater treatment as a model for districts around Lake Limbot?

11

INSPECTION REPORT

12

Site Map

Gorontalo Province

Agricultural Cooperative, Gorontalo State Department of Enterprises

- participant
  - BAPPEDA Ms. Tity, Ms. Ivana
  - Mr. Iwan, Director, Business and Planning Department
  - DPRD (Member of Parliament) Ms. Sinche

- Contents
  - The company produces coconut oil using traditional methods in an agricultural cooperative established in June 2001. The company receives subsidies from the Ministry of Industry of the central government.
  - There is a similar union in Pohwat province, but it is not functioning well.
  - Coconuts themselves should produce almost no waste, but due to lack of technology, there is a large waste portion.
  - We want to make effective use of waste liquid (coconut water) from coconut oil production (bioethanol, methane fermentation).
  - Air pollution from burning coconut shells is an issue. Please let me know if you have appropriate treatment technology.
  - I would like information on how to obtain Halal certification and the standards for export.

Gorontalo Province

Coconut Oil Factory

▲Production by groups within the cooperative

▲Products

Coconut Oil Production Process

Supernatant liquid is now discarded
I want to consider effective utilization

After crushing, squeeze

▲Sedimentation in the tank
Wood vinegar solution added as a preservative

Heat the precipitated portion
for 3 hours

▲filtration

15

Gorontalo Province

Coconut Processing Plant

- Processes 16 tons of coconuts per day
- 35% is discarded (coconut water)

Carbonized coconut shell

▲Carbonization

Waste oil is used in the drying process of coconut shells

▲Coconut water is filtered through the fibers of the outer shell, which are piled up and then discharged into river targets for effective use of the outer shell are also to be considered.

▲Mixture of discarded coconut water and livestock manure examining whether biogas can be obtained?

Wood vinegar solution is extracted from the smoke of the carbonization process and commercialized.

16

Gorontalo Province

Sugar mill (palm sugar)

Slope after planting Allen trees

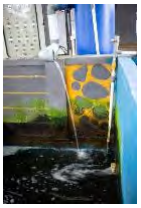
- No waste or wastewater is produced in the manufacturing process.
- Farmers collect sap from the allen trees and bring it to the sugar mill.
- Previously sent to Surabaya and now Jakarta for sale.
- Selling sugar powder, currently considering syrup.
- 1 kg/day/vine can be harvested daily. 2 harvests per day.
  - Flower: Sugar manufacturing
  - Fruit: Food
  - Leaves: knitting material
  - Tree trunks: flooring material
  - Root: Food
- Four to five years after planting, the trees can be harvested daily, making them highly economical and providing a stable income for farmers.
- The Gorontalo State Agricultural Bureau wants to develop corn agriculture. On the other hand, the Forestry Bureau is trying to increase the number of allen trees. The challenge is the lack of horizontal cooperation.
- The Forest Farmers Association program is trying to increase the number of allen trees, but it is the only one in the area that has been able to continue. There is only one plant.
- There is a demand of 200 t/month from Surabaya, but currently only 500 kg/month can be produced.
- There are 467,000 allen trees in Gorontalo Province that are being surveyed for mapping and possible harvesting.
- Currently only 0.1% of the trees are harvested. They are not harvesting because there are no buyers.
- Allen Tree has a strong image of moonshine, and we want to dispel that image (vicious cycle of police seizure → impoverishment → moonshine production).
- If it is an Allen tree, we would like to spread it because it will improve the water retention capacity of the forest and the water quality of Lake Limbot.
- They are building access roads for the harvesting of Allen trees and distributing free trees to farmers.
- Although the government provides cash payments to farmers every year, many use it for living expenses and do not make effective use of it.

17

Gorontalo Province

Hospital (Rumah Sakit Umum Daerah dr. Hasri Ainun Habibie)

- Wastewater Treatment
  - The entire hospital has 168 beds. Currently, 60-70 beds are filled.
  - Wastewater is treated using a water treatment facility called Aipal.
  - The facility capacity is 80 m3, but the capacity is insufficient when there are many patients or during the rainy season.
- hospital waste
  - Since there is no incinerator in the state, it is transported out of the state for processing.
  - Infectious waste will be picked up for 500 yen/kg.
  - (BAPPEDA) A medical waste incinerator will be installed next to Cell 5 of TPA with the support of the Ministry of Environment and Forestry of the central government. If you have Japanese technology, please propose it.



18

Gorontalo Province

Student dormitory 1 (Boarding school Pondok Pesantren Hubulo)

- 424 students in all + 6 faculty households (4-5 students per household)

women's dormitory

- Wastewater Treatment
  - Domestic wastewater and human waste are separated.
  - Urine is treated in an underground treatment facility (conventional Septic tank?). Stench is an issue during the dry season.
  - Domestic wastewater is collected in drainage channels and stored in reservoirs. It is not discharged into the river.
- Well water is used for drinking.
- waste
  - Although garbage separation is implemented, they feel that it is an issue that all garbage is combined together in the collection trucks.
  - Food scraps are used to feed chickens.

▼ Underground manure treatment facilities

▼Drainage canal for domestic use, then to a reservoir.

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Gorontalo Province

Student dormitory 1 (Boarding school Pondok Pesantren Hubulo)

- men's dormitory
  - Compared to the women's dormitory, wastewater treatment facilities are not well equipped. All wastewater is collected in a reservoir, and there is a foul odor.
  - School staff are also aware of the challenges.

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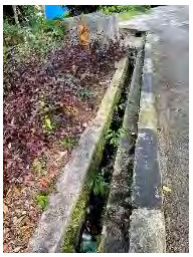
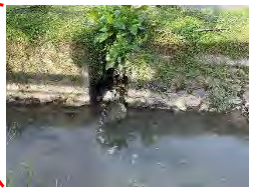
Student dormitory 2 (Boarding school MAN Insan Cendekia Gorontalo)

- About 600 students in all.
- Wastewater Treatment
  - Domestic wastewater and human waste are separated.
  - Urine is treated in an underground treatment facility (conventional Septic tank?).
  - Domestic wastewater is collected in a drainage channel and flows directly into the river through a drainage channel outside the school.
- water supply
  - Insect infestation in the upper water is an issue during the rainy season.

Underground manure treatment facil





▲Drainage canal by the building collects wastewater to drainage canal outside the school.

Lake Limbot

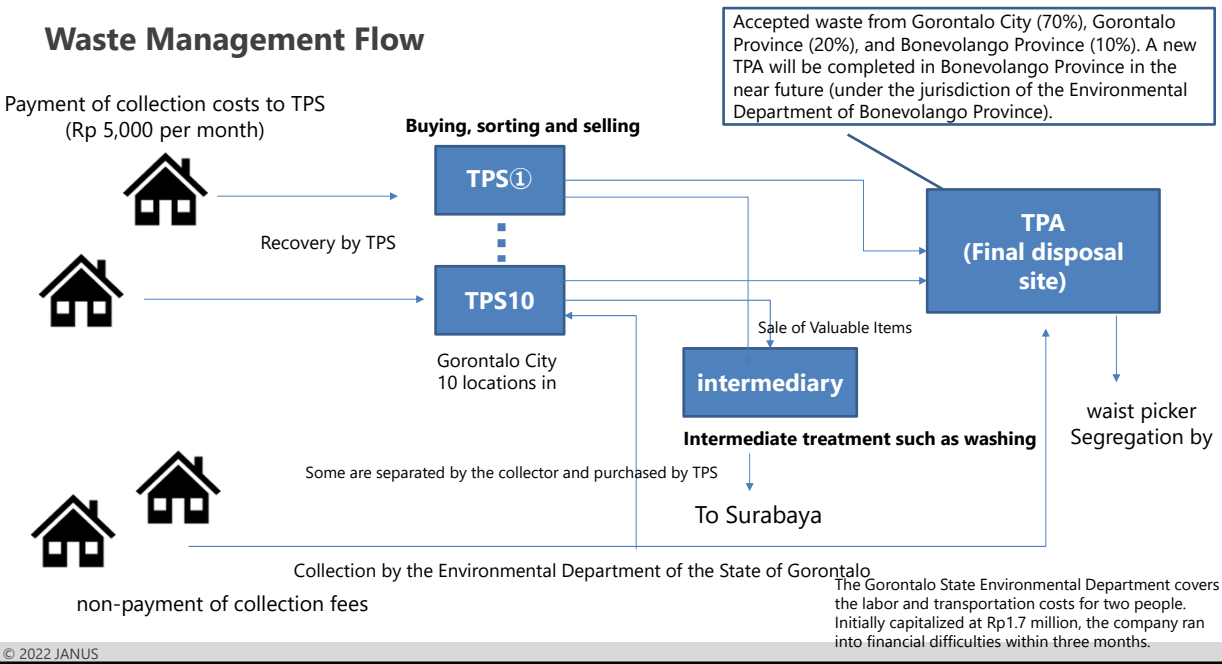
- 23 rivers flow into Lake Limbot
- The improvement of water quality in Lake Limbot is also a priority target of the Indonesian central government.
- The area of the lake has been reduced to about half its original size due to the inflow of sediment.
- As a measure against water pollution, fish ponds will be banned.
- Once a year, E. coli concentrations are measured in a study conducted by the University of the State of Gorontalo.

Septic tank in Gorontalo

- Septic tank (bio-digester) for 200 households in the neighborhood, installed through a program of the Department of Public Works
- Managed by a local estate since 2008, but currently only used by 30 households due to lack of management expertise.
- The equipment itself does not require much maintenance, but the drains leading from each household are clogged?
- Septic tanks are installed in each household to treat toilet waste water



Waste Management Flow



Gorontalo Province

Recovery system, TPS

- Collect and sort trash from households (40% of residents) that have paid a collection fee to TPS.
- In three months, the company ran into financial difficulties.
- Can sell directly to TPS (role of trash bank)
- Households that have not paid the collection fee are collected by trucks from the Environmental Bureau and sent directly to the TPA.
- No value is assigned except for the list on the right, which is reclaimed at TPA.
- Sold to brokers, then sent to Surabaya for recycling

- TPS has been active since last year.
- We want to promote sorting at home, but there is a lack of education
- Plastics: 500 kg/day

- issue
  - lack of funds
  - No compressor or shredder, only sorting
  - Breakdown of collection trucks (currently only one)

type	Price
PET1 (thick)	4000Rp/kg
PET2	3000Rp/kg
Aqua (plastic bottle of drinking water Aqua)	4000Rp/kg
Splite (green plastic bottle)	3000Rp/kg
AleAle (juice cup)	3000Rp/kg
Ingect (oil container)	3500Rp/kg
Bucket (engine oil container)	3000Rp/kg
PP (rigid plastic)	3000Rp/kg
Sembur (plastic bottle cap)	3000Rp/kg

▼Collecting Vehicles

Gorontalo Province

final disposal site

✓ Waste volume is 100-110t/day
✓ Also interested in waste-to-energy, but concerned about air pollution

▲Truck Scale

Disposal to ▲TPA
Sanitary landfill" is carried out by covering the land with soil every day.

▲Waste collected by Westpicker (plastic bottles, cardboard, etc.)

▲ TPA currently in use.
It was supposed to last 3 years, but after 8 months of use, it is in this condition.

▲ full, cover it with soil

Gorontalo Province

Final disposal site Other initiatives




Organic waste is extracted from the garbage collected at the TPA (only some of it) and composted

- ✓ Food waste (70%), pruning branches, etc. (30%)
- ✓ Fermented for 40-50 days, dried and composted


Processing and sales of plastic containers into general merchandise

Gorontalo Province

Final disposal plant Leachate



reservoir

aeration tank

Originally, the filter at the bottom of the reservoir filtered the water and allowed it to percolate into the ground, but the filter is now clogged and the water is being discharged into the river.

- There is no treatment system for leachate, which is discharged into the river.
- Tested for BOD, COD, and nitrogen, but higher than standard values
- During rainfall, leachate overflowed and spilled into the river, killing livestock and making the news. There have also been complaints from nearby residents.
- 52m3/day of leachate is generated. The capacity is 1400m3.

Gorontalo Province

Tulabolo Village

- About 1.5 hours by car from Gorontalo city. 170 families and 490 people live here.
- Actual condition of water use
  - drinking water
    - Water is taken from a water source in the mountains and treated at IPAL ("PDEN").
    - Established in 2015 with support from the central government. It has been operated by the village since then.
      (A water purification system was installed in 2013 with Canadian ODA, but was rebuilt)
    - Maintenance is limited to pipe repairs, with few breakdowns.
    - Filters are not adequate and become muddy when it rains.
    - No charge for water. Supplied to all village residents.
  - Bone River
    - Since the development of the mine, it is no longer used for drinking water.
    - They are fishing and eating fish (eels, etc.). However, the number of fish has decreased.
    - Utilized for agricultural water (rice cultivation)
    - When water supply is not available, water from the Boneh River is also used, but it is not used for drinking.
- mining development
  - Mine development began in 1991 (Conic)
  - The distance from the village to the mine is about 2 hours by motorcycle
  - Although there were economic benefits, there were also impacts such as the water in the Bonaire River becoming undrinkable, fewer fish, and
    and other effects

Entrance to the village
The bridge is only passable by motorcycle.
Residents want it to be passable by car.
to be able to pass through by car.

▲Village of the village

▲Bonne River

Tributary of the Boneh River (Tangi River)

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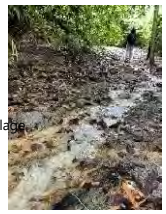
Gorontalo Province

Hungayono

opposite side of the mountain

Site Features

The site looks as if the warm water from the spring is flowing thinly and widely toward the bottom of the cliff, giving the impression that it would be difficult to create a biotope



Site of this survey
3 hours from Tulabolo village

60°C hot water

There are also points where the warm water flows like a river

Ground Penetration

vegetation

✓ Plants near spring water turn black
✓ Frequent changes in the location of the springs
✓ Woody trees also grow where there are no springs

Since the sample collection requires permission from the central government, it was abandoned at this time.

Inflow into rivers

extraction

The leached warm water allows the
A pond of about 2m x 60cm has been created.
(only one location)

Bone River

30

Gorontalo Province

Marine debris

Houses lined up along the coast

▲garbage being discharged along with wastewater?

▲Sachet. Not flotsam, but discarded from dwellings

▲Clothing litter is noticeable

▲Diapers are also found

Gorontalo Province

Marine debris

▲Drinking water (in cups)

Cement bags, etc.

Garbage accumulating on a [illegible] area

▲Fishing net

PET Bottle

Garbage that appears to have been disposed of by nearby residents

Gorontalo Province

Marine debris

Taman Laut Olele (National Park)

▲Unused trash cans

Results of interviews with residents

- ✓ Trash cans were installed with government assistance.
- ✓ On the other hand, with no collection system in place
  burying them on the beach, leaving them there, burning them, etc.
  Burning, etc.
- ✓ I've been lectured on how to sort things out, but meaningless because there is no collection system.
- ✓ Having trouble with diaper waste
- ✓ Many items washed ashore in October-November.
- ✓ Garbage from Lake Limbot also washes ashore.

Dumping garbage into the river

33

SUMMARY

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summary

Local issues and needs

water infrastructure

- ✓Water pollution of Lake Limbot by domestic wastewater
- ✓Lack of septic tank management expertise
- ✓Pollution of the surrounding environment by leachate from the final disposal site
- ✓Organic waste and wastewater treatment

forest management

- ✓Sediment inflow into Lake Limbot
- ✓Study of trees with forest water retention capacity (including cacao)
- ✓Lack of forest management know-how

Decarbonization and Policy Transfer

- ✓Process for developing a GHG emission reduction plan
- ✓Sharing of data types and collection methods
- ✓Insufficient education for government officials and private operators

Other

- ✓Shortage of final disposal sites
- ✓Medical Waste Disposal
- ✓Smart Agriculture Technology and Know-How to Increase Productivity
- ✓Sources of agricultural products
- ✓ecotourism

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summary

Future Actions

water infrastructure

Examination of technologies of companies in the prefecture].

- ✓ Investigate the actual status of wastewater pollution to Lake Limbot, and conduct demonstration experiments in model areas (Asian Water Environment Improvement Model Project, etc.).
- ✓ Connection to a major coconut processing plant in Gorontalo
- ✓ Agricultural waste (livestock manure, agricultural residues, etc.), other food processing plants under hearing

Sharing of know-how

- ✓ Organize the Lake Pollution Control Law, Lake Biwa cleanup cases, etc.
- ✓ Organizing septic tank management methods by Japanese municipalities
- ✓ Tour of final disposal sites in Ehime Prefecture, observation of leachate treatment methods

forest management

[Consideration of connection of companies in the prefecture].

- ✓ Trees that enhance forest water retention

Sharing of know-how

- ✓ Hearing with forestry departments in Ehime Prefecture
- ✓ Organize forest management know-how

Decarbonization and Policy Transfer

Sharing of know-how

- ✓ Process for developing a GHG emission reduction plan
- ✓ Types of data and collection methods
- ✓ Request for Expert Referral from Universidad de Gorontalo

Other

[Consideration of connection of companies in the prefecture].

- ✓ Medical Waste Disposal
- ✓ Agriculture related
  - Plants that enhance forest water retention
  - Cacao pest control
  - Smart technology such as automated coconut harvesting technology
  - Know-how for replanting oranges (old trees)
  - Sources of cocoa, coconut, palm sugar, etc.
- ✓ Tourism related: Ecotourism municipalities, etc. that can be introduced to Turabolo Village.

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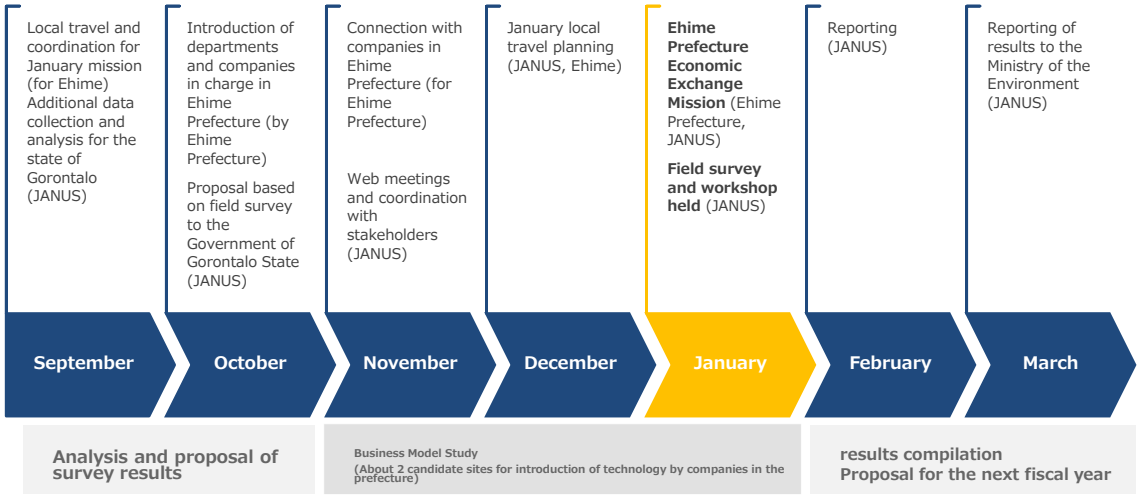
Future Actions

Schedule for the current fiscal year



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(Reference) Information request to BAPPEDA and future actions

Sites	BAPPEDA	JANUS
BAPPEDA	• Calculation of Waste Percentage (next page)	• Share the process to develop a GHG emission reduction plan, types of data and collection methods
Dinas LH	• More about Tempeh Factory	• Provide information on optimal treatment volumes and processes for septic tanks and methane fermentation facilities
Dinas Pertanian	• Types, quantities, and current disposal methods of agricultural waste (livestock manure, agricultural residues, etc.)	• Investigation of the following contents ✓ Plants that enhance forest water retention ✓ Cacao pest control ✓ Smart technology such as automated coconut harvesting technology ✓ Know-how for replanting oranges (old trees) • Sharing examples of effective use of bagasse • Availability of subsidies for the introduction of biomass power generation facilities
Dinas PU	• Sewage treatment system installation plans, budgets, and policies • Budget to address current issues related to waste	• Providing information on septic tank management methods and know-how by Japanese municipalities
UNG	• Research Results on CO2 Emission Reduction by Waste Separation • Materials related to the cacao project, materials related to Hungayono	-

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(Reference) Information request to BAPPEDA and future actions

Sites	BAPPEDA	JANUS
Coconuts	-	• Send hearing sheet on the status of organic waste generation • Investigation of the following contents ✓ Coconut shell processing technology ✓ Market and certification, companies importing cacao and other products in Ehime ✓ How to obtain permits and standards for wood vinegar solution
Boarding school	-	• Share and discuss current situation with septic tank manufacturer
TPS	• Scope of collection of TPS and DLHK tracks, roles, mechanisms, and guidelines • Details of the intermediary to whom the plastic is sold	-
TPA	• Leachate quality test data	• Consult with engineering firm based on water quality data
Limboto	• Water quality data for Lake Limbot	• Introduction of plants that enhance forest water retention • Study of domestic wastewater countermeasures
RSUD	• Medical waste data	• Consultation with businesses based on medical waste data • Improvement of IPAL, consideration of countermeasures

FY2022 Intercity Cooperation Project for Realization of a Carbon Free Society

Ehime Prefecture and Gorontalo Province City-to-City Collaboration for Support Project for Achievement of SDGs and Formation of a Sustainable Decarbonized Society Final Report

February 1, 2023
NUS Corporation

1

Background

Support for planning and technology diffusion to achieve decarbonization and development together in the fast-growing economy of the state of Gorontalo

Subjects

Underdeveloped infrastructure and deforestation

While the population is increasing, water pollution of rivers and lakes is becoming serious due to inadequate water supply and sewage infrastructure.

Rapid deforestation and loss of CO2 sinks due to cultivation of steep slopes in hilly and mountainous areas

policy

Balancing Development Planning and Decarbonization

The priority areas for development in the RAD-GRK (agriculture, forestry, energy, industry, and energy efficiency) are as follows.

(waste management) goal setting

Inclusion of decarbonization targets in post-2022 regional medium-term development plans (RPJMD)

Countermeasures

Promotion of measures through cooperation with Ehime Prefecture and creation of JCM projects

Wastewater treatment by introducing septic tanks, and methane fermentation gasification of septic tank sludge and use for power generation.

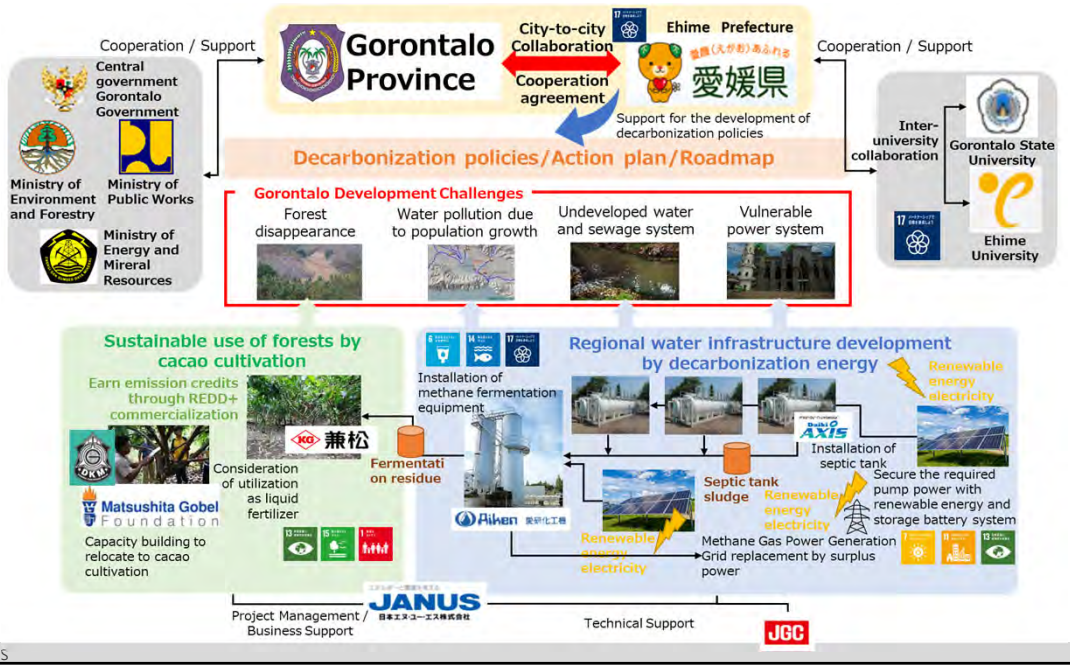
Consider using renewable energy sources to operate facilities.

REDD+ projects are being considered to promote cacao cultivation, reduce deforestation, and conserve forests.

Declaration of Decarbonization, spillover of efforts toward decarbonization in Ehime Prefecture.

2

Business Overview



3

Main Results

Project Candidate		results
Community Water Infrastructure Development	septic tank	• Identification and inspection of candidate sites for septic tank installation • Collection of data on the water quality of Lake Limbot and the Limbot inflow river • Agreement with local government on steps toward implementation
	methane fermentation equipment	• Extraction of candidate sites for introduction of methane fermentation facilities • Confirmed interest in wastewater treatment and energy use in coconut processing plants • Data collection on wastewater from coconut processing plant, discussion on future data collection • Estimation of introduction effect, business feasibility evaluation, and CO2 emission reduction effect • Top Sales by Governor of Ehime Prefecture at Candidate Sites for Methane Fermentation Facilities
	Other	• Assess needs for treatment of final disposal site leachate • On-site inspection by Aiken Kakoki Co., Ltd. to confirm that wastewater treatment is feasible. • Proposal for the introduction of a system for Aiken Kakoki Co. • Confirmation of budget size for introduction and agreement on budgeting by local government
Sustainable Forest Use		• Grasping the actual status of land use at candidate sites for project implementation and reflecting this in the plan • Gorontalo Provincial Government and Provincial Government agreed to cooperate in the project, and understanding of the project was obtained.
Support for decarbonization policy development		• Assessing local government needs for decarbonization policy development • Inclusion of a policy formulation support item in the Action Plan for the Intercity Cooperation Project
Other		• LoI conclusion for MoU conclusion on inter-city collaboration project (Sept. 2022) • Formulate action plans for intercity cooperation projects • Held MoU signing ceremony for intercity collaboration project (January 2023)

4

Ehime Economic Exchange Mission to Indonesia

- Ehime Prefecture Economic Exchange Mission to Indonesia from January 15 to 21, 2023
- Among them, the Governor of Ehime Prefecture, companies in Ehime Prefecture, the Ehime Prefecture Commerce and Industry Association, and about 40 others visited Gorontalo Province.
- MOU signing ceremony for Ehime-Gorontalo inter-city cooperation project on January 19, 2023.
- Commitment to **support the development of a decarbonization plan for Gorontalo and to include intercity collaboration projects, including decarbonization, in the next mid-term plan for** Gorontalo.


脱炭素社会の実現でインドネシアと協力

01月19日 19時06分

愛媛県の中村知事はインドネシアを訪問しています。

１９日は東部にある州の幹部と面会し、脱炭素社会の実現に向けて協力することで一致しました。

愛媛県の中村知事は県内企業の関係者などおよそ８０人と今月１５日から２０日までの日程でインドネシアを訪問しています。

１９日は東部の島にあるゴロンタロ州を訪れ、地元の幹部などと環境問題や経済協力について意見交換を行いました。

そして、脱炭素社会の実現に向けた取り組みで協力することで一致し覚え書きを交わしました。

Report by NHK Ehime
(dated January 19, 2023)

MOU signing ceremony by Governor Nakamura and Governor of Gorontalo Deputy Speaker of the National Assembly Gobel was also present.

Governor Nakamura introduces the city-to-city collaboration project at the MOU signing ceremony with the Indonesian Chamber of Commerce and Industry.

5

Various media coverage

- https://www3.nhk.or.jp/lnews/matsuyama/20230119/8000015014.html
- https://www.nhk.jp/p/himepon/ts/KNLX2WP947/movie/


Pj Gorontalo Sambut Kedatangan Gubernur Prefektur Ehime Jepang

Gorontalo - ligo.id - Penjabat Gubernur Gorontalo menyambut kunjungan Gubernur Ehime, Jepang, Tokihiro Nakamura di VIP bandara lama Djalaluddin, Gorontalo, Rabu (18/1/2023).

Tokihiro datang bersama dengan sejumlah pejabatnya di Prefektur Ehime didampingi Wakil Ketua DPR RI Rahmat Gobel.


Gubernur Ehime; Gorontalo Punya Potensi yang Besar

by REDAKSI NN — 18 Januari 2023 in Daerah, Gorontalo, Headline, Pemprov Gorontalo
Reading Time: 1 min read

Gubernur Ehime saat berkunjung ke Pelabuhan Anggrek, Kabupaten Gorontalo Utara, Rabu, (18/1/2023).(Tim)

NEWSNESIA.ID, GORONTALO– Gubernur Prefektur Ehime, Jepang Tokihiro Nakamura mengatakan Gorontalo memiliki potensi yang sangat besar.


Penjagub Gorontalo – Gubernur Ehime Teken MSP Kerja Sama

January 19, 2023

Penjabat Gubernur Gorontalo Hamka Hendra Noer (tiga kiri) dan Gubernur Ehime Tokihiro Nakamura (dua kiri) menandatangani Memorandum Saling Pengertian (MSP) di Kantor BI Perwakilan Gorontalo, Kamis (19/1/2023). Kerja sama dua provinsi beda negara itu meliputi manajemen lingkungan, pembangunan ekonomi dan industri, pertanian dan kehutanan serta pendidikan dan pelatihan. (Foto: Fadli – Diskominfotik).

6

Cooperation Plan for Intercity Collaboration between Gorontalo State and Ehime Prefecture for Realization of a Decarbonized Society

Cooperation Areas	Activity Program	result	results
Environmental Management	Promote environmental management activities to reduce CO2 emissions	• Information on the main sources of greenhouse gas emissions in Gorontalo and projections of future emissions • Data collection on Limbot Lake cleanup • Results of a Feasibility Study on the Introduction of Wastewater Treatment Technology for Leachate from a Final Landfill Site	• Developing a decarbonization policy direction in the State of Gorontalo • Summary summary of the pollution of Lake Limbot and its management • Organize waste management information and formulate reduction plans, develop waste treatment systems at final disposal landfills • Consideration of possible support from the Japanese government budget
Economic and industrial development	Feasibility study for technology application and business development and promotion for economic and industrial issues in the Gorontalo region	• Results of a feasibility study on the introduction of wastewater treatment technology for a business (coconut processing industry) that produces a large amount of industrial wastewater that affects the environment. • Results of a feasibility study on biomass energy supply for an energy intensive business (coconut processing industry) • Data and information on products and technologies of companies in Ehime and Gorontalo • Conduct business matching activities	• Availability of equipment design, estimation, planning and development of wastewater treatment systems. • Consideration of possible support from the Japanese government budget • Increased productivity of small and medium enterprises (SMEs) within the province of Gorontalo • Economic revitalization through promotion
Agriculture and forestry	Feasibility study on sustainable forest conservation practices	• Forest Conservation Plan for Important Lands in Gorontalo Province • Empowerment of farmers in forest and critical land conservation • Results of a feasibility study on the concept of sloping land agriculture	• Promote community understanding of forest and critical land conservation • Promote understanding of forest conservation measures using REDD+ and other mechanisms • Improve community knowledge of cocoa cultivation
Education and Training	Environmental Education for Sustainable Development	• Training for stakeholders on maintenance and management of water infrastructure systems • Seminars on cacao cultivation and forest conservation for local businesses and farmers • Environmental education seminar for students of the University of Gorontalo	• Increased expertise in the management of water infrastructure facilities • Greater understanding of the importance of forest conservation • Improve knowledge and awareness of environmental protection among academics

7

Regional Water Infrastructure Development Selection of Additional Potential Sites and Estimation of Implementation Benefits

Specification 4-1, (1)

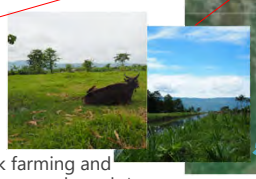
(1) Septic tanks (Lake Limbot area)

- Discussions with state government confirm high cleanup needs for Lake Limbot
- Lake Limbot is a high priority for the central government to address.
- In recent years, the state of Gorontalo has been greatly affected by environmental issues such as the influx of sediment due to forest loss and the proliferation of water hyacinths due to ecosystem destruction.
- In particular, of the rivers that flow into Lake Limbot, the Biyonga River basin has many houses and is considered to have a high load of domestic wastewater and human waste water.
- On the other hand, livestock farming and agriculture are conducted in the vicinity of Lake Limbot, and the impact of agricultural and livestock wastewater is expected to be significant. Since industrial wastewater is also expected to contribute to a certain extent, more detailed studies are required for site selection for the demonstration project.

Upper Biyonga River

Wastewater from each household flows into the river ▶

Collecting domestic wastewater from surrounding households through waterways
Inflows into rivers



Livestock farming and agriculture are conducted ▲

8

Specification 4-1, (1)

(2) Methane fermentation facility (PT. Royal COCONUT)

- Survey of high wastewater dischargers and high energy consumers in the province of Gorontalo
- The largest processing plant in Gorontalo, where coconut processing is a major industry.
- Established in 2007, headquartered in Jakarta
- 66,800 hectares of coconut plantation forest in Gorontalo, producing a variety of processed coconut products
- Although wastewater treatment has been implemented, there are complaints from nearby residents regarding wastewater and odors.
- Confirmed interest in wastewater treatment and energy recovery

Wastewater in the sedimentation tank

Current wastewater treatment flow

Current wastewater volume, wastewater concentration, electricity consumption, etc.

(data) item	value
Plant effluent	400m3/day
Inflow raw water COD concentration (*COD concentrations utilize maximum actual values)	39,000 mg/L
COD concentration of water entering treatment tank	25,000 mg/L
Current power usage (including wastewater treatment facilities)	865kva/day
Current electricity usage	Approx. 3 million yen/month

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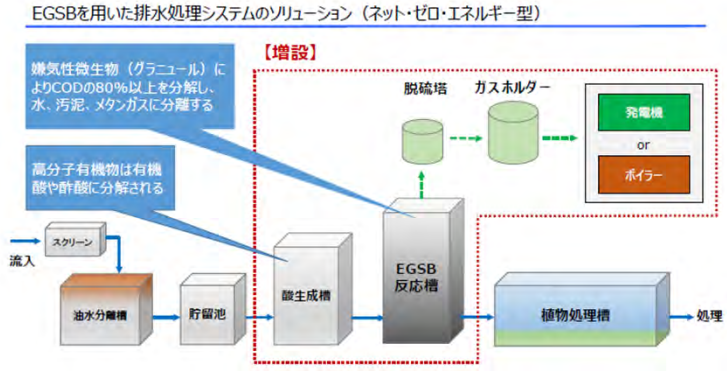
Specification 4-1, (1)

(2) Methane fermentation facility (PT. Royal COCONUT)

- Analysis of wastewater is performed on a regular basis
- COD concentrations are constant, although there is some variation in concentrations
- Energy recovery system (EGSB) utilizing oil-water separation can be considered

Aiken Kakoki Proposal System Co.



GHG reduction by methane fermentation of wastewater

Assuming that 400 m3 of factory wastewater with COD of 39,000 mg/L is generated per day
CH4 (methane) generation is 2,975 Nm3/day
Generates approximately 7,572 kWh/day (approximately 9 times that of the existing plant)
EGSB can supply power to the entire plant
An additional 5,187 kWh/day of surplus electricity is generated

Reference emissions
Avoided CH4 emissions from atmospheric dissipation of industrial wastewater = 124,500 t-CO2
Project Emissions
Greenhouse gas (CH4, N2) emissions from operation of existing plants (including wastewater treatment facilities) = 168 t-CO2
Greenhouse gas (CH4,N2) emissions associated with introduction of wastewater treatment facilities = 295,708 t-CO2
Total project emission reductions
Reduction = 124,668 t-CO2 (legal life of 12 years)

Economics of Methane Fermentation Facilities

Assumed model to generate revenue by selling surplus power to PLN
If we consider the current electricity bill of about 3 million yen/month as income

Initial investment of approximately 2.2 billion yen for a methane fermentation facility of the same scale
When applied
Investment payback is possible in the 4th year

10

Specification 4-1, (1)

(3) Others (final disposal site)

- Located in the province of Gorontalo, the repository receives waste from the city of Gorontalo (70%), the province of Gorontalo (20%), and the province of Bone Bolango (10%)
- During a hearing with the Department of Public Works of the State of Gorontalo, it was **confirmed that** leachate from the final disposal landfill overflows during rainfall and flows into rivers, killing livestock in the area and causing other damage, which is a **high priority for the state to address.**
- Currently, there is no treatment system, only aeration is performed, and the water is discharged directly into the river.
- 52 m3 of leachate per day

Final disposal landfill site

Current processing system

貯留槽

曝気槽

本来ため池の底のフィルターでろ過し地面に浸透させていたが、現在はフィルターが詰まり、河川へ放流されている状態

Discussions with the Department of Public Works (July)

11

Specification 4-1, (1)

(3) Others (final disposal site)

- On November 10, 2022, Aiken Kakoki visited the final disposal site to confirm leachate quality, treatment tank structure, etc.
- As a result, the company determined that **appropriate treatment was** possible **using its technology, and on** January 20, 2023, it submitted a proposal for a system that could be introduced at the final disposal site.
- The effect of the introduction of the system will be estimated from the results of leachate testing in the future.
- Consideration will be given to introducing a package of zero-emission equipment, such as using solar power generation to generate electricity for wastewater treatment equipment, and utilizing the JCM equipment subsidy project.

Consultation with the Department of Public Works and Final Landfill Management Bureau

Aiken Kakoki Proposal System Co.

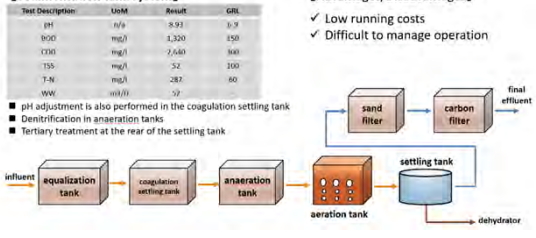
1. Proposal Flow System ①

【Sedimentation tank system】

Test Description	UoM	Result	GRL
pH	n/a	8.93	6-9
BOD	mg/l	1,320	150
COD	mg/l	2,640	300
TSS	mg/l	52	100
T-N	mg/l	287	60
WW	m3/D	52	

- pH adjustment is also performed in the coagulation settling tank
- Denitrification in anaeration tanks
- Tertiary treatment at the rear of the settling tank

【Advantages/Disadvantages】
- ✓ Low running costs
- ✓ Difficult to manage operation



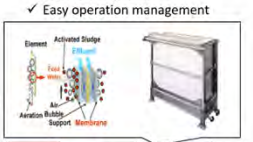
2. Proposal Flow System ②

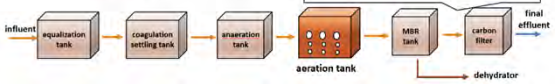
【MBR system】

Test Description	UoM	Result	GRL
pH	n/a	8.93	6-9
BOD	mg/l	1,320	150
COD	mg/l	2,640	300
TSS	mg/l	52	100
T-N	mg/l	287	60
WW	m3/D	52	

- pH adjustment is also performed in the coagulation settling tank
- Denitrification in anaeration tanks

【Advantages/Disadvantages】
- ✓ High running costs
- ✓ Easy operation management





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Local water infrastructure development Project site selection and implementation plan development

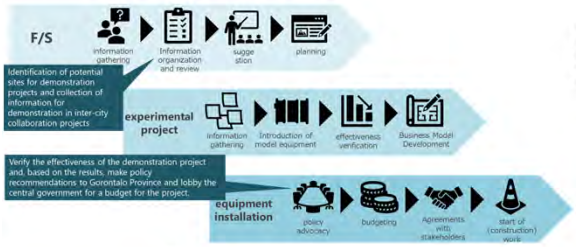
Specification 4-1, (2)

(1) Septic tank

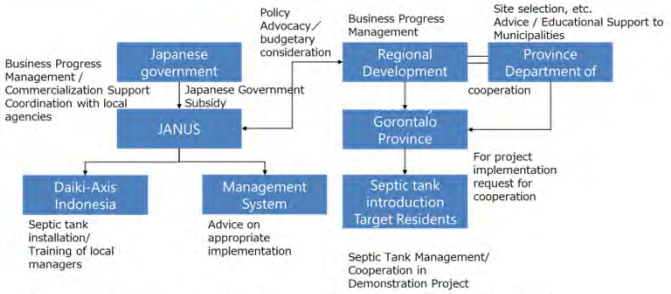
- In Gorontalo, the sewage system is not yet developed, and it is unrealistic to plan to introduce septic tanks on a large scale.
- Septic tanks are public infrastructure and are expected to be maintained based on the budgets of the national and local governments. Since it is essential to verify the effectiveness of the introduction of septic tanks when budgeting, the next step is to conduct a **demonstration** project **with the introduction of septic** tanks **in a limited area** and proceed with the research.
- Considering the priority of the measures taken by the Gorontalo Provincial Government and the Indonesian Central Government, we intend to proceed with the planning of the demonstration experiment, **selecting residential areas and markets, etc. located around Lake Limbot as candidates.**

Homes around Lake Limbot

▲Market drainage channel



Flow of Introduction



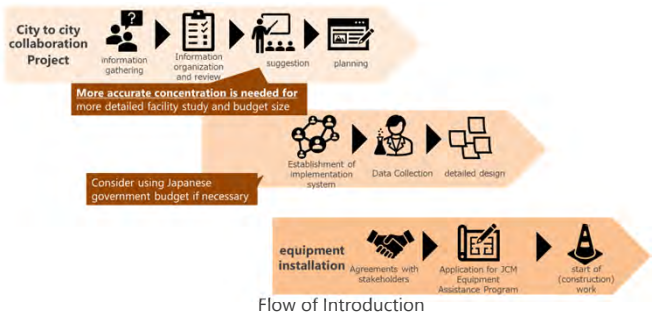
Proposed Implementation Structure for the Demonstration Project

Local water infrastructure development Project site selection and implementation plan development

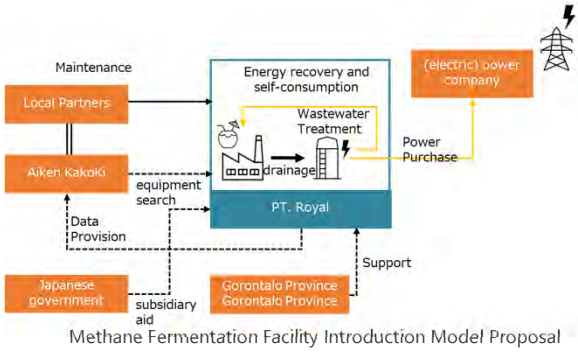
Specification 4-1, (2)

(2) Methane fermentation facilities

- PT. Royal COCONUT has confirmed its interest in wastewater treatment and energy recovery.
- While some data on wastewater is provided, the results of the tests are varied, making it difficult to examine the data in more detail.
- Requested additional water sampling locations and test items, and agreed to cooperate in data acquisition.
- In the next fiscal year's project, we will proceed with designing detailed facilities and estimating facility costs.
- **Through connection to the JCM equipment subsidy project, a** plan will be prepared to subsidize 50% of the equipment costs related to the installation, and the remaining 50% of the investment will be recovered through electricity sales, and an agreement will be reached with PT.



Flow of Introduction



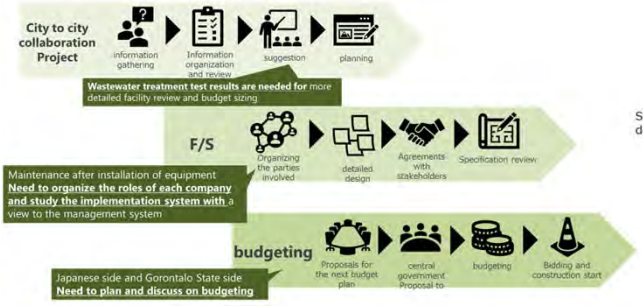
Methane Fermentation Facility Introduction Model Proposal

Local water infrastructure development Project site selection and implementation plan development

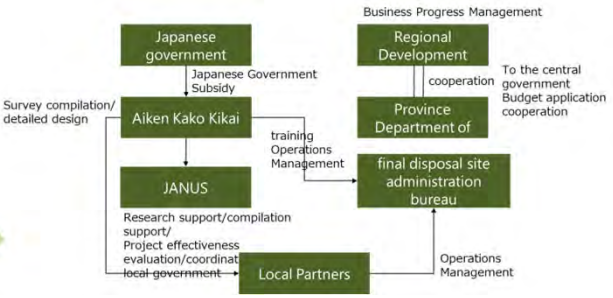
Specification 4-1, (2)

(3) Others (wastewater treatment facilities)

- Considering the use of Japanese government subsidies to support overseas deployment of Japanese technology related to waste and wastewater treatment, as well as the use of JCM by introducing the equipment as zero-emission equipment that uses renewable energy, in combination with obtaining budget from the local government.
- Interview with the Department of Public Works of the State of Gorontalo **confirms that the company intends to include the cost of installing equipment for this project in its budget application to the central government in 2024.**
- Since it is expected that the equipment installer will be decided by bidding, the company will conduct detailed design, initial cost estimation, and study of specifications for bidding by utilizing next year's project and Japanese government subsidies, and will proceed with discussions with the local government with the aim of applying for the budget in 2024.



Flow of Introduction



Proposed F/S Implementation Structure

Regional Water Infrastructure Development Information organization and negotiation for the establishment of a project implementation system

Specification 4-1, (3)

Status of discussions regarding the establishment of an implementation system

Project	officials	Details of discussions (including plans)
septic tank	Department of Public Works, Gorontalo Province	• Requested and agreed to cooperate in the demonstration project • Continued discussion on potential sites
	Ministry of Environment and Forestry, Central Government	• Introduction to septic tanks of Daikiaxis, Inc. • Request for policy support for septic tank promotion
Methane Fermentation Facilities	PT. Royal COCONUT	• Top sales promotion by Governor Nakamura • Expression of interest in their wastewater treatment and energy use • Requested and agreed to cooperate on data provision and detailed design • Plan to start acquiring and sharing necessary data from Feb.
	Department of Energy and Mineral Resources of the State of Gorontalo	• Plans to discuss use of surplus electricity from PT. Royal COCONUT • Plans to request connection to PLN
	PLN	• Discussions regarding the price at which electricity is sold
Others (wastewater treatment facilities)	Department of Public Works, Gorontalo Province	• Already agreed to bear the budget burden as the State of Gorontalo. • Discussions continue to develop FY2024 budget plan

Discussions with PT. Royal COCONUT

Consultation with the Department of Public Works

Top Sales by Governor Nakamura

Discussions at the final disposal site management office

Sustainable Forest Use Identification of Potential Sites and Estimation of Project Benefits

Specification 4-2, (1)

- Continue to confirm the land use status and understand the actual state of deforestation in the candidate sites selected in the previous fiscal year's project.
  - Identified hotspots such as oil palm plantation development in northern Pohuato and timber concessions in northern Gorontalo, and are considering plans for forest conservation projects, including the exclusion of these areas.

GHG Reduction Effects of Forest Conservation

Extracted deforested area in Gorontalo State for the period 2008-2017 and set as baseline period
Average annual deforested area from 2013-2017: 3,532 ha
In the event that the above deforestation is no longer implemented as a result of REDD+ projects
Estimated **annual reduction of approx. 250,000 t-CO2**

Candidate areas for REDD+ projects in the province of Gorontalo

Table 4.1-2: Area of historical deforestation

Year	Area of deforestation (ha)
2008	1,011
2009	5,602
2010	845
2011	1,700
2012	1,382
2013	1,392
2014	2,805
2015	5,819
2016	4,012
2017	3,731
Average deforestation/year (2013-2017)	3,552

Changes in the area of deforested land

▲Corn Farming

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Sustainable forest utilization Information organization and negotiation for the establishment of a project implementation system

Specification 4-2, (2)

- Conduct discussions with BAPPEDA in Gorontalo and the provincial governments in the project area regarding the project plan, request cooperation for project implementation, and gain understanding of the project.
- Collaboration with local counterpart in the private sector, Gobel DKM, to educate cocoa farmers and support the purchase of cocoa beans by new value chains to improve the livelihoods of poor farmers.
- In the coming year, we plan to build a system that will promote forest conservation over the long term, including consideration of conducting forest patrols to ensure that deforestation does not take place.

In the province of Boaremo
Cacao farmland and corn farmland

Discussions with cacao farmers

Visit to a cacao farm

Discussions with BAPPEDA, Gorontalo

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Implementation Issues and Plans for Next Year

Project		task	Plan for the next fiscal year
Regional Water Infrastructure	septic tank	・ Difficulties in setting up a septic tank installation demonstration project site	・ Collaboration with the Department of Public Works of the State of Gorontalo, gathering information on potential sites ・ Survey of precedents ・ Consideration of application to the "Asian Water Environment Improvement Model Project" and other demonstration budgets
	methane fermentation	・ Lack of data on drainage ・ Where excess electricity from the introduction of methane fermentation facilities will be used	・ Request for collection of necessary data ・ Consultation with ESDM and PLN, Gorontalo
	Other (Wastewater treatment)	・ Insufficient data for detailed design ・ Hurdles related to central government budget applications	・ Consideration of using the FS budget for "Promotion of Overseas Business Development of Japan's Recycling Industry," etc., and collection of necessary data. ・ Sharing of central government budget application schedules
Sustainable Forest Use		・ Gaining understanding of cacao farmers ・ Cooperation of county governments, cities, etc.	・ Establishment of a system for sustainable forest use ・ More detailed planning
Support for developing a decarbonization plan		・ Assessing the status of planning in the State of Gorontalo ・ Lack of collaboration with Gorontalo departments for decarbonization	・ Discussions with Gorontalo departments on decarbonization plans ・ Cooperation with Ehime Prefecture's environmental departments
Other		・ Lack of analytical laboratories in Gorontalo ・ Sharing of Ehime's initiatives and technologies of companies in Ehime	・ Discussions with Ehime University, considering support through collaboration with University of Gorontalo ・ Plan to invite Gorontalo Province to Ehime

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Future Activity Plans

Case Details	2021	2022	2023	2024
(1) Regional water infrastructure development			Obtaining budgets for demonstration projects	
septic tank	Organizing Technology Organize considerations for introduction	Selection of additional potential sites Introduction plan formulation	Study on transfer of water quality control and analytical technology	
Methane Fermentation Facilities	Organizing Technology Organize considerations for introduction	effectiveness verification Introduction plan formulation	detailed design decision-making making a deal (e.g. on a credit card)	Application for JCM Equipment Assistance Program start of (construction) work
final disposal site		Requests for assistance from the local community Proposal of wastewater treatment system to the site	data collection detailed design Budgeting support by local government	Budgeting by the State of Gorontalo Bidding and construction start
(2) Sustainable forest use	Potential Area Identification	effectiveness verification systematization		commercialization
(3) Support for decarbonization planning	Ehime Policy Sharing WS held Identification of local issues	Identification of more detailed policy issues MOU/LOI concluded for the realization of a decarbonized society Ehime Economic Exchange Mission	More detailed policy sharing Planning Support	Declaration of Decarbonization

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REFERENCE DATA

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List of field survey destinations

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August Field Survey Results

Local issues and needs

water infrastructure

- ✓Water pollution of Lake Limbot by domestic wastewater
- ✓Lack of septic tank management expertise
- ✓Pollution of the surrounding environment by leachate from the final disposal site
- ✓Organic waste and wastewater treatment

forest management

- ✓Sediment inflow into Lake Limbot
- ✓Study of trees with forest water retention capacity (including cacao)
- ✓Lack of forest management know-how

Decarbonization and Policy Transfer

- ✓Process for developing a GHG emission reduction plan
- ✓Sharing of data types and collection methods
- ✓Insufficient education for government officials and private operators

Other

- ✓Shortage of final disposal sites
- ✓Medical Waste Disposal
- ✓Smart Agriculture Technology and Know-How to Increase Productivity
- ✓Sources of agricultural products
- ✓ecotourism