JCM Project Development Study for Realization of Carbon Neutral in Ubon Ratchathani Province under City-City Cooperation
Among Ubon Ratchathani Province, Warin Chamrap Town Municipality & City of Kitakyushu

Workshop

February 20, 2024

EX Research Institute

Content

1. Outline of the Study
2. Background
3. Activities & Achievement in 2023
4. Activities under planning in 2024

1. Outline of the Study

Project Name	JCM Project Development Study for Realization of Carbon Neutral in Ubon Ratchathani Province, Thailand
Goal	**To realize Carbon Neutral by 2050 in Ubon Ratchathani province**
Objective	To reduce GHG emission in Ubon Ratchathani province
Output (by 2026)	1. To develop a road map for carbon neutral for the province 2. To develop projects / system to reduce GHG emission in the province
Activities (for 2023)	1. To review "Output from the Project on Development of GHG emission reduction guideline at province level for Ubon Ratchathani province" (Methodology, Sources of GHG emission, Active Mass, Future prospect & mitigation plan) and build basic consensus as for direction on mitigation 2. Case Study for Project Development focusing on MSW management in Warin Chamrap municipality (Waste Analysis & etc.) 3. Other Projects finding in the Province 4. Knowledge Sharing as for cases in Japan & discussion) for mitigation & to make Project known among the relevant parties in the province (Workshop) & expanding activities to other areas in the project
Japanese Team	1. City of Kitakyushu 2. Kitakyushu International Techno-Cooperation Association (KITA) 3. KOBELCO Environmental Solution Co., Ltd. 4. EX Research Institute / EXRI ASIA
Duration	November 2, 2023 – March 8, 2024 (as per contract with MOEJ)

1. Outline of the Study

北九州市 CITY OF KITAKYUSHU

EX Research Institute Ltd.

KITA 公益財団法人 北九州国際技術協力協会 Kitakyushu International Techno-cooperative Association

株式会社神鋼環境ソリューション KOBELCO ECO-SOLUTIONS CO.,LTD.

City-City Cooperation

Output: GHG Emission Inventory → Output: Road Map for Decarbonization → Carbon Neutral Declaration (by 2050)

Ubonrachatani Province

Focal Point

Warin Chamrap Town Municipality

Model City

Introduction & Implementation of projects & technologies for Decarbonization

Output

Re-Energy 100% Ubon Rachatani Model

Project Site (Government Office)

Power Supply from National Grid

Electricity Fee

SPC

- Purchasing Low Cost Power from RE Power Plants in City
- * Excess Power@ Lower Cost
- * Contract
- 100% Renewable Energy
- Energy Saving
- No Initial Cost
- System Installation
  - Solar Panel
  - Power Battery
  - EV Charger (*OP)
- Profit Sharing (Electricity Fee)
- Operation (Energy Management) & Maintenance
- * Investment

System Owner

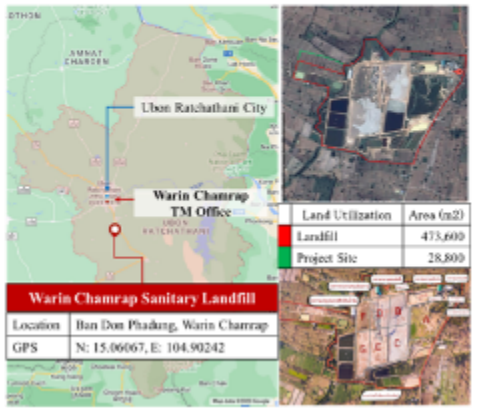
Community

* Investment

Output

MSW Biogas Power Plant

- Produce 2MW of electric power & RDF from 350t/d of MSW
- Reduce 767,920tCO2 through the project period (including CH4 emission from landfill)



Output

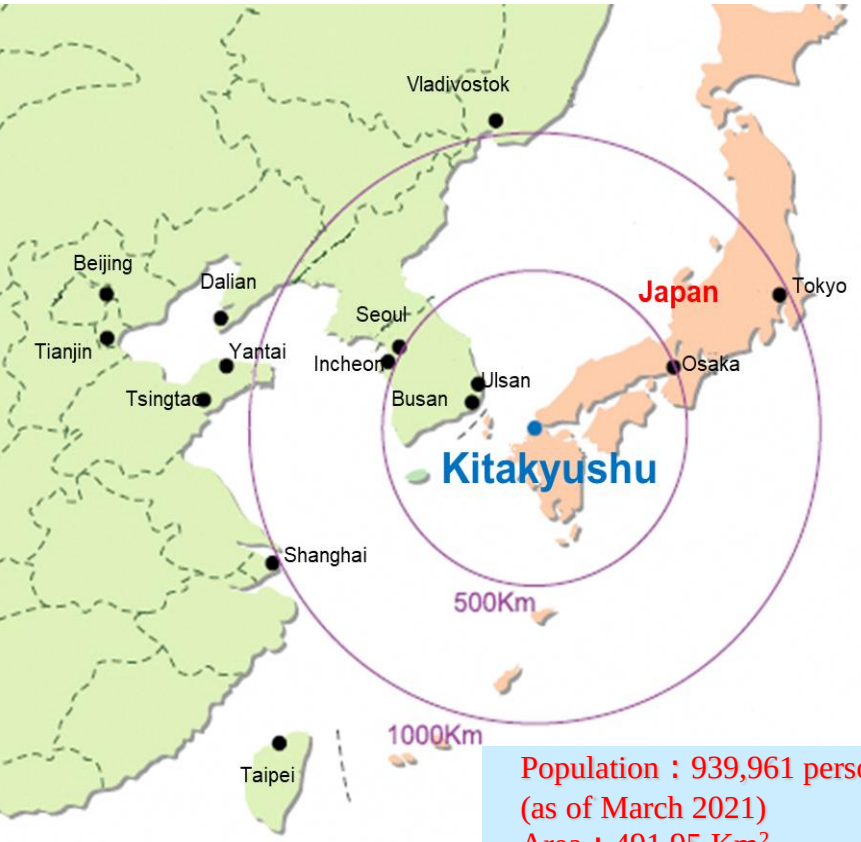
Decarbonization Domino

Ubon Rachatani Province

Population	:	1,9 million
Land Area	:	15,800km2
GPP	:	THB12,600 million
Main Industry	:	Primary Industry (Agriculture)

2. Background

2-1. Introduction of City of Kitakyushu



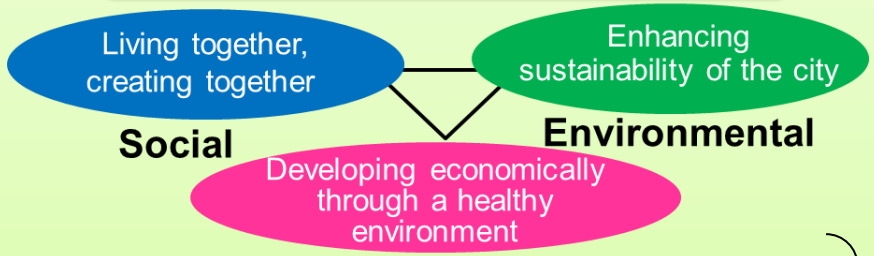
Population：939,961 persons (as of March 2021)
Area：491.95 Km²

Source: Presentation of City of Kitakyushu

Grand Design towards the Creation of a "World Capital of Sustainable Development" completed in 2004

COMMITMENT OF THE RESIDENTS OF KITAKYUSHU TO ALL PEOPLE, THE EARTH AND FUTURE GENERATIONS, born after many discussions by citizen, NPOs, businesses, and administrations etc

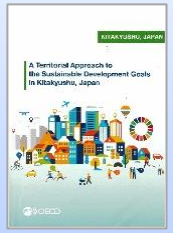
Basic Philosophy
Creation of a city with true wealth and prosperity, inherited by future generations



Period for development: 2 years
Citizen's opinion: more than 1,000
Holding of Citizens Forum: 2 times
Examination meeting (34 members): General meeting 4 times, sectional meeting 10 times

Environmental Plan incorporating the SDGs
(Nov. 2017)

SDGs Future City Initiative by Gov. of Japan (Jun. 2018)



SDGs Pilot Model City for territorial approach by **OECD** (Apr. 2018)

2. Background

2-2. City-City Cooperation between Ubon Ratchatani Province, Warin Chamrap Municipality & City of Kitakyushu

August 2019

Kitakyushu City and the United Nations Environment Programme (UNEP) have agreed to cooperation to reduce marine debris.

北九州市 CITY OF KITAKYUSHU ⟷ Cooperation ⟷ UN environment

October 2019

Mun River Joint Clean Up

At Jaeramair City, Ubon Ratchathani Province

Speech of Sarit, governor of Ubon Ratchathani

Mun River Joint Clean Up

Garbage washed ashore on tree

Analysis of collected garbage

Waste management support in Ubon Ratchathani Province

Challenges in the Province

1. Organic Waste (Warin Chamrap City Landfill Site)
2. Plastic Waste (Warin Chamrap City Landfill Site)
3. E-waste (Waste PU from Refrigerator)

Dismantling the refrigerator

Waste PUF

Landfill@Warin Chamrap TM

Activities in 2023

1. Knowledge Sharing

(1) Study Tour to Kitakyushu, Japan

(2) Questionnaire Survey

- Waste Management at Waste Generation Sources (with UBRU)
- Utilization & needs for Compost (with UBRU & Yan Ki Nok SDM)

3. Experiment of Pyrolysis of Waste PU from Refrigerator

2. Background

2-3. City – City Cooperation

City – City Collaboration / Cooperation / Partnership is a concept that Cities from developed countries assist cities from under Developing Countries, or even Middle-Income Countries in Urban Development by transferring their knowledge & experience And technologies depending on agreement by both parties.

City is growing up
= Start facing many issues & challenges

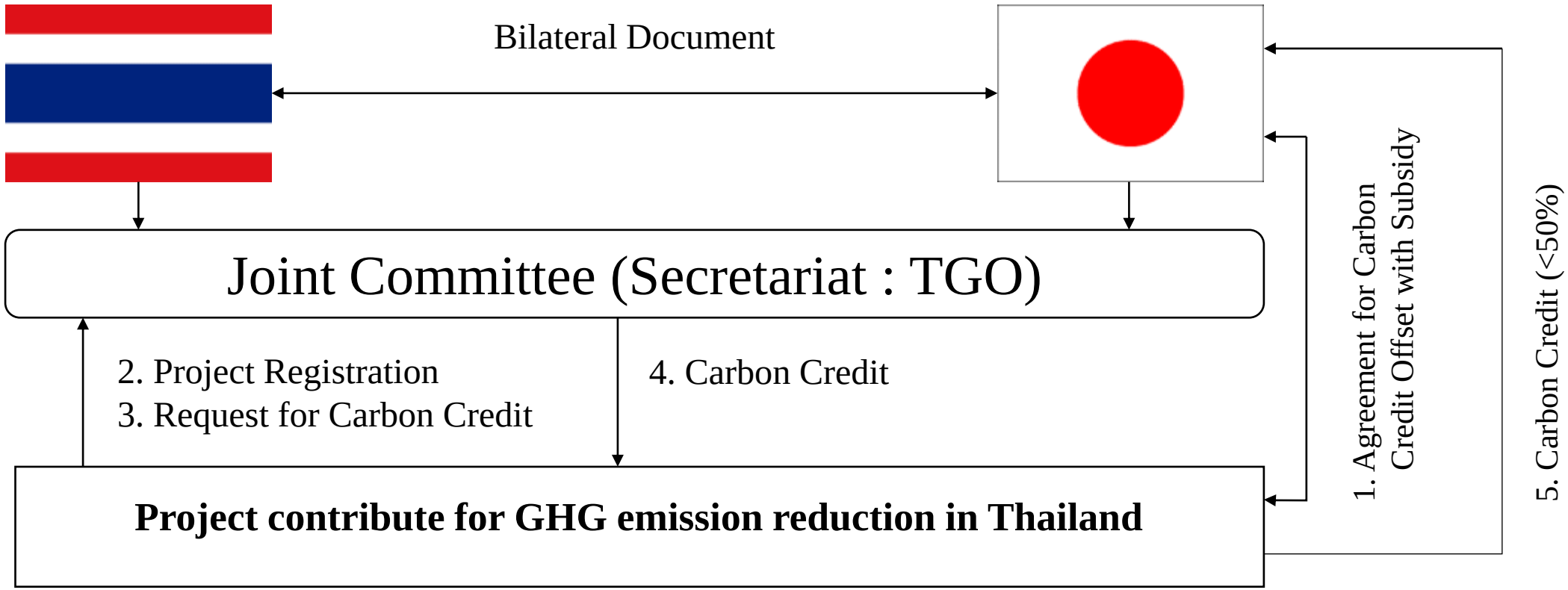
- Municipal Solid Waste
- Sewage
- Traffic
- Pollution & etc.

Support as Mentor City

- **Japanese Local Administrative Organization** will support Cities from Overseas by Development of Project in line with concept **of Low Carbon Society** under Joint Crediting Mechanism.
- **Ministry of the Environment, Japan** supports for the JCM Project Development Study under City – City Collaboration

2. Background

2-4. Joint Crediting Mechanism (JCM) – initiated by Japan & Partner Countries including Thailand

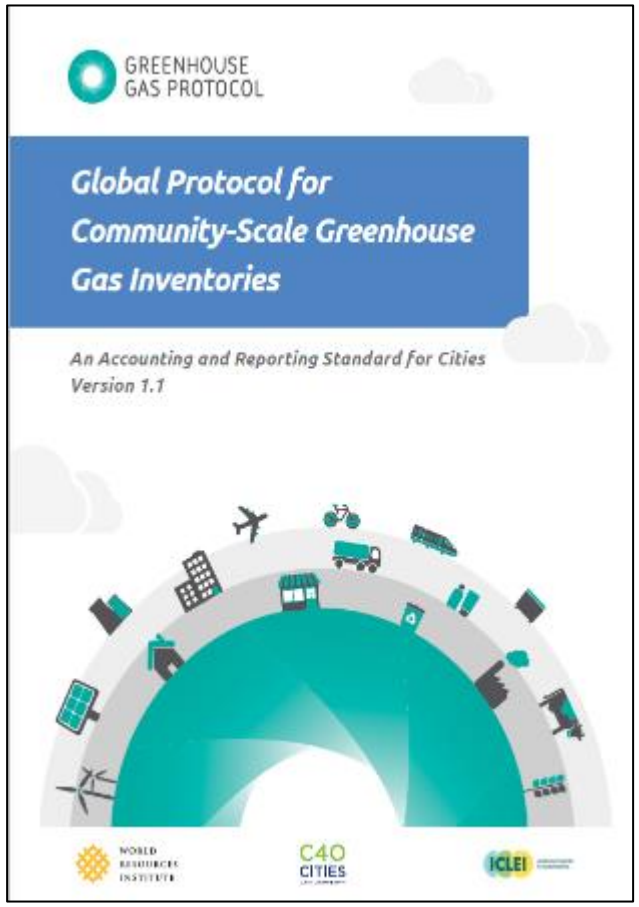


JCM Subsidy (Grant)
- not exceeding **50 percent** of the project cost (facilities & equipment contribute for GHG emission reduction)
- not exceeding **JPY2,000 million** (equivalent to **THB480 million**)
- The Government of Japan will pay as per milestone agreed (in advance of carbon credit transfer)

Japan has entered in JCM with **28 countries** including Thailand and developed **241 projects** in total JCM https://gec.jp/jcm/

3. Activities & Achievement in 2023

3-1-1. GHG emission reduction guideline at province level for Ubon Ratchathani province



Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC)

Sector		2019				
		Scope 1	Scope 2	Scope 3	BASIC	BASIC+
Stationary Energy	All type of Fuel	216,077	838,547		**1,054,624**	**1,054,624**
	Grid supply power (Fossil Fuel)					
Transport	All type of Fuel	850,439		74,676	**850,439**	**925,115**
Waste	MSW(Landfill)	156,603			**156,603**	**156,603**
	MSW(RDF)	-			-	-
	MSW (Incineration)	783			**783**	**783**
	Wastewater	227,113			**227,113**	**227,113**
	MSW(outside of area)	165,458				
IPPU	All					
AFOLU	Livestock	509,395				**509,395**
	Land Use	(3,933,577)				**(3,933,577)**
	Open Burning	356,841				**356,841**
	Rice Cultivation	2,420,110				**2,420,110**
Total		969,242	838,547	74,676	**2,289,562**	**1,717,007**

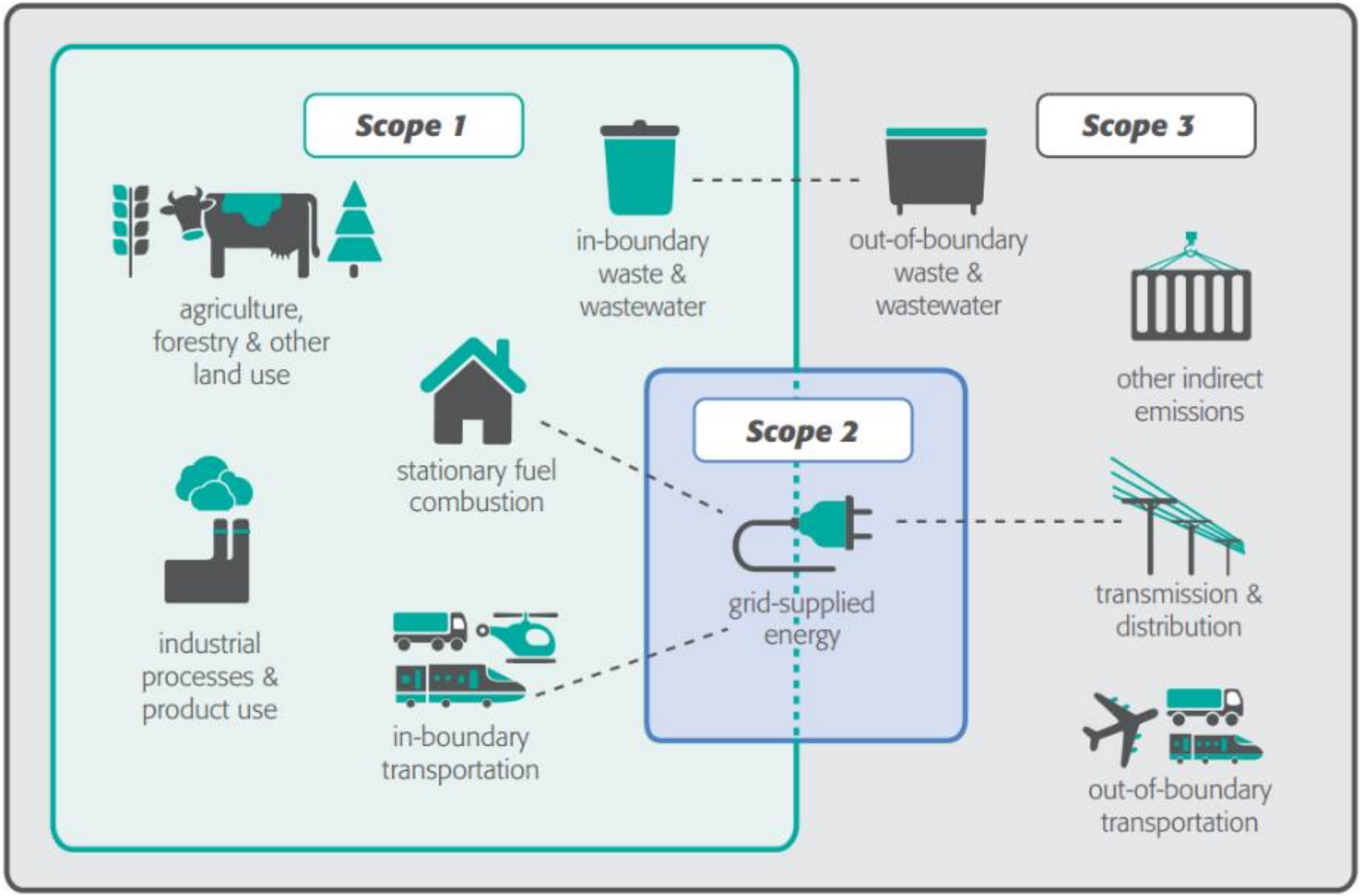
Mandatory release sources for BASIC reporting

\+ Mandatory release sources for BASIC+ reporting

Additional Emission Sources from Scope 1 (Cities Only)

Unable to determine the amount of release

- Supplementary Explanation -



Source: Global Protocol for Community-Scale Greenhouse Gas Emission Inventories

3. Activities & Achievement in 2023

3-1-2. Mitigation Actions under planning in Ubon Ratchathani province

Sector		2030 (BAU) tCO2/year		Mitigation Activities			Amount of GHG emission	
				Project Name	GHG emission			
		BASIC	BASIC+		BASIC	BASIC+	BASIC	BASIC+
Stationary Energy	All type of Fuel (exclude Fossil Fuel based Grid Supply Power)	1,365,093	1,365,093				1,208,958	1,208,958
				Energy Efficiency（EE）				
				Switch Street Light into LED	5,329	5,329		
				Energy Saving in commercial, institutial & industrial activities	115,461	115,461		
				Energy Saving in Agricultural Activities	24,697	24,697		
				Alternative Energy（AE）				
				PV for commercial, institutional & indutrial activities	4,518	4,518		
				PV for Agricultural activities	6,130	6,130		
Transport	All	1,067,878	1,067,878				575,314	575,314
				Transport Management（TM)				
				Car Free Day	4,442	4,442		
				EV Bike for Delivery Service	4,017	4,017		
				Promotion on switching to EV	13,170	13,170		
				Promotion on Bio-Diesel utilization	466,328	466,328		
				Promotion on Bio-Ethanol utilization	4,607	4,607		
Waste	MSW	10,278	10,278				0	0
				Waste Management (WM)				
				MSW reduction at waste generation source	198,807	198,807		
		3,498	3,498	Landfill management & avoidance of methane gas emission	2,366	2,366	1,132	1,132
	Wastewater	1,014,123	1,014,123				957,484	957,484
				To increase amount of wastewater treated by facility	56,639	56,639		
AFOLU	Livestock		854,780					854,780
	Land Use		-3,706,130					-4,097,335
				Forest Management & Green Space (FOR)				
				Sustainable Afforestration		-319,147		
				Reforestration & to reduce deforestration		-11,125		
				To increase green space in public area		-60,933		
	Open Burning		2,320,874					1,680,780
				Agriculture (AGR)				
				Reduction of Open Burning		640,094		
	Rice Cultivation		2,419,538					1,994,125
				Proper utilization of Fretilizer		425,413		
Total		3,457,372	5,346,434		906,511	2,363,223	2,742,888	3,175,238

3. Activities & Achievement in 2023

3-1-1. GHG emission reduction guideline at province level for Ubon Ratchathani province

Sector		2019		2030(BAU)						2030(Target)					
				Amount(tCO2)		Change				Amount(tCO2)		Change			
						Amount(tCO2)		%				2019		BAU	
		BASIC	BASIC+	BASIC	BASIC+	BASIC	BASIC+	BASIC	BASIC+	BASIC	BASIC+	BASIC	BASIC+	BASIC	BASIC+
Stationary Energy	All type of Fuel	1,054,624	1,054,624	1,365,093	1,365,093	310,469	310,469	29.4%	29.4%	1,208,958	1,208,958	14.6%	14.6%	-11.4%	-11.4%
	Grid supply power （Fossil Fuel）				-	-					-				
	Total	1,054,624	1,054,624	1,365,093	1,365,093	310,469	310,469			1,208,958	1,208,958	14.6%	14.6%	-11.4%	-11.4%
Transport	**Transport**	850,439	925,115	1,067,878	1,067,878	217,439	142,763	25.6%	15.4%	575,314	575,314	-32.4%	-37.8%	-46.1%	-46.1%
Waste	MSW(Landfill)	156,603	156,603	6,780	6,780	-149,823	-149,823	-95.7%	-95.7%	0	0	-100.0%	-100.0%	-100.0%	-100.0%
	MSW(RDF）	-	-	-	-	-	-			-	-	-	-	-	-
	MSW (Incineration)	783	783	3,498	3,498	2,715	2,715	346.7%	346.7%	1,132	1,132	44.6%	44.6%	-67.6%	-67.6%
	Wastewater	227,113	227,113	1,014,123	1,014,123	787,010	787,010	346.5%	346.5%	**957,484**	**957,484**	**321.6%**	**321.6%**	-5.6%	-5.6%
	MSW(outside of area)					-	-								
	Total	384,499	384,499	1,024,401	1,024,401	639,902	639,902	166.4%	166.4%	958,616	958,616	149.3%	149.3%	-6.4%	-6.4%
IPPU	All					-	-								
AFOLU	Livestock		509,395		854,780	-	345,385		67.8%		854,780		67.8%		0.0%
	Land Use		-3,933,577		-3,706,130	-	227,447		5.8%		-4,097,335		-4.2%		-10.6%
	Open Burning		356,841		2,320,874	-	1,964,033		550.4%		**1,680,780**		**371.0%**		-27.6%
	Rice Cultivation		2,420,110		2,419,538	-	-572		-0.02%		1,994,125		-17.6%		-17.6%
	Total		-647,231		1,889,062		2,536,293				432,350		-166.8%		-77.1%
Total		2,289,562	1,717,007	3,457,372	5,346,434	1,167,810	3,629,427	51.0%	211.4%	2,742,888	3,175,238	19.8%	84.9%	-20.7%	-40.6%

3. Activities & Achievement in 2023

3-1-3. GHG emission sources in Ubon Ratchathani province

Objectives

- to understand situation & climate change related sites in the province
- to consider possible mitigation actions for the province

Places visited

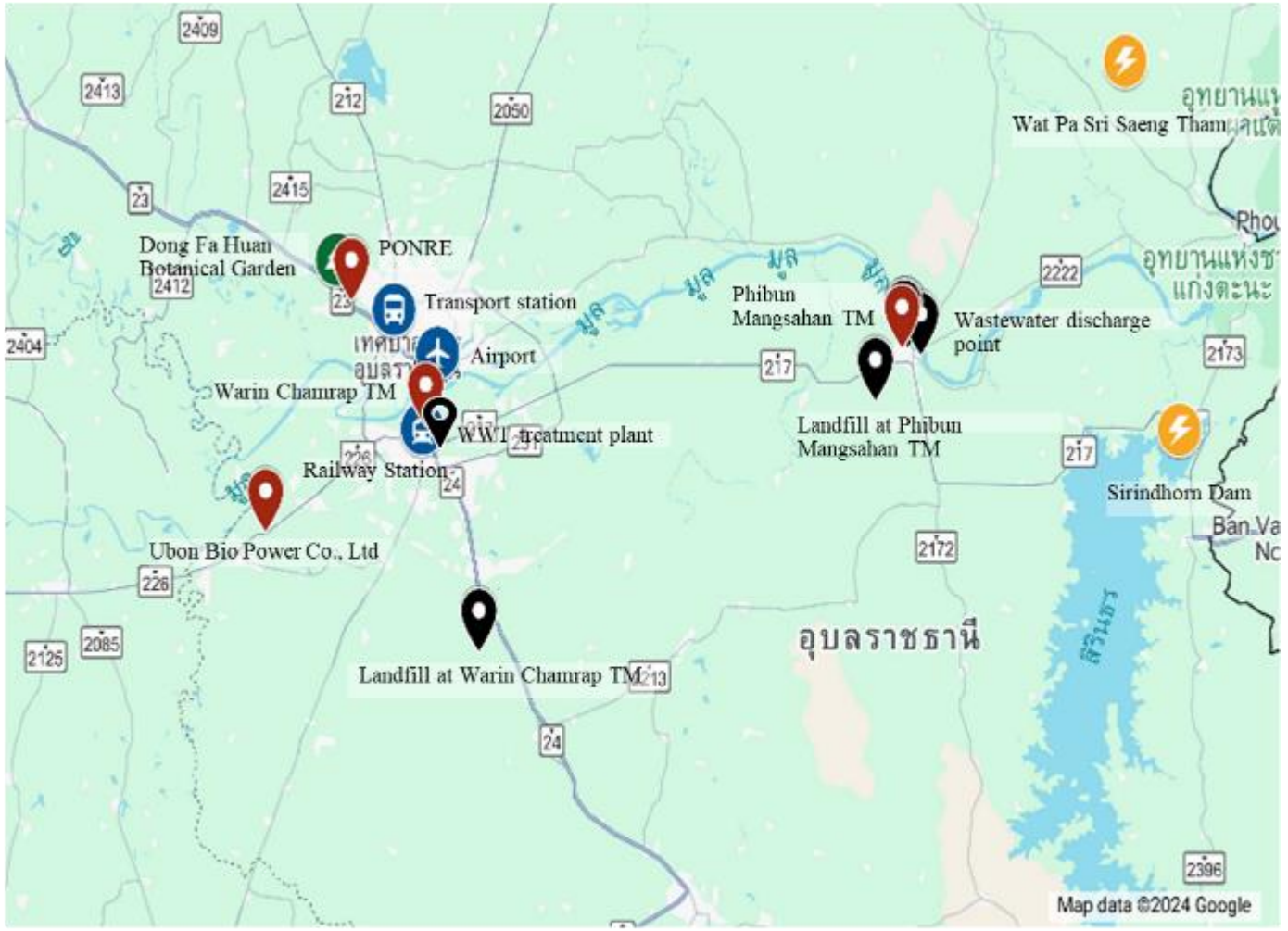
Stationary Energy
- Commercial, Institutional Building & Facilities
- Renewable Energy Project Sites
- Smart Community (Energy)

Transport
- Airport, Bus Station & EV Charging Station, Railway Starion

Waste
- Landfills (Warin Chamrap & Phibun Mangsahan)
- Wastewater related sites (ditto)

AFOLU
- Botanical Garden
- Rice Cultivation Field

Further Discussion on Mitigation Actions for Carbon Neutral



3. Activities & Achievement in 2023

3-1-4. Interview with relevant parties in the Province

Dept. of Energy, Ubon Ratchatani Province

- Energy Efficiency
- Energy Saving
- On-Site PPA (for household)

Dept. of Agriculture Extension

- Introduction of alternative method for rice field burning
- Introduction of alternative rice cultivation method

Federation of Thai Industry, Ubon Ratchathani

- Afforestation in unused Private Land
- Biogas Project (by a member of FTI)
- New Eco-Friendly & Low Carbon Award in Lent candle contest in the Province

Wat Pra Sri Seang Tham

- Zero Carbon School / Community by Solar System
- Solar System installation at hospitals in the province
- Unformal education as for solar system to community members

3. Activities & Achievement in 2023

3-2-1. Case Study for Project Development focusing on MSW management in Warin Chamrap municipality

Date	2023/11/25 (Sat) – 2023/12/01 (Fri) (7 consecutive days)	Sampling Time	8.00 ~ 14.00 (6 hours+)
Project Owner	City-City Cooperation among Warin Chamrap TM, Provincial Office of Natural Resources & Environment in Ubon Ratchathani Province & City of Kitakyushu		
Implementation	EX Research Institute (EXRI ASIA) & Ubon Ratchathani Rajabhat University		
Process & Items to be analyzed	Process	Items analyzed (No. of Sample/day)	

Process:

- Data Collection
- Planning
- Pre-Meeting (11.24)
- On-Site Meeting (11.24)
- Sampling (2 steps)
- Sample Preparation
- On-Site Analysis
- Analysis (Laboratory)

Items analyzed (No. of Sample/day):

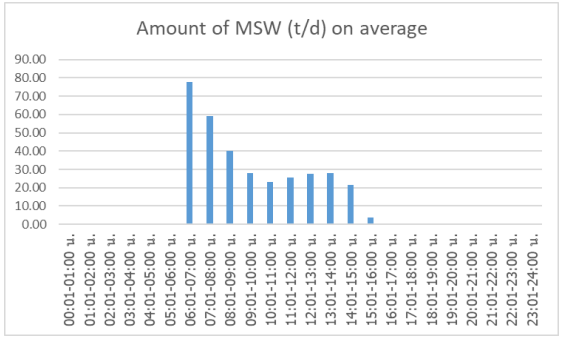
1. Specific Gravity (3)
2. Waste Composition (Wet & Dry) (3)
3. Proximate Analysis (Moisture, Ash, Combustible) (1)
4. Chemical Analysis (C, H. N. O + S) (1)
5. COD 7 (1)

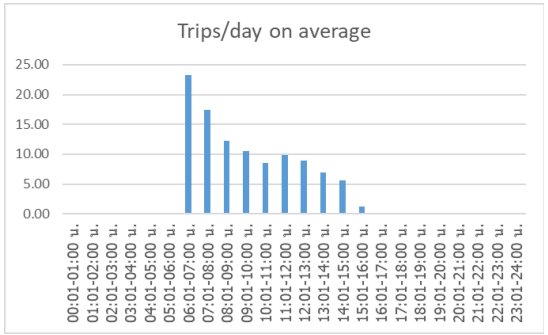
3. Activities & Achievement in 2023

3-2-2. Waste Sampling & Analysis in Landfill of Warin Chamrap municipality

Data Collection ～ Site Meeting

Data shared by Warin Chamrap TM





Time	Amount	Amount (t/min)	OP1	OP2	OP3	OP4
06:01-07:00 น.	77.62	1.29				
07:01-08:00 น.	59.13	0.99				
08:01-09:00 น.	40.15	0.67				
09:01-10:00 น.	28.04	0.47				
10:01-11:00 น.	23.25	0.39				
11:01-12:00 น.	25.59	0.43				
12:01-13:00 น.	27.37	0.46				
13:01-14:00 น.	27.88	0.46				
14:01-15:00 น.	21.36	0.36	252.78	193.64	231.41	172.28
			75.5%	57.8%	69.1%	51.5%

Time	No. of Truck	Min/truck	OP1	OP2	OP3	OP4
06:01-07:00 น.	23.24	2.58				
07:01-08:00 น.	17.36	3.46				
08:01-09:00 น.	12.28	4.89				
09:01-10:00 น.	10.56	5.68				
10:01-11:00 น.	8.48	7.08				
11:01-12:00 น.	9.79	6.13				
12:01-13:00 น.	8.97	6.69				
13:01-14:00 น.	6.89	8.71				
14:01-15:00 น.	5.61	10.70	53.33	49.87	42.63	42.63
			51.0%	47.7%	40.8%	40.8%

Pre-Meeting & On-Site Meeting among parties

Finalized 08:00-14:00 as sampling hours

Sampling ～ On-Site Analysis

Sampling on site

- Recording of Base Data (Time, Car No. Sample No. with weight)
- Pictures (Transporter, Waste & Waste Sample collected)

Sample preparation (Primary Sample)

- Picked up samples collected through sampling on site randomly (upto 400kg)
- Quartering for Primary Sample (<200kg)

On Site Analysis & Sample Preparation (Secondary Sample)

Item	Q'ty	Methodology
Specific Gravity	3/day	As per Notification No. 95 of MOEJ
Composition (WET Basis)	3/day	Foods, Papers/ Cardboard, Textiles, Grasses/ Woods, Plastics, Rubbers/ Leathers, Metals, Bottles/Stone & Others

- Secondary Sample (5kg) preparation as per proportion of the Primary Sample

3. Activities & Achievement in 2023

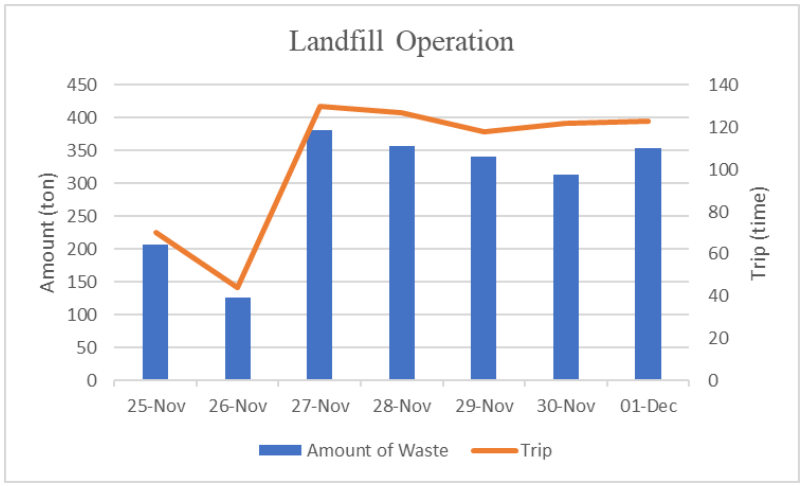
3-2-3. Result of On-site Waste Analysis

1) General Information

Sampling Date & Time : 08:00-14:00, Nov 25 (Sat) – Dec 01 (Fri), 2023

Operation & Sampling Works :

Description	Operation	Sampling	%
Amount of MSW	2,078.16 ton	2,550.20kg	-
No. of Trip (total)	734	362	49.3%
No. of Trip (core time)	392	362	92.3%



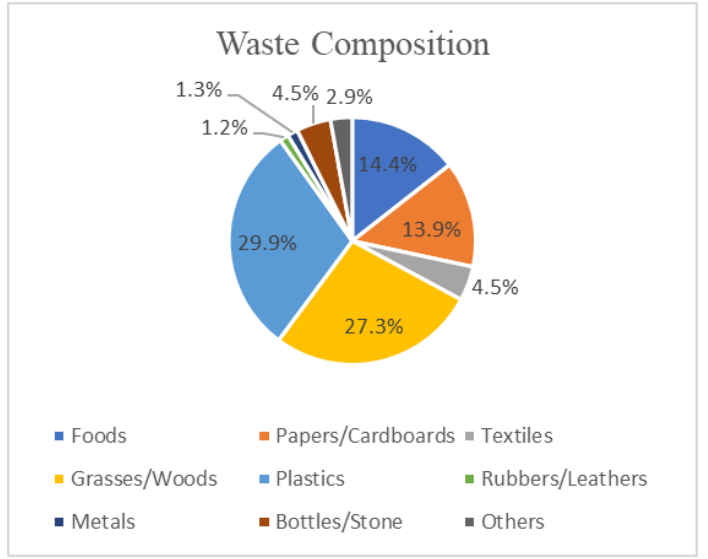
2) Findings from On-Site Analysis

Specific Gravity

Date	Average	Max	Min	Median
11-25	0.09	0.10	0.07	
11-26	0.10	0.10	0.10	
11-27	0.13	0.14	0.12	
11-28	0.10	0.12	0.09	
11-29	0.10	0.11	0.10	
11-30	0.12	0.12	0.11	
12-01	0.10	0.11	0.09	
	0.11	**0.14**	**0.07**	**0.10**

Waste Composition (WET)

	WET basis Average(%) Actual	Average(%) Adjust	Max (%)	Min (%)
Foods	10.34	**14.4**	31.64	11.9
Papers/Cardboards	9.95	**13.9**	20.02	13.2
Textiles	3.23	**4.5**	13.28	2.6
Grasses/Woods	19.56	**27.3**	43.55	16.9
Plastics	21.41	**29.9**	47.53	18.4
Rubbers/Leathers	0.85	**1.2**	4.43	0.1
Metals	0.97	**1.3**	3.04	0.5
Bottles/Stone	3.23	**4.5**	7.89	2.2
Others	2.04	**2.9**	10.75	0.0
Total	71.58	**100.0**		



3. Activities & Achievement in 2023

3-2-4 Result of Laboratory Waste Analysis

1) Waste Composition (Wet & Dry) and Moisture Content

Waste Type	Proportion			Moisture Content		
	Average	Max	Min	Average	Max	Min
Waste Composition (wet)						
Foods	12.5%	27.0%	6.7%	44.6%	58.1%	30.3%
Papers/Cardboards	11.2%	17.9%	7.7%	29.3%	48.7%	10.3%
Textiles	9.1%	14.7%	2.9%	22.8%	38.6%	7.7%
Grasses/Woods	15.7%	38.1%	4.3%	51.3%	64.6%	17.4%
Plastics	16.5%	25.3%	12.6%	15.3%	23.1%	5.6%
Rubbers/Leathers	4.2%	9.0%	0.9%	5.9%	41.2%	1.1%
Metals	4.1%	7.8%	1.3%	3.2%	8.8%	1.2%
Bottles/Stone	16.3%	33.6%	4.2%	1.4%	2.9%	0.2%
Others	10.4%	19.2%	5.0%	29.5%	64.7%	6.7%
Total				**26.2%**	**40.2%**	**19.3%**
Waste Composition (dry)						
Foods	9.5%	21.0%	3.6%			
Papers/Cardboards	11.4%	22.9%	6.3%			
Textiles	9.2%	13.7%	3.9%			
Grasses/Woods	10.4%	22.6%	4.4%			
Plastics	18.7%	25.1%	12.8%			
Rubbers/Leathers	5.0%	11.1%	1.1%			
Metals	5.2%	9.8%	2.2%			
Bottles/Stone	20.9%	41.2%	6.9%			
Others	9.7%	18.7%	2.2%			

2) Three Elements

Element	Average	Max	Min
Moisture (total)	26.0%	41.1%	20.2%
Ash	50.4%	60.1%	38.3%
Combustible	23.5%	36.7%	17.0%

3) Chemical Analysis

	C	H	N	S	O	Ash
Average	11.77	2.26	0.23	0.37	17.92	67.44
Max	29.63	4.48	0.41	0.45	23.43	77.17
Min	4.44	0.77	0.12	0.30	8.23	51.60

4) CoD

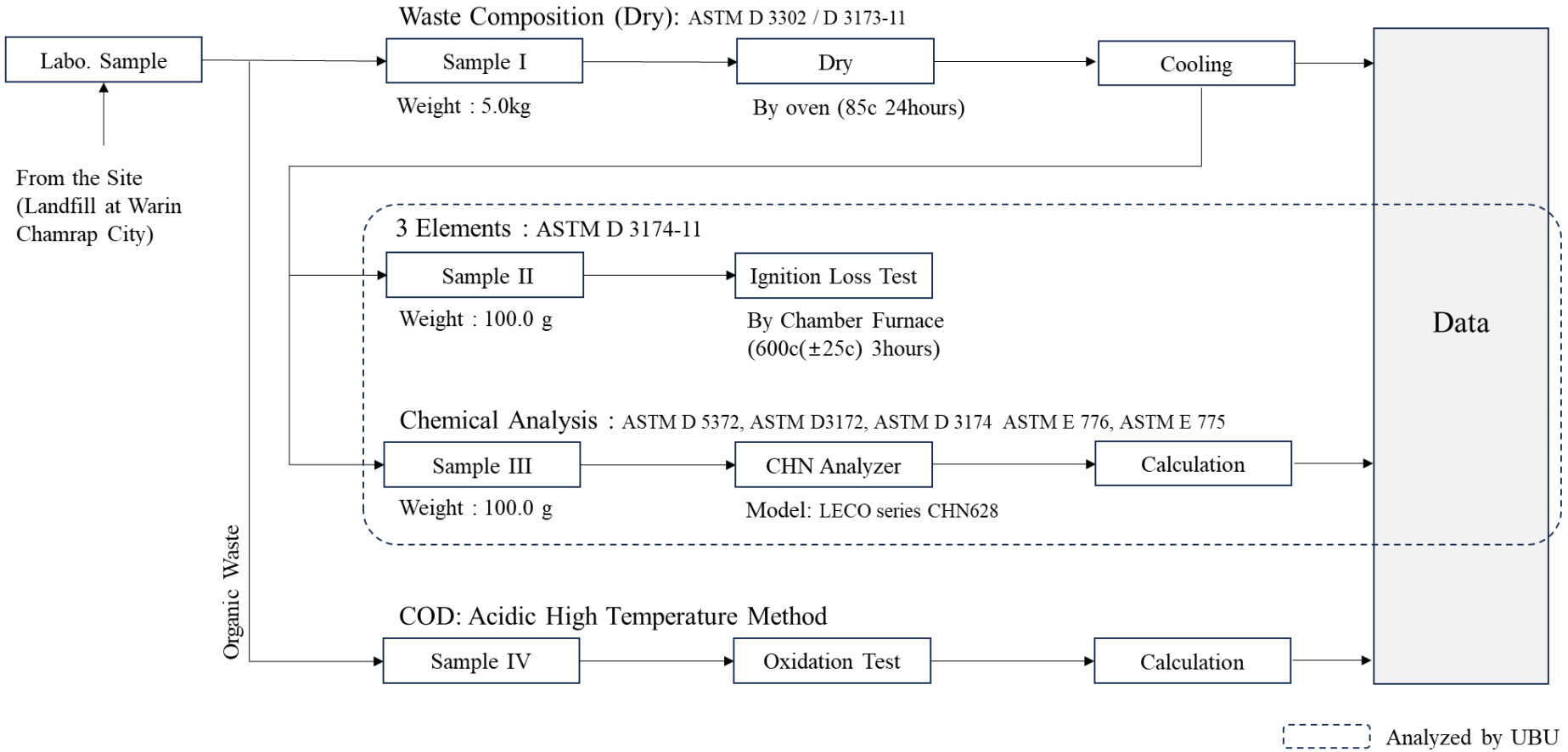
	Average	Max	Min
CoD (ppm)	1,397.26	1,691.69	1,079.17

UBRU Laboratory

UBU Laboratory

3. Activities & Achievement in 2023

3-2-5 Laboratory Process Flow



Appearance of Sample II

Appearance of Sample IV

Hot Air Oven
Memmert; Germany
Models: 30-1060

CHN Analyzer
LECO; USA
Model: CHN628

Chamber Furnace
CARBORITE; United Kingdom (UK)
Model: CWF 1200

On-Site	Mr. Wattanachai Malai	Laboratory	Ms. Yupaporn Amnat	Approved by	Prof. Dr. Nanthaporn Sutthiphapa

3. Activities & Achievement

3-3-1. Other Projects finding in the Province

Issues finding from the survey

Currently Situation

- There are only **2 sites** of wastewater treatment plant in the province
- A combined treatment capacity of approximately 40,000 m3/d.
- Almost all LAOs don’t have a plan for developing wastewater treatment facility.




Up to 227,113 tCO2eq in Total emitted from Wastewater Treatment Activities in the province

Developing and increasing the efficiency of wastewater treatment system in Ubon Ratchathani Province to reduce GHGs emission in waste sector

3. Activities & Achievement in 2023

3-4. Public Relation & Knowledge Sharing

(1) Introduction of Activities for Carbon Neutral the case of City of Kitakyushu

By Mr. Mitsuyoshi Hamada, City of Kitakyushu.

Time: 11.00-12.00 (TST)

Outline

Activities & Models for decarbonization

(2) Our Technology & Our Activities in the Mekong region

By Mr. Shinichi Yamaguchi, KOBELCO ECO-SOLUTION Co., Ltd.

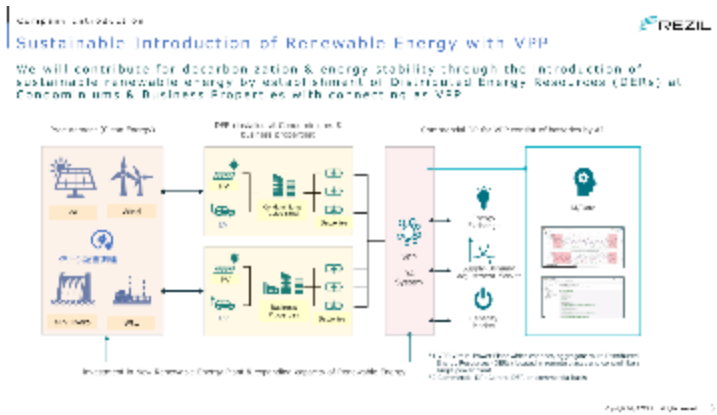
Time: 13.00-13.50 (TST)

Outline

Technologies applicable for MSW Management & wastewater treatment

(3) We make Decarbonization Effortless

By Mr. Hiroki Ueno, Rezil inc



Time: 13.50-14.40 (TST)

Outline

Virtual Power Plant in Japan

(4) Possible Countermeasure against Forest Fire

By Mr. Takayoshi Kawahara, Shabondama Soap Co., Ltd

Time: 14.50-15.40 (TST)

Outline

Concept of fire forest management & Countermeasure Method

4. Activities under planning in 2024 (subject to MOEJ's acceptance of proposal)

City of Kitakyushu

Activities under planning

- To update value for quantification of GHG emission
- To ensure implementation of the existing mitigation actions
- To find more mitigation actions in the province
- To find potential investor(s), technical provider(s) & financial sources(s) for mitigation actions in the province
- To raise more awareness and involve more parties in mitigation actions

Ubon Ratchatani Provincial Office

Planning

- Climate Change Guideline for Ubon Ratchathani province
- Others (Development Plan, Clean Province & etc.)

Driving

- Awareness Raising
- Public Relation & Promotion

Implementation

Supervising

Local Administrative Organizations

Citizen/Community

Private Company

Public Organizations

NPO/NGO

(Target) Road Map & Declaration for Carbon Neutral by 2050

Driving parties to Carbon Neutral by 2050

(Goal) Carbon Neutral by 2050

Thank you for your attention