Consultation on the Solid Waste Management PPP Guide for LGUs

December 11, 2019

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Policy Formulation Division
PPP Center

Outline of the consultation

CONSULTATION OBJECTIVES

- To discuss salient points of the draft SWM-PPP Guide
- To map and validate with LGUs the major issues and problems they face in relation to SWM
- To identify areas where PPP Center can provide assistance and support

About the SWM-PPP Guide ("the Guide")

BACKGROUND

- In 2018, the PPP Center participated in the 3rd Dialogue on Waste Management between the Philippines and Japan where it committed to prepare a guide for LGUs on designing SWM projects under the PPP modality

- PPP Center has been coordinating with various stakeholders and development partners to develop the draft Guide. Such partners include:

  ✓ DENR EMB Solid Waste Management Division
  ✓ Institute for Global Environmental Strategies
  ✓ JICA
  ✓ Infrastructure Asia

Solid Waste Management PPP Guide for LGUs

Identifying challenges faced by LGUs

PPP CENTER PERSPECTIVE

- Cost of preparing feasibility studies and other project development activities
- Apprehensions in evaluating unsolicited proposals received
- Lack of capacity to develop and monitor large infrastructure projects and complex contracts
- Difficulty in prioritizing projects considering time frame of LGU office and budgeting cycle
- Challenges in attracting private sector interest and competition

Identifying challenges faced by LGUs

SURVEY OF KEY ISSUES OF LGUs

- Survey design: Identify likely causes of issues per the functional elements of SWM

- Likely causes of issues of LGUs:
  - Inadequate manpower
  - Weak technical capacity
  - Inadequate public
  - Inadequate financial capacity
  - Lack of adequate infrastructure

Identifying challenges faced by LGUs

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  - Inadequate financial capacity
  - Lack of adequate infrastructure

Survey of key issues of LGUs

Issue No. 1:
Related to waste handling separation, storage at source

	Absence of waste storage system at Source	**Lack of proper waste segregation at Source**
Inadequate manpower	3	2
Weak technical capacity	2	2
Inadequate public participation	**4**	**4**
Inadequate financial capacity	2	2
Lack of adequate infrastructure	2	2
Not an issue	1	

Appendix 9

Survey of key issues of LGUs

Issue No. 2:
Related to collection

	Low service area coverage for waste collection	Low waste collection efficiency	Improper street cleaning on regular basis
Inadequate manpower	**5**	**4**	2
Weak technical capacity	**4**	3	
Inadequate public participation	1	2	3
Inadequate financial capacity	3	3	2
Lack of adequate infrastructure	2	1	1
Not an issue			

Survey of key issues of LGUs

Issue No. 3:
Related to waste transfer and transport

	Low number of transfer stations	Waste transportation in un-covered/open vehicles	Redundant/Out-dated vehicle for transportation	Improper design/infrastructure of storage depots
Inadequate manpower		1	2	1
Weak technical capacity		3	2	1
Inadequate public participation	1	1	1	
Inadequate financial capacity	3		2	1
Lack of adequate infrastructure	**5**	2	3	3
Not an issue		1	1	1

Survey of key issues of LGUs

Issue No. 4:
Related to waste processing and recovery

	Absence/lack of capacity for waste processing	Absence/lack of scientific waste disposal/ landfill	Distant landfill location resulting in high transportation costs
Inadequate manpower	3	2	1
Weak technical capacity	3	3	2
Inadequate public participation	3		
Inadequate financial capacity	2	**4**	2
Lack of adequate infrastructure	**5**	**4**	3
Not an issue			1

About the SWM-PPP Guide ("the Guide")

OBJECTIVE OF THE GUIDE

- To assist LGUs in identifying, developing, procuring, and identifying key activities prior to the implementation of SWM projects using the PPP scheme

SCOPE AND LIMITATIONS

- Cover all phases of SWM-PPP projects from project development to pre-implementation;
- Provide a background on the national SWM strategy and the role LGUs;
- Include useful case studies on SWM-PPP projects; and
- Be limited to projects implemented by LGUs.

Note: The Guide shall not include the selection of the appropriate SWM intervention, nor does it identify or promote a specific SWM technology.

Appendix 9

About the Guide

INTENDED USERS

- Practitioners responsible for implementing PPP projects at the local level
- Approving bodies for SWM-PPP projects for reference during project appraisal

TARGET LGUs

Those that have:

- A PPP Code legislated by its local sanggunian
- A 10 year SWM Plan approved by the National Solid Waste Management Commission
- Local Solid Waste Management Board

Major parts of the Guide

Chapter 1:
National SWM Strategy and the Role of LGUs

- Overview of the Ecological SWM Act of 2001
- Roles and responsibilities of LGUs
  - Option to cluster
- Issues at the local-level and options for private sector participation
  - Types of private sector involvement
  - Possible waste projects per segment of the traditional waste hierarchy

Major parts of the Guide

Chapter 2:
Project Concept Note for the SWM Sector

- Pointers for the formulation of a PCN for an SWM-PPP Project
- Prescribed template
- Sample PCNs

Major parts of the Guide

Chapter 3:
Critical elements of a Feasibility Study for an SWM Project

- Identifying relevant baseline information for an SWM project FS
- Determining the appropriate project scope;
- Evaluating proposed solutions (technical, financial, legal, regulatory)
- Identifying considerations on PPP project structuring

Appendix 9

Major parts of the Guide

Chapter 4: Approval

- Pointers on appraising SWM-PPP projects

Chapter 5: Procurement

- For projects implemented through the BOT Law, refers to the BOT Law (RA 7718) and its IRR, and the Guidebook on BOT Projects
- For projects implemented through Joint Venture Agreements, refers to Guidebook on Joint Ventures for LGUs

Chapter 6: Pre-implementation

- Pointers for setting up a good project monitoring framework

Other sections of the Guide

The Guide will also discuss the following:

- **Pointers on managing unsolicited proposals in the sector**
- **Safeguard issues related to SWM-PPP projects**
  - Environmental issues*
  - Engagement of the informal waste sector
- **Communications planning**

**Following issuance of DENR Administrative Order 2019-21 on Establishing WtE Facilities*

PPP Center Services

PPP Center Services

Type of support for LGUs	

Capacity development support	• **SWM-PPP Guide**
	• **Capacity building sessions**
	  • Introduction to PPP concepts or PPP 101
	  • Concept note formulation
	  • Project prioritization
	  • Management of unsolicited proposals
	  • Financial and economic analysis of PPP projects

Project support	• **Technical assistance on actual PPP projects**
	  • Project development
	  • Evaluating unsolicited proposals
	• **PDMF**
	• **Legal assistance**
	• **Project monitoring**

Appendix 9

SWM-PPP Guide

PLANNED ACTIVITIES IN 2020

- Inter-agency workshop with members of the National Solid Waste Management Commission
- Finalization of the Guide
- Printing and dissemination of the draft Guide

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Questions?

For further information, please visit:
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PPPPinas

Appendix 9

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Meeting No. xx	**Title/Description:** **Inter-Agency Workshop on the draft Solid Waste Management (SWM) PPP Guide for Local Government Units (LGUs)**		
Date: *January 28, 2020*	**Started:** *9:30 AM*	**Adjourned:** *2:00 PM*	**Venue:** PPP Center Board Room
Presiding Officer: Atty. Phebean Belle A. Ramos-Lacuna Director III Policy Formulation, Project Evaluation and Monitoring Service (PFPEMS) PPP Center		**Agenda:** 1. Background on the initiative 2. Insights from Philippine LGU SWM Plan Data 3. Workshop	
Attendees: • **Members of the National SWM Commission:** ○ DILG ○ DTI-BOI ○ DOST ○ DA ○ DOH ○ DPWH ○ MMDA ○ PIA ○ DENR ○ TESDA ○ League of Cities of the Philippines ○ Private sector representative from the recycling industry – Philippine Plastic Industry Association ○ Private sector representative from the manufacturing industry – Motolite • **Resource persons from:** ○ DOE ○ Institute for Global Environmental Studies ○ Environweave ○ Economic Research Institute for ASEAN and East Asia (ERIA) ○ Philippine Pollution Control Associate of the Philippines		**Background:** • **On the SWM-PPP Guide ("the Guide") -** The Guide is intended to assist LGUs in identifying, developing, procuring and implementing SWM projects using the PPP scheme. The Guide shall: (1) cover the phases of SWM-PPP projects from project development to pre-implementation; (2) provide a background on the national SWM strategy and the role of LGUs; (3) include useful case studies on SWM-PPP projects; and (4) be limited to projects implemented by LGUs. • **On the inter-agency workshop** - The purpose of the workshop shall be to: (1) identify the key issues faced by LGUs in implementing RA 9003, or the Ecological SWM Act; and (2) solicit comments and inputs from relevant agencies on the initial draft of the SWM-PPP Guide.	
Highlights			
Topic/Agenda	***Discussion/Status/Remarks***		***Agreements/Action Items/Next Steps***

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1. Background on the initiative	• In the welcoming remarks, PPP Center Deputy Executive Director Mia Mary G. Sebastian identified the factors which led to the PPP Center initiative to draft a sectoral guide on SWM:
	  ○ *PPP Center local PPP strategy* - launched in 2017, the local PPP strategy intensified the Center's assistance to LGUs in all aspects of the PPP Program from project development, capacity building, to policy support;
	  ○ *3rd Dialogue on Waste Management between the Philippines and Japan* - In 2018, the PPP Center participated in the Dialogue where, together with partner agencies, it committed to prepare a guide for LGUs on designing SWM projects under the PPP modality.
	• She discussed the objective of the Guide and noted that the intended users of the knowledge product are those practitioners responsible for implementing PPP projects at the local level, approving bodies for SWM-PPP projects for reference during project appraisal, as well as other parties who are interested in participating in the SWM-PPP sector.
		N/A

2. Insights from Philippine LGU SWM Plan Data	• Ms. Melissa Cardenas of Environweave presented the findings of an ERIA-commissioned market study on data from 10-year SWM plans of 285 LGUs. She discussed patterns from the data such as the correlation between waste generation and factors such as population density and operating income. A Google map of 140 final disposal sites (90 sites	N/A

	based on the DENR EMB database, 30 based on site visits, and 30 based on Google earth images) was also presented to the body.
	• Based on the SWM plans studied, Philippine cities typically allocate about USD 25 to USD 33 per ton for SWM, while most Philippine municipalities allocate less than USD 20 per ton.
	• Major comments on the presentation included:
	  ○ LGUs which recorded high generation of hazardous solid waste may be those that do not strictly implement segregation
	  ○ Kalibo, Aklan should not be lumped together with other municipalities since it is a special case as a top tourist destination
	  ○ There will likely be a weak relationship between population density and waste generation since generation of waste is on a per capita basis
	• PPP Center Director Phebean Belle A. Ramos-Lacuna thanked Environweave for sharing the findings of their study. She further noted that the inclusion of the Environweave presentation to the workshop was to help identify key issues faced by LGUs in implementing RA 9003, serving as the jump-off point for the workshop proper.	

3. Workshop on the draft Guide	*A. Workshop instructions* • To start the workshop proper, Dir. Ramos-Lacuna highlighted the following key messages: ○ PPPs should be seen as a way to comply with the provisions of RA 9003	N/A

	○ SWM intervention thru PPP should be based on the needs of LGUs, amount and type of waste generated, technical capacity, and available technology ○ PPP is not just for waste-to-energy; other aspects of SWM value chain can be included such as waste processing and landfill facilities, waste processing, collection and transportation, and integrated SWM facilities ○ Economies of scale and clustering between LGUs may make SWM-PPP projects more viable • The PPP Center, through Ms. Bea Quintos, presented the salient points of the draft Guide. Major comments from the body are discussed below. *B. General comments* • Suggested references to include in the draft Guide: ○ Waste Analysis and Characterization Study (WACS) Guideline ▪ DOST-ITDI noted that the WACS Guideline is currently under development but will soon be released to the public ○ NSWMC resolutions on Waste-to-Energy and Clustering ▪ DENR-EMB provided copies of the resolution prior to the meeting ○ Updated NSWM Strategy	

	▪ DENR-EMB noted that the draft is currently under development, but a copy of the working draft may be provided ○ DENR Department Administrative Orders on WtE and safe closure of landfills ○ DA reference on quality compost ○ TESDA reference on training on safe handling of waste ○ DOE Omnibus Rules on Energy Projects ▪ DOE provided a copy of the Omnibus rules prior to the meeting • Role of the NSWMC ○ Clarification that the NSWMC can ensure SWM-PPP projects are aligned with the 10-year SWM Plan of the LGU (i.e. LGU may not add/remove projects from their 10-year SWM Plan) ○ Information sharing between NSWMC and PPP Center on monitoring SWM-PPP projects ▪ PPP Center has a Project Monitoring Division which conducts site visits, prepares case studies/lessons learned from these projects. PPP Center can share such information with the NSWMC counter-parts.	

	• Clustering
	  ○ Suggestion to include case studies or examples of successful SWM-PPP projects in other jurisdictions which used a cluster-based approach
	
	• Format of the draft Guide
	  ○ Suggestion to consider web-based platform and module-type learning for LGUs
	  ○ Consider LGU-friendly format
	
	C. Major comments per section
	
	• Ch. 2: R.A. 9003 and the National SWM Strategy
	  ○ Suggestion to use the SWM framework prescribed under R.A. 9003, and include the discussion of the framework before the illustration of models of resource recovery
	
	• Ch. 3: PPPs in the SWM sector
	  ○ Suggestion to adopt National SWM Framework (i.e. inverted triangle) when identifying possible waste projects per segment of the traditional waste hierarchy
	  ○ Suggestion to remove logos of the League of Provinces, League of Municipalities, and Liga ng mga Barangay from the governance framework illustration since it is really the LGUs that are charged with the implementation, not the Leagues
	  ○ For PPPs for setting up waste processing, suggestion to highlight that the facility will depend on	

	the type of waste to be processed (e.g. organic waste)
	
	• Ch. 4: Local SWM-PPP Projects
	  ○ Include a discussion of NSWMC Resolution No. 68, Series of 2013: Guidelines on the Clustering of LGUs Common Ecological Solid Waste Management System
	
	• Ch. 5: Developing a Project Concept Note (PCN) for the SWM Sector
	  ○ Suggestion to include type of technology and minimum criteria for such technology
	  ○ Suggestion to include sources of financing, however, it was noted that it may be too soon in the project development process to do so
	  ○ Suggestion to include disaster resilience aspect on the level of the PCN
	
	• Ch. 6: Critical elements of a Feasibility Study for an SWM Project – general comment
	  ○ Highlight project location; there should at least be three (3) project location options and FS should discuss which sites are most suitable
	
	• Ch. 6: Critical elements of a Feasibility Study for an SWM Project - *legal and institutional analysis section*
	  ○ Clarification that DOST Environmental Technology Verification Certificate is a requirement for all projects which use new	

	technologies, not just WtE projects ○ Correction on the numbering of the following laws: ▪ R.A. 9725 (Clean Water Act) ▪ R.A. 8749 (Clean Air Act) ○ Suggestion to include write-up on market options for WtE project (i.e. sale of electricity); include reference to DOE Department Circular 2019-10-0013 ○ Identification of roles of oversight agencies ▪ **PPP Center requested member agencies of the NSWMC to provide their preferred wording re: the roles of oversight agencies thru email** • Ch. 6: Critical elements of a Feasibility Study for an SWM Project – *considerations in structuring an SWM-PPP project* ○ Reiteration that power or energy considerations are outlined in the DOE DC 2019-10-0013 ○ Suggestion to distinguish between permitting requirements for the establishment (i.e. location-based clearance), and the requirements for the technology (DOST ETV protocol) ○ Identification of critical decision parameters for WtE facilities, risks associated with a development of MSW	

	treatment plants under PPP scheme, and sharing responsibilities properly between public and private sectors ▪ IGES presented an overview of their comments to the draft Guide • Ch. 7: Project Approval in the SWM Sector ○ Suggestion to revise discussion on 'Pointers for the approving body'; as noted, said section must provide appropriate decision-making framework for the LGU ○ Consider outlining process flow/decision tree for the approval process ▪ IGES suggested to use as Procedures for Placing Orders for the Construction of Waste-to-Energy Facilities in Japan as possible model • Ch. 9: Project implementation (up to pre-construction only) ○ Clarification whether PPP Center intends to develop a template operations manual for SWM-PPP projects ▪ PPP Center clarified that the intent of the write-up on the operations manual is to identify important aspects that should be considered in developing one; a template manual will not be provided to the LGU	

	○ Suggestion to include a write-up that, for WtE projects, it would be important for the LGU to conduct a study on how the project will impact recycling rates in the area (i.e. updating of WACS study) ○ Clarification that ECC stands for Environmental Compliance Certificate ○ Suggestion to include list of tax incentives, such as those in the BOI Investment Priorities Plan ▪ BOI clarified that an SWM-PPP project may only register for one incentive (i.e. either for PPP, or as environment and climate-related project) ○ Suggestion to include list of financing options, such as those provided by the Climate Change Commission, and government financial institutions such as Landbank and Development Bank of the Philippines, and concessional financing (e.g. JICA) ○ Suggestion to clarify in the draft Guide that: ▪ Financing can be to the project study and/or the project ▪ Incentives may be to the host LGU or to the private proponent ○ Reiteration that power or energy considerations are outlined in the DOE DC 2019-10-0013	

	○ Suggestion to include that regular reports must be submitted to the NSWMC, and that SWM-PPP projects must be part of the approved updated 10-year SWM plan of the LGUs D. *Discussion on the sections of the draft Guide to be further developed* • Ch. 10: Special issues in SWM-PPP projects (e.g. informal waste sector, formulation of a communications plan) ○ Environweave noted that discussion of the informal waste sector must be sensitive to the people who comprise it (i.e. marginalized groups such as women and children) ○ DOST suggested to refer to the NSWM Strategy which includes the informal waste sector, and to use as reference studies developed by the World Bank • Annex on comparison of emission standards ○ Section to be retained as there is value in comparing Philippine standards with international standards; Philippine standards must still be followed, pursuant to various laws, rules, and regulations ○ Suggestion to consider that highlighting compliance to more stringent environmental standards will have a cost component; LGU must be aware of these, and that the LGU must not unwittingly shoulder this burden	

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	▪ PPP Center noted the suggestions and clarified that one of the roles of the agency is to provide technical assistance to LGUs, such that the PPP contracts they enter into is based on an optimal allocation or risks.	
4. PPP Center support to the SWM sector	• PPP Center Director Lerma A. Advincula discussed the Center's involvement in the SWM sector through its project development mandate. • She identified the following projects as part of the PPP Center's pipeline: ○ Quezon City Integrated SWM Facility – *for award to original proponent* ○ Cebu City Integrated SWM – *currently under development* ○ Marikina Integrated SWM – *unsolicited proposal under evaluation* ○ Iloilo City SWM – *currently under conceptualization* ○ 17 other SWM project in early stages of development	N/A
5. Synthesis and next steps	• Dir. Ramos-Lacuna thanked the member agencies of the National SWM Commission as well as the resource agencies which participated in the workshop. • She noted that the draft Guide is targeted for release in the first half of 2020, and that the PPP Center will take into account the comments received during the workshop.	**Next steps for workshop attendees:** • **Submit comments/inputs on the draft SWM-PPP Guide by February 28, 2020** **Next steps for PPP Center:**

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		• Once available, circulate revised draft SWM-PPP Guide to workshop attendees • Update workshop attendees on activities, timelines related to the finalization of the SWM-PPP Guide

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"The Case study Analysis for BAT/BEP Guideline"

22nd November 2021

The Technical Cooperation Project (TCP) for Capacity Development on Improving Solid Waste Management (SWM) through Advanced/Innovative Technologies

Contents of Presentation

1. Structure and Scope of Case Study
2. Results of Case Studies
3. Findings

1. Structure and Scope of Case Study

BAT/BEP Guidelines in the TCP (Backgrounds and understanding)

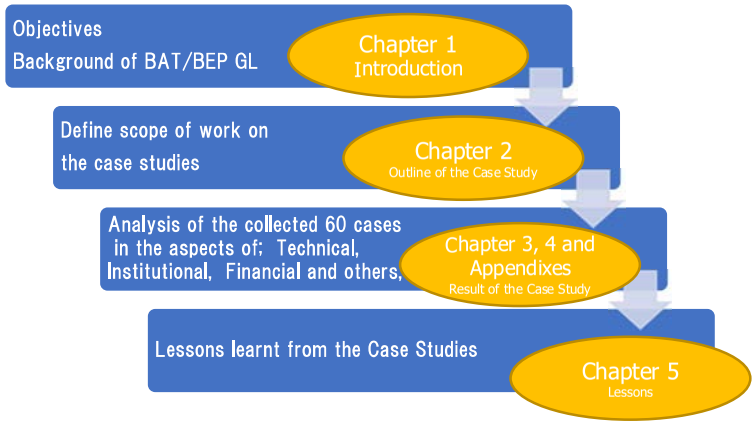
1. NSWMC Resolution669-2016:

The National Ecology Center (NEC) is in charge of finalizing and publishing the BAT/BEP guidelines

2. Understanding in the TCP:

1. BAT/BEP Guidelines to be drafted in the TCP with cooperation with DOST, while finalization of the guidelines and preparation of budget shall be arranged by the NEC
2. "BAT/BEP Guidelines for WTE technologies" will not be "Obligation" but "Recommended Technologies" for WTE.

Structure of Document



Scope of Case Study

1. WTE Technology
   - WtE facilities utilizing combustion technology, as the Appropriately Controlled Combustion (WtE-ACC)
2. Countries and Region
   - East Asia (Japan, China, Taiwan and Korea)
     - a high percentage of cases processed by WtE-ACC and a large number of cases.
   - Southeast Asia/ South Asia
     - Same region where the Philippines are located
   - EU, North America (Other Developed Region)
     - Other Developed Region
3. Treatment Capacity
   - Minimum 100 tons/day, which may avoid low efficiency and unfeasibility of facilities

2. Results of Case Studies

The Collected WtE Cases

Region/ Country	Number of Cases
East Asia	32
China	1
Japan	30
Taiwan	1
Southeast/South Asia	8
India	1
Singapore	4
Thailand	2
Vietnam	1
North America	3
USA	3

Region/ Country	Number of Cases
EU	17
Austria	2
Belgium	1
Denmark	2
Finland	2
France	1
Germany	1
Italy	1
Netherlands	1
Norway	1
Spain	1
Sweden	3
United Kingdom	1
Total	60

Example of A Collected Case Study (Suginami Incineration Plant)

Name	Suginami Incineration Plant	Location	Suginami ward, Tokyo, Japan
Impl. Body	Clean Authority of TOKYO	Footprint	3.6 ha
Capacity	600t/d (300 x 2lines)	Heat Usage	Power 24.2MW
Target Waste	Combustible municipal solid waste	Waste Quality	8,854 kJ/kg

History	Dev. Plan	Demolish	Bid	Const. St/Fin		Op. Start/Fin		Demolish
Original	-	-	-	-	-	-	-	-
Actual	-	-	-	2012	2017	2017	-	-

Capex	-	Source	NG Subsidy + LG			
Opex	1.01 B-JPY/yr (2019)	Source	LG + TF + Energy			
Fin. Scheme	Public Build (DB) and Own	Dev. approach	Solicited			

Coverage (SOW)	Collection	Transp.	Incineration	Power sale	Bottom ash	Fly ash
	LG (ward)	LG (ward)	LG	LG	LG	LG

Process Type	Stoker type	EPC / Tech	Hiz (JPN)		

Pollution Control	Exhaust Gas	Wastewater	Bottom ash	Fly ash	Other
	Stricter Standard (Scrubber + SCR + Bag Filter)	Discharge to Sewage	Eco-cement or SLF	SLF after chemical treatment	

Example of A Collected Case Study (Suginami Incineration Plant)

Description of salient features as the case study of BAT/BEP

Salient Features	Explanation
1. Utilization of surplus heat after electricity generation	The surplus heat after electricity generation is utilized by providing adjacent public facilities such as hot water pool, botanical garden, cultural center.
2. Implementation of site tour	Site tours are periodically implemented to be understand by residents about the WtE facility
3. IEC through of museum of waste management history or hot water pool	In the WTE facility, there is museum of Tokyo Gomi Senso (Experience to tackle with opposition by the residents of Suginami ward for WtE facility construction), which describe the background, opposition of the WTE facility by the residents

Example of A Collected Case Study (Nong Khaem WTE plant)

Name	Nong Khaem WTE plant	Location	Nong Khaem, Thailand
Impl. Body	C&G Environmental Protection Holdings Limited (C&G)	Footprint	? ha
Capacity	500 t/day	Heat Usage	Power 9.8MW
Target Waste	Municipal solid waste	Waste Quality	? KJ/kg

History	Plan	Bid	Const. St/Fin		Op. Start/Fin		Demolish
Original	-	-	-	-	-	-	-
Actual	-	-	-	2014	2014	2034	-

Capex	THB 900 million	Fund Source	BMA			
Opex	1000 Bahts/ton	Fund Source	Tipping fee from BMA + energy sale ?			
Fin. Scheme	BOT	Dev. approach	?			

Coverage (SOW)	Collection	Transp.	Processing	Energy sale	Bottom ash	Fly ash
	C&G	C&G	C&G	C&G ?	BMA ?	BMA ?

Process Type	Stoker type	EPC / Tech	New Sky /Hiz ?	(Remarks if any)	

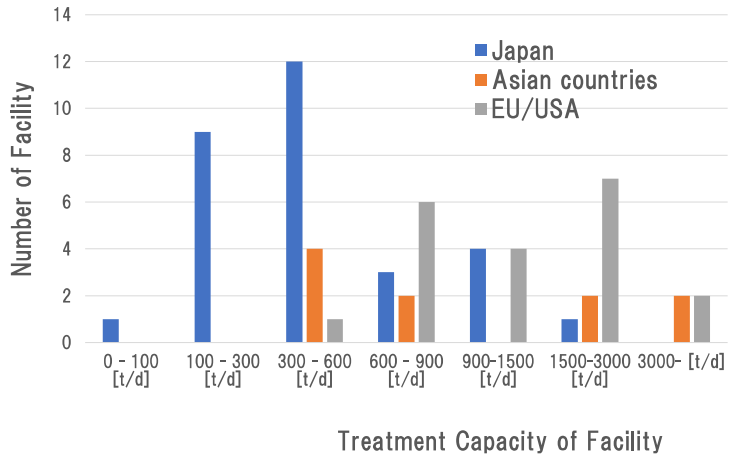
Pollution Control	Exhaust Gas	Wastewater	Bottom ash	Fly ash	Other
	?	?	?	?	?

Example of A Collected Case Study (Nong Khaem WTE plant)

Description of salient features as the case study of BAT/BEP

Salient Features	Explanation
1. First WtE plant in Metropolitan Bangkok.	This is first WtE plant in Metropolitan Bangkok which operates until now. However, it is not sufficiently disseminated about operation and maintenance information such as environmental monitoring or receiving waste amount or characteristics, etc

Treatment Capacity of the WtE-ACC Facilities



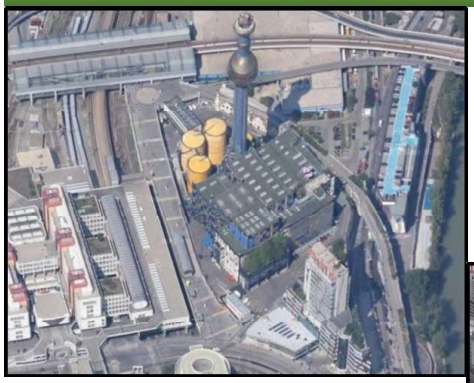
Treatment Capacity of Single Furnace

Lines of Furnace	Cases	Minimum	Maximum	Note
1	1	720	720	Incineration Line 6, Denmark
2	13	60	450	
3	11	100	1,000	
4	2	200	750	
5	1	340	340	Tuas Incineration Plant, Singapore
No information	32	-	-	
Total	60	60	1,000	

Type of Combustion Furnace

	Fluidized bed (FB)	Stoker	Gasification and Melting (GM)	FB, GM	Total
1. East Asia	3	25	3	1	32
2. Southeast/ South Asia	0	8	0	0	8
3. EU	3	13	0	0	17
4. North America	0	2	0	0	3
Total	6	48	3	1	58
Ratio (%)	10	83	5	2	100

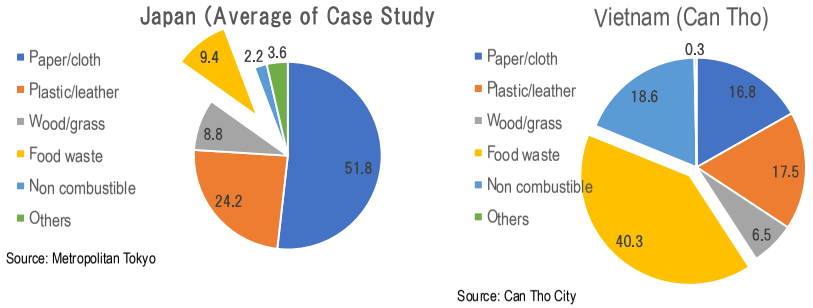
WtE Facilities located in the Center of the Urban Area



Wien-Spittelau, Vienna, Austria (ID306)
Source: Wien Energie GmbH

Shibuya Incineration Plant, Tokyo, Japan
Source: Clean Authority of Tokyo

Physical Composition of Target Waste



Physical Composition of Waste for WTE-ACC in Japan (%)

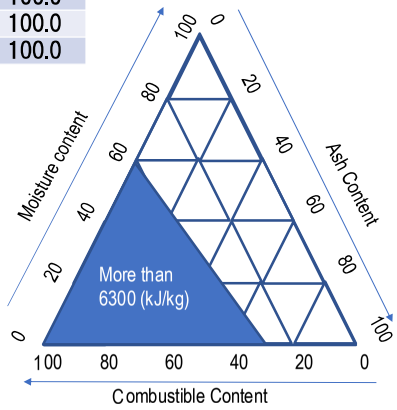
Physical composition (dry base)	Paper/ cloth	Plastic/ Leather	Wood/ grass	Food waste	Non-combustible	Others
Maximum	63.5	32.0	19.3	19.6	5.9	13.6
Average	51.8	24.2	8.8	9.4	2.2	3.6
Minimum	42.6	17.4	2.4	5.3	0.7	0.0

Target waste (Typical or Acceptable Range, etc)

Moisture, Combustible, Ash Contents of Wastes in Japan

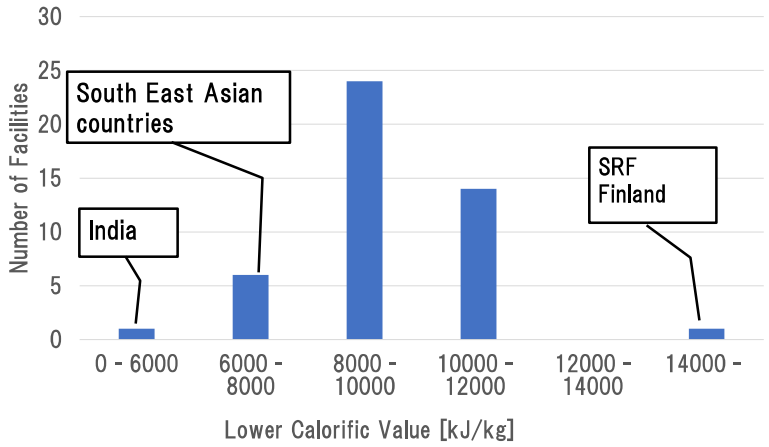
	Moisture (%)	Combustible (%)	Ash (%)	Total (%)
Maximum	52.6	60.2	10.7	100.0
Average	40.9	52.0	7.1	100.0
Minimum	33.3	41.1	4.7	100.0

- Suitable moisture, combustible and ash contents are in the blue triangle, as values of Japan Cases are in.



Source: National Institute for Environmental Study

Lower Calorific Value of the Waste



Emission Standards of Exhaust Gas

Parameter	Japanese Law	Facility standard (Shinkoto)	Actual
NOx [ppm]	250	60	36 - 41
HCl [ppm]	430	15	<2
SO_2 [ppm]	Area basis	20	<1
Particulates [mg/Nm^3]	80	0.02	<0.001
Mercury [μg/Nm^3]	50	-	<5
DXNs [ng/Nm^3]	0.1	-	<0.00005

Parameter	EU Directive	Facility standard (Isseane, France)
NOx [ppm]	87.7	28.5
HCl [ppm]	5.5	2.2
SO_2 [ppm]	15.7	7.5
Particulates [mg/Nm3]	9	1.3
Mercury [ppm]	45	13.1
DXNs [ppm]	0.09	0.03

Environmental Monitoring

Examples of EU and Japan

Item	O&M/S in Japan (Section 17 above)	MOE Circular (Kansei 95), Japan	EU directive 2000/76 (EU Directive 2010-75)	WTE Technical Standards (under endorsement) in the Philippines
	Mandatory	Recommended	Mandatory	
Capacity of WtE	All	For >200t/d		
DXNs	1/year	-	2/year	1/year
SOx	2/year	6/year	Continuous	2/year
Dust	2/year	6/year	Continuous	2/year
HCl	2/year	6/year	Continuous	2/year
NOx	2/year	6/year	Continuous	2/year

Role and responsibilities of public and private

	PFI			DBO	DBM	Public + Long term contract	Public works	Remarks
	BOO	BOT	BTO					
Degree of public involvement	←						→	
Role	w eak						strong	
Construction								
Design	Private	Private	Private	Public	Public	Public	Public	
Construction	Private	Private	Private	Public	Public	Public	Public	
Funding	Private	Private	Private	Public	Public	Public	Public	
Operation								
Operation	Private	Private	Private	Private	Public	Private	Public	
Maintenance	Private	Private	Private	Private	Private	Private	Public	
Ownership of facilities								
Construction period	Private	Private	Private	Public	Public	Public	Public	
Operation period	Private	Private	Public	Public	Public	Public	Public	

: Role of the private sector

Note: In the PFI system, the private sector own the facility, while in DBO/DBM and Public works, the public will be the installer.

Business Scheme of WtE-ACC Case Studies

Business Scheme	Number of cases	In Japan	Outside of Japan	Remark
Public Build (DB) and Operate	21	13	8	Japan, Singapore, Netherland, Italy, Denmark, Finland
DB+O (15yrs)	1	1	0	Japan
DB+O	2	0	2	France, Singapore
DBO (15yrs)	4	4	0	Japan
DBO (20yrs)	10	9	1	Japan, USA
BTO (20yrs)	2	2	0	Japan
BOT (20yrs)	3	0	3	Thailand, Taiwan, India
BOO (25yrs)	1	0	1	Singapore
BOO (22yrs)	1	0	1	Vietnam
-	15			No information
Total	60			

Development Approach of WtE-ACC Case Studies

Development Option	Cases	%
Solicited	51	85
Solicited (1993), Unsolicited (2007)	1	2
No information	8	13
Total	60	100%

Financial Aspect (Operation and Maintenance Expenditure)

Examples of Japan

(million US$)

Item	Shinkoto WtE plant		Toshima WtE plant		Ota WtE plant	
Pesonnel cost	7.0	22%	1.9	13%	0.7	5%
Utility cost	2.3	7%	0.8	5%	0.9	6%
Maintenance	13.8	44%	5.2	37%	2.0	13%
Ash handling	4.7	15%	1.3	9%	3.2	21%
Others	3.6	12%	5.0	35%	8.3	55%
Total O&M cost	31.4	100%	14.2	100%	15.0	100%
Total wase amount (thousand ton/year)	411.6	-	92.1	-	173.1	-
O&M cost (US$/ton)	76.4	-	154.1	-	86.8	-

Source: Clean Authority of Tokyo (2019)

3. Findings

3. Findings
1) Target waste

- The target waste of WtE is not decided uniformly. LGUs shall decide or check the target waste to be treated in their WtE facility their plan.
- The waste segregation practiced commonly before treatment by WtE facility. The segregation practice, methodology and technology in the preceding countries can be references to the LGUs in the Philippines

3. Findings, 2) Combustion Technologies and Treatment Capacity

- Stoker (moving grate) is the most adopted because of track record, variety of treatment capacity.
- Since, the operation period of WtE facility is long as 20 years or more, the technology shall be evaluated carefully.
- The LGUs shall evaluate type of furnace appropriate for their solid waste amount.

3. Findings,
3) Area

- The area for WtE can be minimized according to availability of land and the conditions of the surrounding area.
- WtE facilities have been constructed and operated in the populated and urbanized area.

3. Findings,
4) Energy Recovery

- The electricity generation efficiency has been improved as the treatment capacity of WtE facilities become bigger.
- To achieve very high efficiency of electricity generation, more cost could be required.
- Various methodologies which contribute to improve the efficiency of energy recovery is available

3. Findings,
5) Pollution Control

- Environmental standards of WtE facility is set as stricter than the National standards in the existing cases.
- Such stricter standards can be met by installing appropriate pollution control technology and eases making public consensus for its development

3. Findings,
6) Ash Handling

- Utilizations of bottom ash as cement aggregate, other construction use are practiced. Such utilization sometime requires additional cost and could be revenue source depending on the conditions.
- Fly ash containing heavy metals or other toxic materials, it is stabilized by cement solidification, chemical treatment, or dispose at hazardous waste landfill site.

3. Findings,
7) Business Scheme

- A solicited approach was adopted in almost all cases in the case study.
- This is the fact that the WtE projects took this approach could reach to the construction and operation.
- Proposals from the private sector are based on the proponent's interest, which may not be best for waste management in the LGUs.

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THANK YOU FOR YOUR ATTENTION!

Appendix 9

Japan International Cooperation Agency

Department of Environment and Natural Resources

Case Study Analysis for Guideline of Best Available Technique / Best Environmental Practice

Under the Project for Capacity Development on Improving Solid Waste Management through Advanced/Innovative Technologies in the Republic of the Philippines

December 2021

Inter-Agencies Technical Working Group

Subgroup Output 1

Table of Content

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Appendix 1: Comparison of Case Study Data in the Target Countries

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Appendix 3: EMB Director’s letter requesting WtE Operator/Manager to Cooperate the Case Study

Appendix 4: Members List of the Inter-Agency Technical Working Group Subgroup Output1

Chapter 1. Introduction

1.1 Background and Objectives

In the Philippines, as envisaged by RA 9003, solid waste must be segregated, utilized as effectively as possible, and treated and disposed of in a sanitary manner after reduction of waste for final disposal. This is also in line with the globally accepted concept of Waste Hierarchy. However, many LGUs in the Philippines have not established a complete sanitary waste flow.

In view of this situation, it is necessary to find a realistic way to solve the critical problem of unsanitary solid waste management, along with the realization of the 3Rs in line with the ideals of RA9003, which has been pursued over the past 20 years.

The problem is particularly acute in the big LGUs, which have large populations and generate large amounts of municipal solid waste on a daily basis. For this reason, such major LGUs are considering adopting Waste-to-Energy (WtE) technologies as one of the solutions.

In this context, the Philippine government worked on a legislation to direct the development of WtE projects, thus, the National Solid Waste Commission (NSWMC) issued Resolution 669 in 2016. The Department of Environmental and Natural Resources (DENR) also conducts activities to align with this Resolution.

The DENR Administrative Order (DAO) 2019-21 otherwise known as the **Guidelines Governing WtE Facilities for the Integrated Management of Municipal Solid Waste** has been issued to provide a guideline on evaluation, establishment, operation, and decommission of WtE facilities for integrated management of municipal solid waste. The guidelines cover the minimum requirements for the development of WtE facilities and is useful for development and operation of WtE facilities utilizing municipal solid waste. In addition to the guideline, it is necessary to have the more detailed information of the technical, institutional, and financial alternatives of WtE projects to develop WtE facilities in the Philippines.

The WtE Guidelines from DAO 2019-21does not provide the operational standards for WtE technologies. While the minimum requirements must be met, the objective is to provide information from existing case studies that can be used as reference for WtE facilities necessary for LGUs. It was intended to have a flexibility for the facilities to adopt- allowing them to observe the standards through the recommended technologies gathered from other WtE facilities across the globe.

According to the requirement described in Section 12 of the National Solid Waste Management

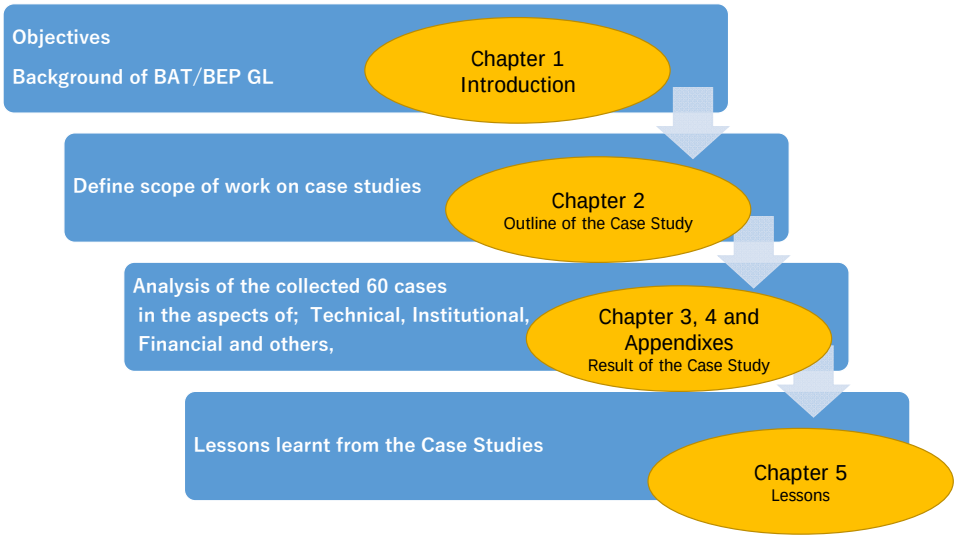
Commission (NSWMC) Resolution 669 issued in June 2016, the National Ecology Center (NEC) shall prepare the Best Available Technologies (BAT) /Best Environmental Practices (BEP) guidelines for Waste to Energy (WtE) technologies. However, NEC has not yet been established at this moment. In line with this, an activity under the Technical Cooperation Project (TCP) entitled **Project for Capacity Development on Improving Solid Waste Management through Advanced/Innovative Technologies in the Republic of the Philippines** under Output 1 was tasked to prepare the draft BAT/BEP guideline. The JICA Experts Team (JET) was tapped to implement the said TCP and coordinate with Philippine counterparts to carry out the activities of the project.

In this context, this BAT/BEP guideline is prepared to provide some of the best available technologies and best environmental practices through a survey of cases studies of the existing WtE facilities in Asian, European, and American countries with more detailed technical, institutional and financial information.

JET tried to obtain credible information from WtE implementing agencies (local/national government), project operators, and secondary information sources and validate by 2 or more sources. However, it was not possible for implementing agencies, operators to validate all gathered information. It is a constrain of the case studies that there are missing information including the latest updates.

1.2 Structure of the Guideline

The structure of the guideline is as follows:



The outline of the case study such as scope, methodology, schedule, and survey contents are explained

in Chapter 2. The collected case studies and the information gathered from each case are discussed in Chapter 3 and 4. The BAT/BEP as the example of suitable technology of combustion type, energy recovery procedure, pollution control technique and ash treatment and of institutional aspects such as project scheme, financial scheme, citizen participation are summarized in Chapter 5.

The results of the analysis from the data gathering are summarized in Chapter 5.

Chapter 2. Outlines of the Case Study

2.1 Methodology

The survey was conducted mainly by utilizing secondary information. The information sources for the case studies are the internet, professional journals, official websites of the facilities, and magazines.

In the secondary information, many facilities did not disclose detailed information on project costs, operating costs, and detailed technologies, and such information were not obtained.

To supplement such information, we attempted to obtain additional information by sending official letters through DENR-EMB to the operators and managers of WtE facilities in the case study. The survey yielded responses on two WtE facilities[1], which were reflected in the case study.

2.2 Schedule

The case study was conducted during the period indicated below.

Literature and other information survey: March 2020 - March 2021
Questionnaire survey (via EMB letter): December 2020 - March 2021

2.3 Scope of Case Studies

There are various types and capacities of WtE facilities currently operating across the world. It is necessary to determine the scope of the case study of WtE facilities to be considered in this report,

[1] Klemetsrud Combined Heat and Power (CHP) plant(ID302, Norway), Palm Beach Renewable Energy Facility 2 (ID318, USA) responded to the EMB letter.

that can be used as references for the WtE facilities to be put up in the Philippines.

(1) WtE Technology

WtE Technology generally refers to the technology which uses thermal energy to generate energy in the form of electricity or heat, from waste. In DAO 2019-21, WtE is defined as "the process of converting wastes with various technologies, usually the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes".

Though there are various types of WtE technologies such as Gasification/Pyrolysis, Refused Derived Fuel (RDF), and Biomethanation (aerobic digestion, biogas) Facilities, combustion technology is one of the most popular[2] and reliable WtE technologies at this moment with a long history of application. In this BAT/BEP guideline, the case studies would be primarily targeted for the WtE facilities utilizing combustion technology, so called the Appropriately Controlled Combustion (WtE-ACC).

(2) Countries and Region

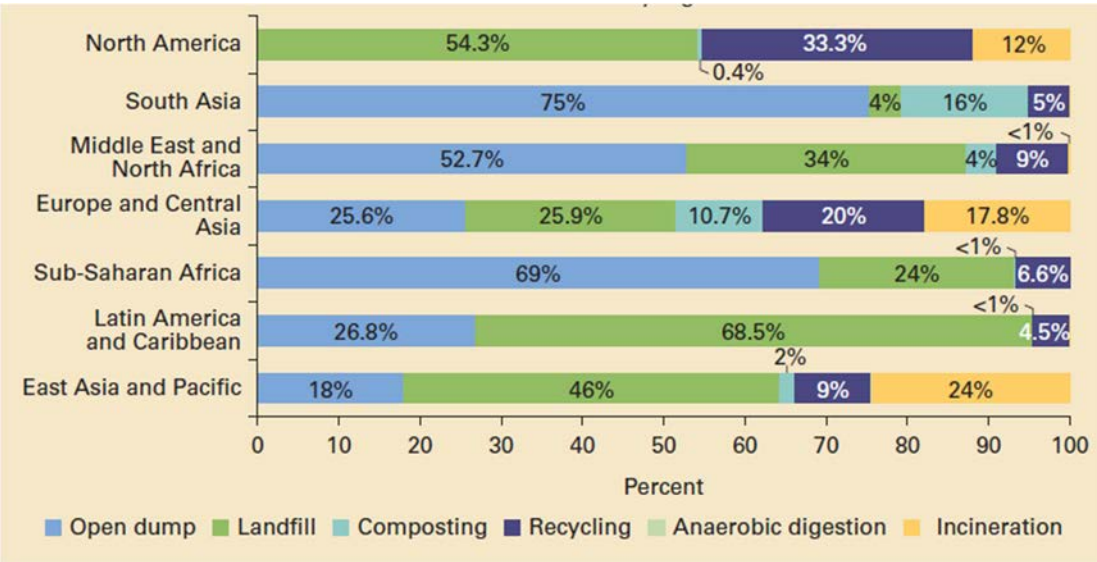
The WtE track record of waste combustion and the characteristics of the Philippines are considered to decide the countries and region for the case study. As shown in **Figure 2.1**, the track record is dominated by North America, the EU, and Asia; therefore, WtE cases in the following three regions were included in the study.

Table 2.1 Region and Country of the Cases of WtE

Region/Country	Characteristic
East Asia (Japan, China, Taiwan, and Korea)	・ a high percentage of cases processed by WtE-ACC and a large number of cases. (ex. 376 waste incinerators in Japan (not including 71 private facilities)) (Source: Ministry of Environment, Japan, 2017) ・ This region belongs to Asia same as the Philippines and share similarities in terms of climate, such as humid climate and typhoons. ・ Many technology providers.
Southeast Asia/ South Asia	・ The region to which the Philippines belongs. While there are not many WtE-ACC facilities in operation, efforts, and introduction of facilities in neighboring developing countries are useful for reference.
EU, North America (Other Developed Region)	・ In, EU, the introduction of WtE-ACC has been promoted by the policy to reduce the final disposal volume. (ex. 492 WtE-ACC cases in Europe (not including hazardous waste treatment facilities)) (Source: CEWEP, 2018) ・ Many technology providers.

Source: Prepared by ITWG-Subgroup Output1

[2] https://www.uncclearn.org/wp-content/uploads/library/unep23092015.pdf



Source: What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, World Bank, 2018)

Figure 2.1 Treatment and Disposal Method by Region

(3) Treatment Capacity

a Range of the Capacity of WtE-ACC in the Case Study

The minimum treatment capacity to be collected and analyzed in this guideline is set as 100 tons/day based on the two reference documents of waste combustion facility.

・ Pre check list for Feasibility Study of Waste Power Generation Plant (2019, JICA)

One of the most important items to be checked for the target municipality is that “the target city population is 100,000 or more. (Or plant capacity is 70 tons/day or more).”

The reason to decide these values are described in the explanatory note of JICA pre checklist as follows.

(Source: the explanatory note of Pre checklist for Feasibility Study of Waste Power Generation Plant,2019)

The larger the target city population, the better. The larger the scale of the waste incineration power generation facility, the more appropriate environmental measures can be taken, the lower the construction and operation costs per ton of waste, and the higher the power generation efficiency. As a guide for target cities considering the introduction of MSW incineration power generation, a population of at least 100,000 is required.

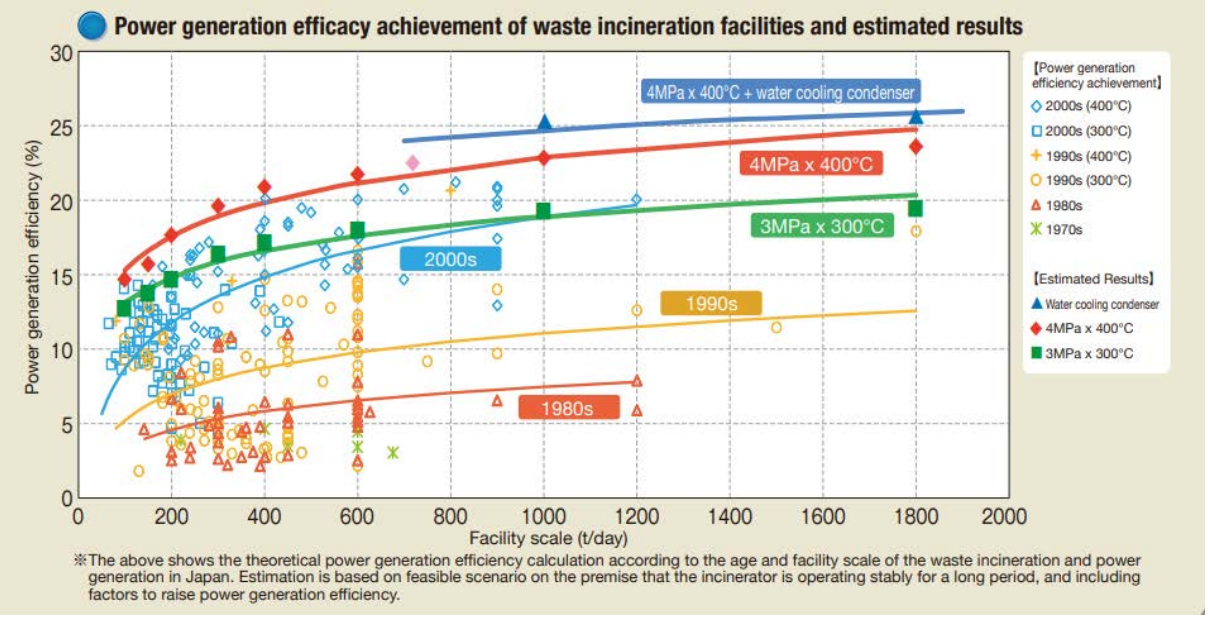
In May 1997, the Ministry of Environment, Japan issued a notice entitled "Plan for Wide-Area Waste Incineration," stating that, as a general rule, waste incineration plants to be built in the future should be fully continuous furnaces that produce little dioxin, and that incineration should be carried out under stable combustion conditions, and that the necessary scale of incineration plant should be secured. In order to achieve this, it is necessary to secure the required scale of incineration facilities. The required scale of the incineration plant should be 300 tons/day or more (at least 100 tons/day), taking into account geographical and social conditions as much as possible.

Taking into consideration the recent improvement in power generation efficiency, the introduction of waste incineration power generation facilities in local cities in Japan, and the fact that "power generation may be difficult for small-scale facilities of less than about 70 tons/day ", the target city population should be 100,000 or more (or the facility scale should be 70 tons/day or more). In order to increase the population of the target city, it is effective to establish a wide-area treatment system in cooperation with multiple cities, and wide-area treatment is being promoted in Japan.

Table 2.2 Capacity of the Waste Combustion Facility in Japan

Treatment Capacity (ton/day)	Number of Case			Electricity Generation capacity (Average)		
		With electricity generation	Ratio (%)	Capacity (kW/case)	Efficiency (average %)	Total Generation (MWh/Case)
Less than 50	372	2	0.5	86	1.8	347
50~100	204	14	6.9	1,240	11.3	5,330
100~300	394	144	36.5	2,624	12.4	11,759
300~600	133	118	88.7	5,642	13.2	25,454
600<	59	59	100.9	14,408	12.2	53,495
Total	1,162	337	29.0	-	-	-

Source: Ministry of Environment, Japan



Source: Ministry of Environment, Japan

Figure 2.2 Efficiency Improvement of Electricity Generation of WtE-ACC Facilities in Japan (1970s – 2000s)

・ Municipal Solid Waste Incineration -A Decision Maker's Guide- (2000, World Bank)

One of the keys for incineration economy is given that "To be economically feasible, the individual incineration units should have capacities of at least 240 tons/day (10 tons/hr), and there should be at least two separate unit"

Although 100 tons/day is larger than the 70 tons/day indicated in the JICA Pre checklist, the target capacity of the case study is set at a slightly larger scale, referring to the World Bank (WB) document.

On the other hand, the maximum capacity was not set for data collection because giga size facility is not so common and such information is limited.

b Waste Amount Estimate for LGUs in the Philippines

In order to get approximate treatment capacity of WtE for LGUs in the Philippines, waste amount is

estimated based on the LGU's population (**Table 2.3**) and waste generation unit by the NSWMC[3] as shown in **Table 2.4**.

The capacity of the waste treatment either WtE-ACC or other treatment methods should be able to accommodate the waste generation volume of LGUs. The waste volume depends on the size of local government. Each LGU bears the responsibility of municipal solid waste management in the Philippines.

Table 2.3 Population in Primary LGUs[4] (2015)

Category	Less than 500,000	0.5 to 1 million	1 to 2 million	2 to 3 million	More than 3 million	Total
Number of LGUs	49	40	20	8	3	120

Source: Categorized based on population census (2015)

Table 2.4 Numbers of LGUs Categorized according to the Amount of Waste Generation

Category (tons/day)	Less than 100	100-200	200-300	More than 300	Total
Number of LGU	34	43	20	23	120
%	28.3	35.8	17.7	19.2	100.0

Source: Calculated based on per capita waste generation rate described in National Solid Waste Management Status Report [2008-2018]

It is analyzed that about 80% of Primary LGUs including provinces do not generate more than 300 tons/day but twenty-three (23) LGUs do. This opens the possibility in 23 municipalities to consider WtE facilities with more than a 300 tons/day capacity which satisfies at least 240 tons/day, the benchmark given by the WB document. At the same time, equivalent to the required capacity of feasible WtE-ACC.

c Clustering of LGUs

A clustering of LGUs can be a way to set the bigger capacity of WtE-ACC facility which may give not only more electricity generation but more efficiency in electricity generation. This can also be a

[3] The municipal solid waste generation rate per capita in each LGU are assumed as 0.69 [kg/day/person] for High Urban Cities including Metropolitan Manila and the other is 0.34 [kg/day/person]. In addition, it is assumed that 60% of municipal solid waste will be treated as WtE after separation of recyclable or incombustible waste.

[4] Primary LGUs includes 81 provinces, 33 highly urbanized cities (HUC), 5 independent component cities (ICC), and an independent municipality (Pateros of NCR)

solution to support small LGUs, which does not have capacity in terms of financial, technical and human resources aspect, by bigger LGUs as recommended in RA9003 for even conventional management of municipal solid waste such as MRFs. This is because it has been promoted in the experienced countries such as one in EU and Japan. However, the following issues shall be considered and discussed to make consensus among LGUs for adopting the LGUs clustering.

- Possible change in administration of LGUs,
- Site selection concerns (Not in my backyard or NIMBY),
- Waste collection and transportation efficiency, as transportation distances could be longer for member LGUs
- Environmental impact by WtE-ACC, waste transportation etc.

In the case of Japan, more than 300 ton/day of WtE-ACC facility is recommended for the purpose to efficient energy recovery in WtE-ACC facility according to the Ministry of Environment, Japan circular in 1997. The clustering of LGUs is possible in case that certain conditions for LGUs listed above are satisfied.

d Application of WtE-ACC to LGUs in the Philippines

It is commonly understood that the WtE-ACC require more waste treatment cost than conventional municipal solid waste management consists of only waste collection, transportation, and final disposal at landfill site. Nevertheless, it is considered as a practical method for the megacity suffering from huge waste amount and limitation of land for final disposal site.

Considering the fact that any WtE-ACC facility has not been developed in this country, it is assumed that mega cities such as Quezon City, Davao City and Cebu City, where LGUs struggles with huge amount of waste generation, would be candidates to install such facility at initial stage of WtE-ACC development in the Philippines as the TCP collaborates.

Table 2.5 Waste Generation in Quezon City, Davao City and Cebu City

LGUs	Quezon City	Davao City	Cebu City
Waste Amount (tons/day)	3,320	991	862
Year of data	2019	2017	2015

Source: 10-year SWM Plan of LGUs

2.4 Survey Contents

The survey contents which illustrate the characteristic of WtE-ACC facility are adopted as shown in

Table 2.6. In addition to the WtE-ACC cases, governmental policy to control and support the WtE-ACC facility development in neighboring countries were surveyed.

Table 2.6 Survey Contents of the Case Studies

Survey Item	Survey Contents
Profile	
Implementing Body	- Name of local government (LGU) - Name of association by multiple LGUs in case of cluster waste management - Name of public service corporation or special purpose company in case of PPP project
Site	- Name of country and location - Area /footprint is described Footprint (ha) - Land Use
Planned and actual schedule	- Schedule of planning, design, construction, and operation - Their planned and actual schedule
Coverage (Scope)	- Scope of implementation body (only WtE-ACC, or including waste collection, transportation, energy recovery and distribution, ash disposal, etc.)
Technical Aspect	
Target Waste	- Type of target waste is described such as municipal solid waste or industrial - If target waste includes hazardous waste or not - If target waste includes sewerage sludge or not
Capacity/Quantity	- Plant capacity of daily or annual quantity of “Target Waste”
Processing Type	- Type of incineration facility like stoker type or fluidized bed combustion, Refused Derived Fuel (RDF), etc.
Lower calorific value of the target waste	- Lower calorific value of “Target waste” - Information on range of lower calorific value (LCV)
Heat Utilization	- Power generation for electricity utilization - Heating value by utilizing heating for community or other hot water utilization
Pollution Control	- Management of exhaust gas, wastewater, etc. - If national standards on emissions are observed or are imposing stricter standards
Ash Management	- Treatment and disposal procedure of bottom ash including separation process of recyclable material in the bottom ash - Treatment and disposal procedure of fly ash
Technical Provider	- EPC contractor or manufacturer of WtE-ACC facility
Institutional Aspect	
Business Scheme (Implementation Framework)	- Public Own & Operate, Public Own & Private Operate (separate), - BOO, BOT, BTO, etc. under PFI (Financed by Private)
Development Approach	- Solicited approach which is proposed by local government, or unsolicited approach which is proposed by private service providers.
Citizen Involvement	- Public consultation process including explanatory meeting - Information dissemination to public
Project income and / cost	- Government tax, power sales, gate fee (tipping fee), other government subsidies for initial/annual, etc. - Capital expenditure (CAPEX), operation expenditure (OPEX)

Source: ITWG Subgroup Output1

2.5 The Collected WtE-ACC Cases

The 60 cases have been collected and the number of cases by each country is summarized as shown in **Table 2.7**. The case of WtE-ACC facilities includes East Asian countries (China, Taiwan, and Japan), Southeast/South Asian countries (India, Singapore, Thailand, and Vietnam), European countries (EU) (Austria, Belgium, Demark, Finland, France, Germany, Italy, Spain, Sweden, and United Kingdom)

and North American countries (USA).

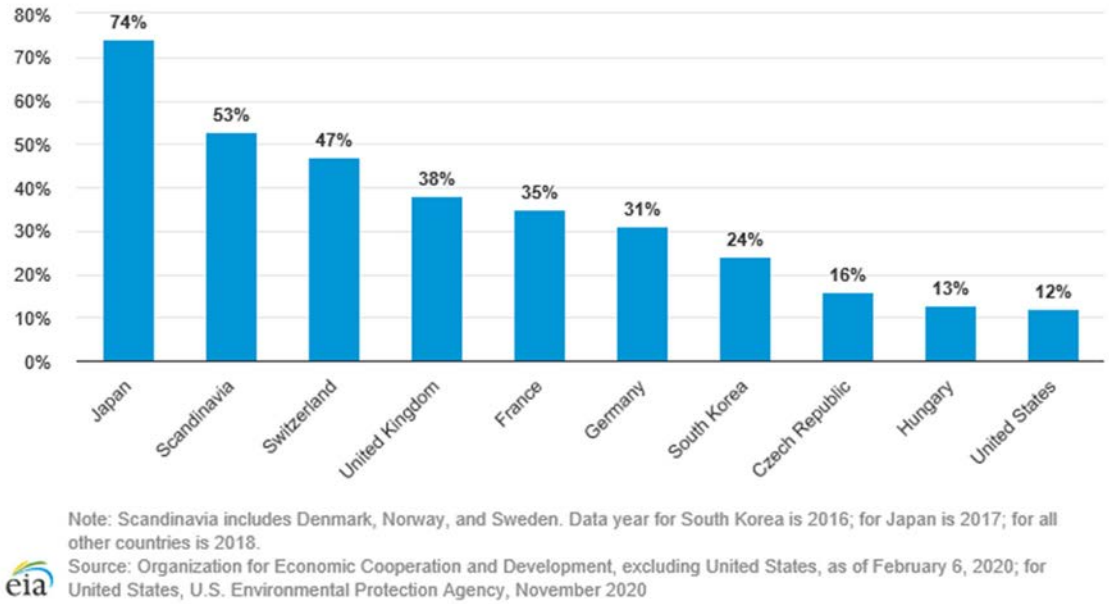
The percent of municipal waste treated by WtE-ACC plants in some European countries and in Japan is relatively high as illustrate in **Figure 2.3**, It was analyzed on the website showing the data that it could be because those countries have little open space for landfills. Furthermore, JET is familiar to the case in Japan which has many experiences of waste combustion since 1960s' and can access to the detailed information, half of the gathered cases- 30 among 60- are from this country. Singapore is the only country in Southeast Asia at this moment where the waste combustion is the mainstream of waste management before the final disposal by landfilling. The cases were collected to cover the countries as many as possible for EU members and USA.

Table 2.7 Number of WtE-ACC Cases by Regions and Countries

Region/Country	Number of Cases
East Asia	**32**
China	1
Japan	30
Taiwan	1
Southeast/South Asia	**8**
India	1
Singapore	4
Thailand	2
Vietnam	1
North America	**3**
USA	3

Region/Country	Number of Cases
EU	**17**
Austria	2
Belgium	1
Denmark	2
Finland	2
France	1
Germany	1
Italy	1
Netherlands	1
Norway	1
Spain	1
Sweden	3
United Kingdom	1
Total	**60**

Source: ITWG Subgroup Output1



Note: Scandinavia includes Denmark, Norway, and Sweden. Data year for South Korea is 2016; for Japan is 2017; for all other countries is 2018.
Source: Organization for Economic Cooperation and Development, excluding United States, as of February 6, 2020; for United States, U.S. Environmental Protection Agency, November 2020

Figure 2.3 Percent of Total Municipal Solid Waste That is Burned with Energy Recovery in the Selected Countries

Chapter 3. Example of the Collected Information for the Cases

3.1 The Collected Cases of WtE-ACC Facility

The profiles of all cases are shown in **Table 3.1**.

Table 3.1 List of WtE-ACC Case Study

ID	Name of Facility	Country	Treatment capacity (tons/day)	Electricity generation (MW)	Design LCV (kJ/kg)	Start. Const. (Year)	Start Operation (Year)	Business Scheme	Development Approach	Furnace
101	Ota Incineration Plant	Japan	600	22.8	14,800	2010	2014	Public Build and Operate	Solicited	Grate
102	Shinkoto Incineration Plant	Japan	1,800	50.0	10,501	1994	1998	Public Build and Operate	Solicited	Grate
103	Suginami Incineration Plant	Japan	600	24.2	8,854	2012	2017	Public Build and Operate	Solicited	Grate
104	Maishima Incineration Plant	Japan	900	32.0	8,768	-	2001	Public Build and Operate	Solicited	Grate
105	Higashisaitama Incineration Plant	Japan	800	24.0	7,572	1991	1995	Public Build and Operate	Solicited	Grate
106	Tobuki Incineration Plant	Japan	300	2.1	8,255	1994	1998	Public Build and Operate	Solicited	Grate
107	Ukisima	Japan	900	12.5	9,600 - 11,300	1991	1995	Public Build and Operate	Solicited	Grate
108	Sunrise Clean Center	Japan	160	3.9	8,963	2015	2019	DBO	Solicited	Grate
109	Kushiro Wide-area Federation WtE facility	Japan	240	4.4	8,600	2003.1	2006.3	DB+O (15yrs)	Solicited	Fluidized bed, gasification, and melting
110	Funabashi city south incineration plant	Japan	339	8.4	9,900	2016.3	2020.3	DBO (15yrs)	Solicited	Grate
111	Mito city incineration plant	Japan	330	9.6	9,300	2016.3	2020.3	DBO (20yrs)	Solicited	Grate
112	Yatsushiro environmental center	Japan	134	2.9	9,200	2015.3	2018.9	DBO (20yrs)	Solicited	Grate
113	Miyanojin Clean Center	Japan	163	3.6	9,700	2013.3	2016.3	DBO (20yrs)	Solicited	Grate
114	Yokkaichi Clean Center	Japan	336	9.0	10,100	2012.1	2016.3	DBO (20yrs)	Solicited	Grate

ID	Name of Facility	Country	Treatment capacity (tons/day)	Electricity generation (MW)	Design LCV (kJ/kg)	Start. Const. (Year)	Start Operation (Year)	Business Scheme	Development Approach	Furnace
115	Asakawa Seiryu Environmental Association Combustible Waste Treatment Facility	Japan	228	5.2	9,200	2016.11	2020.3	DBO (20yrs)	Solicited	Grate
116	Tachibana Shori Center	Japan	600	9.0	9,500	2017.1	2023.7 (planned)	-	Solicited	Grate
117	Thermal Energy Center	Japan	420	10.6	9,600	2020.3	2025.3 (planned)	DBO (15yrs)	Solicited	Grate
118	Ozenji Treatment Center	Japan	450	7.5	-	2007	2012	Public Build and Operate	Solicited	Grate
119	Clean Center Rinkai Plant	Japan	450	13.5	10,170	2009.11	2013.4	BTO (20yrs)	Solicited	Gasification and Melting
120	Hamamatsu City New Incineration Plant (tentative)	Japan	399	15.1	9,200	2018.2	2024.4 (planned)	BTO (20yrs)	Solicited	Gasification and Melting
121	Nerima Incineration plant	Japan	500	18.7	8,489	2010, 12	2015, 11	Public Build and Operate	Solicited	Grate
122	Kuwana Wide Area Cleaning Business Association Waste Treatment Facility	Japan	174	3.1	4160-10,370	2017	2020	DBO (20yrs)	Solicited	Grate
123	Toshima Incineration plant	Japan	400	7.8	9,709	-	1999	Public Build and Operate	Solicited	Fluidized bed
124	Shibuya Incineration plant	Japan	200	4.2	9,787	1998	2001	Public Build and Operate	Solicited	Fluidized bed
125	Saitama city Sakura Environmental Center	Japan	380	8.5	9,536	2010	2015	DBO	Solicited	Gasification and Melting
126	Musashino Clean Center	Japan	120	2.7	8,413	2014	2017	DBO (20yrs)	Solicited	Grate
127	Funabashi city north incineration plant	Japan	381	8.8	6,400	-	2017	DBO (15yrs)	Solicited	Grate
128	Hatsukaichi Energy Clean Center	Japan	150	3.1	-	2016.7	2019.4	DBO	Solicited	Fluidized bed
129	Yokohama city, Kanazawa Incineration Plant	Japan	1,200	35.0	9,825	1995	2001	Public Build and Operate	Solicited	Grate
130	Yokohama city, Tsurumi Incineration Plant	Japan	1,200	22.0	11,646	-	1995	Public Build and Operate	Solicited	Grate

ID	Name of Facility	Country	Treatment capacity (tons/day)	Electricity generation (MW)	Design LCV (kJ/kg)	Start. Const. (Year)	Start Operation (Year)	Business Scheme	Development Approach	Furnace
201	Tuas Incineration Plant	Singapore	1,700	20.0	-	-	-	Public Build and Operate	Solicited	Grate
202	Tuas South WtE Plant	Singapore	3,000	36.0	-	-	2000	Public Build and Operate	Solicited	Grate
203	Senoko WtE Plant	Singapore	2,205	36.0	-	-	1993	Public Build and Operate	Solicited	Grate
204	Keppel Seghers Tuas WtE Plant	Singapore	800	22.0	-	-	2009	BOT	Solicited	Grate
205	Nong Khaem WtE plant	Thailand	500	9.8	-	-	2014	BOT	Solicited	Grate
206	Maoli WtE Plant	Taiwan	500	11.8	9,660	-	2008	BOT	Solicited	Grate
207	Can Tho solid waste treatment plant	Vietnam	400	75.0	6,280	2017	2019	BOO (22yrs)	-	Grate
208	Laogang solid waste treatment plant (phase I)	China	3,000	60.0	7,100	-	2014	-	Solicited	Grate
209	Jabalpur WtE facility	India	600	11.5	3780-4620	-	2016	BOT	-	Grate
210	Phuket WtE facility	Thailand	500	5.0	> 7,200	-	1999	-	-	Grate
301	Afval Energie Bedrijf Amsterdam (AEB)	Netherlands	4,400	125.0	10,000	2004	2008	DBO	Solicited (1993), Unsolicited (2007)	Grate
302	Klemetsrud Combined Heat and Power (CHP) plant	Norway	1,080	130.0	10,000-11,000	Line 1&2: 1983	Line 1&2: 1985 Line3 :2011	-	-	Grate
303	Issy-les-Moulineaux WtE plant (Isseane)	France	1,700	52.0	8,000 - 11,700	(2001-Civil Works) 2003	2007	DB+O	Solicited	Grate
304	ASM Brescia 'Termoutilizzatore'	Italy	2,670		6300 - 13800	-	1998 (MSW), 2004 (Biomass)/	DBO	-	Grate
305	Zabalgarbi / Bizkaia WtE Plant	Spain	830	95.0	8,000	1999	2005	-	-	Grate
306	Wien-Spittelau	Austria	720	6.0	9,500	2012	2015	PPP	Solicited	Grate

ID	Name of Facility	Country	Treatment capacity (tons/day)	Electricity generation (MW)	Design LCV (kJ/kg)	Start. Const. (Year)	Start Operation (Year)	Business Scheme	Development Approach	Furnace
307	Amager Bakke	Denmark	1,870	66.0	11,500	-	2017	-	Solicited	Grate
308	Incineration Line 6 / The Energy Tower	Denmark	720	19.0	-	2011	2014	Public Build and Operate	Solicited	Grate
309	Lahti Gasification Facility (Kymijärvi II)	Finland	830	50.0	16,100	2009	2012	DBO	Solicited	Fluidized bed
310	Allington Energy from Waste (EfW) Incinerator	United Kingdom	1,500	43.0	6,500 - 12,500	2004	2008	-	Solicited	Fluidized bed
311	Brussels Waste-to-Energy plant*	Belgium	1,368	20.0	9,000	1984	-	-	Solicited	Grate
312	Sysav South Scania Waste-to-energy plant	Sweden	2,100	833.3	-	-	1973 (1st/2nd), 2003 (3rd), 2008 (4th)	-	Solicited	Grate
313	Lejonpannan (CHP Plant)	Sweden	770	83.5	10,500	2013	2016	-	Solicited	Grate
314	Dåva kraftvärmeverk (Deaf 1)	Sweden	750	310.0	-	2000	-	-	Solicited	Grate
315	Mainz Waste-to-Energy Plant	Germany	1,130		9,815	-	2003, 2008	-	Solicited	Grate
316	Pfaffenau Waste Incineration Plant	Austria	830	14.0	-	2006	2008	-	-	
317	Riikinvoima Ekovoimalaitos WtE Plant	Finland	480	54.0	-	2014	2017	-	-	Fluidized bed
318	Palm Beach Renewable Energy Facility 2	USA	3,000	95.0	-	2012	2015	DBO (20yrs)	Solicited	Grate
319	SEMASS Resource Recovery Facility	USA	3,000	78.0	11,630	-	1989	-	Solicited	
320	Montgomery County Resource Recovery Facility	USA	1,830	55.0	-	-	-	-	Solicited	Grate

Note: "-" means the data was not able to obtain,

Note: ID100-199: Cases of Japan, ID201-299: Cases of other Asian countries, ID301-399: Cases of EU and North American countries

Sources: ITWG Subgroup Output 1

3.2 Examples of the collected information for the Cases

The pertinent information gathered from each WtE-ACC facility in the 60 collected cases is compiled into 2 slides consist of “profile of the facility” and “salient features” (See Appendix 2). The compiled information of the two cases is shown below as examples. The most survey contents were filled for these two cases but for some cases where information was not available, certain cells were left blank.

(1) Ota Incineration Plant, Tokyo, Japan

Ota incineration plant is located in the land area of 9.2 ha in Ota ward in Tokyo Metropolis, which is operated by the implementation body, the Clean Authority of Tokyo (CAT23). The plant has been planned in 2006, which is 4 years before the bidding by CAT23. It is the union responsible for WtE-ACC facilities in 23 wards (LGUs) of Tokyo Metropolis and owns and operates 21 WtE-ACC facilities. Because approximately every 3-5 years, they have to develop new construction plan of WtE-ACC, it has much capabilities and know-hows of WtE-ACC procurement and operation.

The bid for Ota incineration plant whose treatment capacity is 600t/day was announced and was awarded for design-build EPC contractor. Design and construction period are for 4 years from 2010 to 2014 and operation was started from 2014 as planned in 2006.

The plant has two lines and the capacity of each line is 300 tons/day. The main heat usage in the plant is electricity generation and they generate 22.8 MW of electricity. The LCV of municipal waste in the design is around 14,800 kJ/kg. The target waste is combustible waste which is transported to the plant by separate collection from the waste collection points. The CAPEX is around JPY19 billion (around US$200 million) and OPEX is JPY1.5 billion (around US$16 million). The revenue sources of CAPEX and OPEX are indicated in the figure below.

The collection and transportation are implemented by the ward, municipal solid waste incineration, power sale and final disposal is implemented by the ward too. The adopted process types, which is the type of furnace such as stoker and fluidized bed combustion, is stoker type. The applied standards of pollution control are set as stricter than the national standards of Japan and they utilize wet scrubber, selective catalytic reactor, and bag filter. Wastewater is discharged into public sewerage after the treatment. Bottom ash is utilized for cement material which is called as eco-cement and fly ash is disposed of at the landfill site after stabilization.

Ota Incineration Plant / Researcher: JET

Name	Ota Incineration Plant	Location	Ota ward, Tokyo, Japan
Impl. Body	Clean Authority of TOKYO	Footprint	9.2ha
Capacity	600t/d (300 x 2lines)	Heat Usage	Power 22.8MW
Target Waste	Source segregated "Combustible Waste"	Waste Quality	14,800 KJ/kg

History

	Dev. Plan	Demolish	Bid	Const. St/Fin		Op. Start/Fin		Demolish
Original	2006	-	2010	2010	2014	2014	2039	2039
Actual	2006	2008.4	2010	2010.6	2014.9	2014.9		

Capex	18.797 B-JPY	Source ('12-14)	NG Subsidy (30%), Bond (50%), LG (20%)
Opex	1.486 B-JPY/yr (2019)	Source ('18-19)	LGs' share (57%), TF (26%), Energy (17%)
Fin. Scheme	Public Build (DB) and Own	Dev. approach	Solicited

Coverage (SOW)

Collection	Transp.	Incineration	Power sale	Bottom ash	Fly ash
LG (ward)	LG (ward)	LG	LG	LG	LG

Process Type	Incineration (Stoker),	EPC / Tech	Takuma (JPN)

Pollution Control

Exhaust Gas	Wastewater	Bottom ash	Fly ash	Other
Stricter Standard (Scrubber + SCR + Bag Filter)	Discharge to Sewage	Eco-cement	Provincial SLF after chemical treatment	

NIPPON KOEI EJEC 1

The features of this case are summarized in the slide of "Description of salient features" as shown in **Table 3.2**. Three features are highlighted: 1) the smooth implementation of the project, as actual schedule is as same as planned in 8 years before commercial operation, which means no delay, 2) the regular monitoring reports were published for public and the visit tours at the plant for residents to build the trust and the relationship were conducted as well, 3) LGU prepare the plan and adopt solicited approach for tender process. During the planning stage, they prepare the budget for investment and operation and maintenance for this project.

Table 3.2 Salient Features of Ota Incineration Plant

Salient Features	Explanation
Smooth Implementation	According to the planned schedule of planning, design, bidding, construction and operation, the actual activities have been implemented without significant delay.
Build trust in the relationship with residents	From planning stage, environmental consideration has been implemented and monitoring report is periodically published to the public.
Strong ownership of LG (Solicited x Budget)	LG adopt the solicited approach for tender process as well as their planning and budget preparation with support of central government.

Source: Analyzed by ITWG Subgroup Output1

(2) AEB plant, Amsterdam, Netherland

Afval Energie Bedrijf (AEB) plant is located in Amsterdam and the implementation body is AEB, a service branch of the city of Amsterdam that the City of Amsterdam is the sole shareholder. The capacity of the facility is totally 4,400 tons/day, which includes 6 lines. Though there is no information of planned schedule, it takes around 6 years from 1998 to 2004 for planning and bidding and the construction period is around 3 years from 2004 to 2027. After the period, the operation is planned as 20 years.

The main heat usage in the plant is electrical power generation and community heating. The electricity generation capacity is 125 MW. The planned LCV of waste quality is around 10,000 kJ/kg. The target waste is municipal solid waste, commercial waste, and sludge. CAPEX is around € 370 billion (around US$440 billion). The OPEX is not clear but the turnover is €180 million (around US$210 million) by tipping fee € 67/ton (US$80/ton). The coverage indicates that collection and transportation is implemented by AEB and surrounding local governments. Except energy distribution, AEB implements the WtE-ACC operation and final disposal of bottom ash and fly ash. The type of process of the facility is the stoker. The applied pollution control standards are stricter than EU Directive as well as Netherland national standards. Scrubbers and Selective Catalytic Reactor are installed and operated. The plant applies the closed system to prevent wastewater discharge. Bottom ash is utilized for cement material or sand-lime brick.

Afval Energie Bedrijf WtE facility / Researcher: JET

Name	Afval Energie Bedrijf Amsterdam (AEB)	Location	Australhavenweg, Amsterdam
Impl. Body	AEB owned by Local Government (19 municipality partners)	Footprint	-
Capacity	4400 t/day	Heat Usage	Electric power125MW Heat usage 250,000 GJ
Target Waste	Municipal Solid Waste, Commercial Waste, Sludge	Waste Quality	10,000 KJ/kg (ave. cal. value)

History	Plan	Bid	Const. St/Fin		Op. Start/Fin		Demolish
Original	-	-	-	-	-	-	-
Actual	1998	2001	2004	2007	2008	2027	-

Capex	€370 million (2007 expansion)	Fund Source	Debt (Green finance € 80 million, EIB, € 170 million)
Opex	• Turnover > € 180 million • Profit > € 12 million • Gate fee ~ € 67/ton	Fund Source	Sales + Bank Loans + State Aid (from City of Amsterdam)
Fin. Scheme	DBO	Dev. approach	1993 (solicited), 2007 (unsolicited)

Coverage (SOW)	Collection	Transp.	Processing	Energy Sale	Bottom ash	Fly ash
	AEB + LG	AEB + LG	AEB	JV with Ene. Comp.	AEB	AEB

Process Type	Stoker	EPC / Tech	MNC, FLSmidth Airtech A/S, Siemens Fabricom GTI

Pollution Control	Exhaust Gas	Wastewater	Bottom ash	Fly ash	Other
	Emission level is < 20% allowed EU Directive, Stricter than Dutch Limits *SNCR, ESP and Wet and dry scrubbers	No waste water	Reprocessed to be Sand-lime bricks, c oncrete	Treated to be used as Asphalt concrete	

EJEC

The features of this case are summarized in the slide of "Description of salient features" as shown in **Table 3.3**. Three features of the case are 1) the large treatment capacity by transporting wastes including 19 surrounding municipalities, 2) the high thermal efficiency as net efficiency of electricity generation is approximately more than 30%, 3) efficient transport of waste by utilizing train or barge.

Table 3.3 Salient Features of AEB plant

Salient Features	Explanation
1. High Capacity	The plant can process 4400 t/d, an average 1,400,000 tons of waste + 100,000 tons of sludge per year.
2. High Thermal Efficiency	The newest two lines of the Amsterdam moving grate combustion plant utilizes reheat Rankine steam cycle which produces electricity with a net efficiency of >30%. The annual availability is reported to be >90%.
3. Efficient Transport of Waste due to Plant Accessibility	Waste are shipped partly through barges and through railway. The presence of link roads and a railway makes the site easily accessible.

Source: Analyzed by ITWG Subgroup Output1

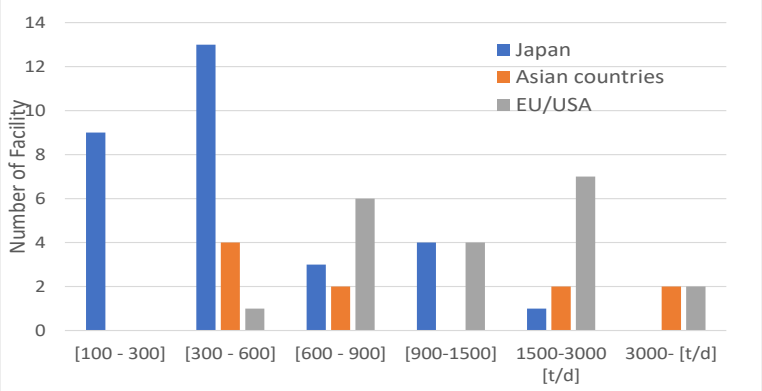
Chapter 4. Results of the Case Studies

4.1 Technical Aspects

4.1.1 Capacity of WtE-ACC Facility

(1) Total Capacity of the WtE-ACC Facility

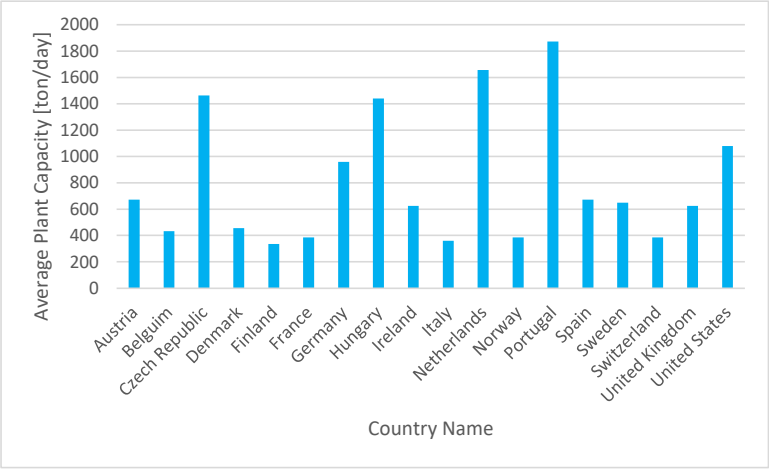
The distribution of the WtE-ACC facilities in the case study is shown in **Figure 4.1**, which is categorized by the treatment capacity ranges. The minimum treatment capacity is 120tons/day for Musashino Clean Center (ID[5]126, Japan) while the maximum, capacity was 4,400tons/day of Afval Energie Bedrijf Amsterdam (ID301, Netherland).



Source: ITWG Subgroup Output1

Figure 4.1 Capacity of WtE Facilities of the Case Study

In EU, the capacity of 6 country WtE-ACC cases is more than 1,500 tons/day out of the 17 cases, which count for 35%. According to the ISWA data (see Figure 4.2), the average capacity of WtE-ACC facilities in 5 countries of EU exceed 600ton/day out of 17 countries. It is analyzed that the bigger capacity, more than 1,000 ton/day, of WtE-ACC facilities are commonly developed in EU and USA. This is because they promote bigger capacity and high efficiency WtE-ACC facility in the energy policy and also promote clustering of local government units to gather more waste.



Source: Waste-to-Energy State-of-the-Art-Report 6th Edition ISWA

Figure 4.2 Average Capacity of WtE facilities in EU and USA

On the other hand, Japan has less capacity where most of the cases are

[5] ID corresponds to ID number in **Table 3.1**.

between 100 ton/day to 600 ton/day, according to the statistic of Ministry of Environment, Japan, as shown in **Table 2.2**. Three (3) cases out of 30 WtE-ACC facilities in the case study have the capacity more than 1,000 ton/day.

In Japan, in principle, all LGUs shall treat their municipal waste in their jurisdiction to avoid waste transportation beyond the boundary. Because of this principle and the national governmental policies including subsidy, during and after high-economic development in 1960s onward, individual small-scale LGUs developed and own their combustion facilities and management of waste by combustion became common since the 1970s. Then, due to the following situations, many relatively small-scale WtE-ACC facilities are still existing.

- Old facilities like 6 cases in the case study which started operation in 1990s, are still being operated after drastic rehabilitation
- The default management system is maintained even when the facility is renewed.
- National Government (Ministry of Environment Japan) subsidise 1/2 to 1/3 of CAPEX for all WtEs-ACC regardless the capacity of facility planned by LGUs as long as the project plan meets the regulation.
- Small-scale facility is accepted for remote islands and areas where the collection and transportation distance is long.

(2) Capacity of a Single Furnace

The maximum capacity of a single furnace is around 1,000 ton/day for a 24-hour operation for the case of stoker type incinerators. One thousand (1,000) tons of treatment capacity was confirmed in the Palm Beach Renewable Energy (ID 318, USA) and the Semass Resource Recovery (ID319, USA). The maximum capacity of the fluidized bed type is 200tons/day confirmed in Toshima Incineration plant (ID123, Japan) while this information is available only 2cases.

In the planning and design stage of WtE-ACC facilities, maintenance period of the combustion furnace should be considered. For a facility that consists of multiple furnaces give a benefit that the facility is not required to suspend operations during the maintenance period. The cases adopting multiple furnaces reported by the case study is shown in **Table 4.1**.

Table 4.1 Number of Furnace Lines and Treatment Capacity of Single Furnace

Lines of Furnace	Cases	Minimum	Maximum	Note
1	1	720	720	ID308, Incineration Line 6, Denmark
2	13	60	450	
3	11	100	1,000	
4	2	200	750	
5	1	340	340	ID201, Tuas Incineration Plant, Singapore
No information	32	-	-	
Total	60	60	1,000	

Source: Analyzed by ITWG Subgroup Output1

4.1.2 Combustion Technology

The stoker type of furnace is adopted in 83% of cases (48 out of 58 cases). This trend is confirmed in all regions in the study. It is analyzed that the stoker type (moving grate)[6] is the most common because this technology has a long historical experience and a stability in operation.

Table 4.2 Type of Combustion Furnace in the Case Study

	Fluidized bed (FB)	Stoker	Gasification and Melting (GM)	FB, GM	Cases
1. East Asia	3	25	3	1	32
2. Southeast/South Asia	0	8	0	0	8
3. EU	3	13	0	0	17
4. North America	0	2	0	0	3
Total	6	48	3	1	58
Ratio (%)	10	83	5	2	100

Note: No information in two cases (one in EU and one in North America) out of 60 cases.

Source: ITWG Subgroup Output1

The characteristic of the two dominant furnace types, stoker type (Moving Grate) and fluidized bed combustion type, is shown in **Table 4.3**. Although the Fluidized Bed has an advantage given that a smaller space required for installation, the capacity of single furnace is much lower than a stoker type. In terms of environmental and social aspects, both types of furnace can meet requirements specified

6 https://www.researchgate.net/publication/304401875_Energy_Recovery_from_Municipal_Waste_based_on_Moving_Grate_Technology/fulltext/578e5b4708aecbca4caacd6a/Energy-Recovery-from-Municipal-Waste-based-on-Moving-Grate-Technology.pdf?origin=publication_detail

in the conditions of the contract. No significant difference in the initial cost per unit tons of waste is found between both types in the experiences of Japan.

Table 4.3 Comparison of Two Combustion Technologies Dominant in the Case Study

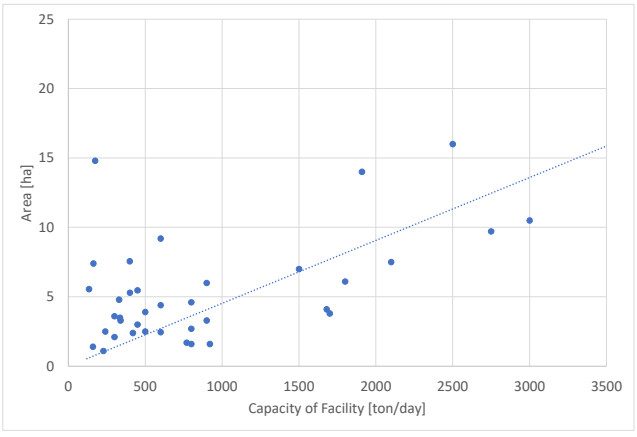
Items	Stoker Type	Fluidized Bed Combustion Type
Type of acceptable waste	- Various types of municipal solid waste - Waste with very high calorific value - Liquid waste	- Various types of municipal solid waste - Bulky waste needs to be shredded to input
Capacity of single furnace	- Less than 1,000 tons/day (24 hours)	- Less than 200 tons/day (24 hours)
Advantage	- High reliability - Less electricity utilization - Higher capacity of treatment - No need for shredding of bulky waste before combustion	- High combustion speed - Less oxidation of metal - Requires a smaller space of combustion furnace than stoker type incinerators
Disadvantage	- Much auxiliary fuel is necessary for starting the process of combustion - Bigger area required than Fluidized Bed Type	- Waste shredding required for bulky waste before feeding to combustion furnace - Lower capacity than stoker type - High ratio of fly ash - Relatively difficulty of Combustion control

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

4.1.3 Required Area of WtE-ACC Facility

A WtE-ACC facility needs a sufficient area for a facility building that includes a waste receiving pit, combustion furnace, energy recovery facility, air pollution control facility, stack, inside roads and buffer zone.

The area of WtE-ACC facilities in the collected cases is shown in **Figure 4.3**. It is analyzed that approximately 2 to 4 ha/1,000tons/day is necessary.

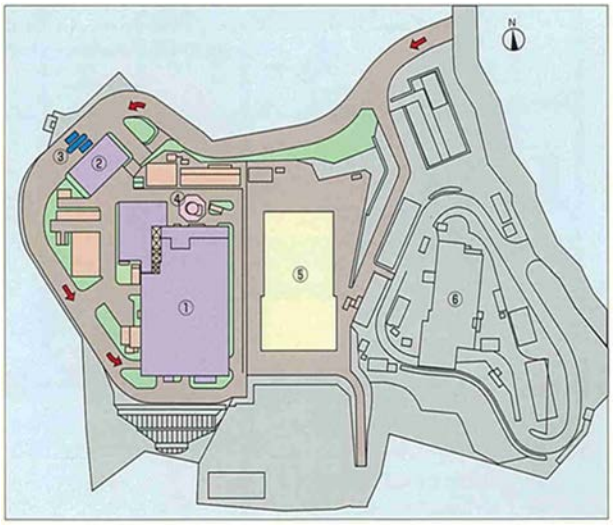


Source: ITWG Subgroup Output1

Figure 4.3 Area of each WtE facility

The total area and footprint basically depend on the capacity of the WtE-ACC facility. The area also depends on the supplemental facilities to be added, such as material recovery facilities (like a crushing facility, separation conveyor, plastic baler), ash storage area, pretreatment facility, and heat utilization facility, to name a few. (ex. Tobuki Incineration

Plant (ID106, Japan) as shown in **Figure 4.4**. Additionally, there are other considerations that affect the area requirement per supplemental facility. The buffer zone for example, depends on the surrounding condition and environmental regulation in each country. For example, in Japan, the Factory Location Law (1959) stipulates necessary green area and environmental facility like park or sports area while the distance as buffer zone for the surrounding communities is not required. As shown in the following pictures, some WtE-ACC facility are constructed in the center of city, where the wide land for the construction of WtE-ACC facility is not available. If the prevention measure of air pollution by stack, air pollutants control system, mitigation measure of noise and vibration is adopted, the WtE-ACC facility can be constructed in the urban area.



Note: (1) Incineration plant, (2) Office, (3)Truck weighing station (4)Stack, (5)Incombustibles Treatment Center, (6)Plastic Recycling Center (7)Tobuki Yuttari Hall
Source: Tobuki Incineration Plant

Figure 4.4 An Example of WtE-ACC Facilities Layout

Wien-Spittelau,
Vienna, Austria (ID306)
Source: Leaflet of Wien Energie GmbH

Shibuya Incineration Plant,
Tokyo, Japan (ID124)
Source: Clean Authority of Tokyo

Figure 4.5 Examples of WtE-ACC Facility located in the Center of the Urban Area

4.1.4 Category of Target Waste for Combustion

As confirmed in the case study, in Japan, the target waste of incinerators is mainly “combustible waste” defined and announced by the local government as a rule and an obligation in the waste collection target area, which shall be consistent with their municipal solid waste management plan. Waste

generators such as citizens and business owners separate deposit and discharge their waste for collection process following the rule. Normally, industrial waste is to be managed under the responsibility of waste generators and treated in an industrial waste incinerator. WtE-ACC facilities such as Higashisaitama (ID105) and Hamamatsu (ID120) also treat sewerage sludge with combustible municipal waste. Some facilities also receive disaster waste in emergency cases in the case of earthquakes and flood disaster that is frequently experienced in Japan.

In EU and USA, the target waste of WtE-ACC facility is mostly reported as municipal solid waste and non-hazardous industrial waste. Normally, definition of combustible waste is not used, unlike Japan. According to the reference document of some case studies, the separate collection is implemented, and the target wastes for WtE-ACC facility are the waste residue after separation of recyclable waste and compostable waste. It is assumed that the target waste may include the residues from the Mechanical Biological Treatment (MBT) facility after the separation of recyclable plastic, metal, paper, and/or compostable waste as well as municipal solid waste which is directly collected from households and business establishments.

In addition to municipal solid waste, Sysav South Scania (Sweden, ID312) and Lahti Gasification (ID309, Finland) accept industrial waste, and Klemetsrud Combined Heat and Power (ID302, Norway) treats hospital waste. There is no information available, but it seems that different tariffs may be applied to the waste received other than municipal waste. Palm Beach (ID 318, USA) targets “unprocessed waste”. It cannot be determined whether it means "garbage that is not subject to processing by another method" or "accepted without processing at all".

In the case of Southeast and South Asian countries, the target waste is defined as municipal waste (5cases) or combustible waste (2cases). It is supposed that mainly mixed collected municipal solid wastes are treated by the WtE-ACC facilities because many localities have not practiced the separate collection, and the completeness of waste separation is poor even when the separate collection is introduced in the LGUs in these regions.

The combustion furnace, either stoker or fluidized bed type, can accept most of type of waste. Even incombustible waste such as metal, concrete brick or liquid waste can be treated while it is not desirable. However, nowadays, each local government defines the type of waste for WtE-ACC to sustain their waste management. This must be the same in the Philippines.

4.1.5 Physical Composition of the Target Waste

The physical composition of target waste data which are only available in the case studies of Japan are shown in **Figure 4.6**. The maximum, minimum and average rates are shown in **Table 4.4**. The range

of physical composition of paper/cloth, which is highest ratio is 42.6 to 63.5 % and its average is 51.8%. The range of food waste is 5.3% to 19.6 % and its average is only 9.4%.

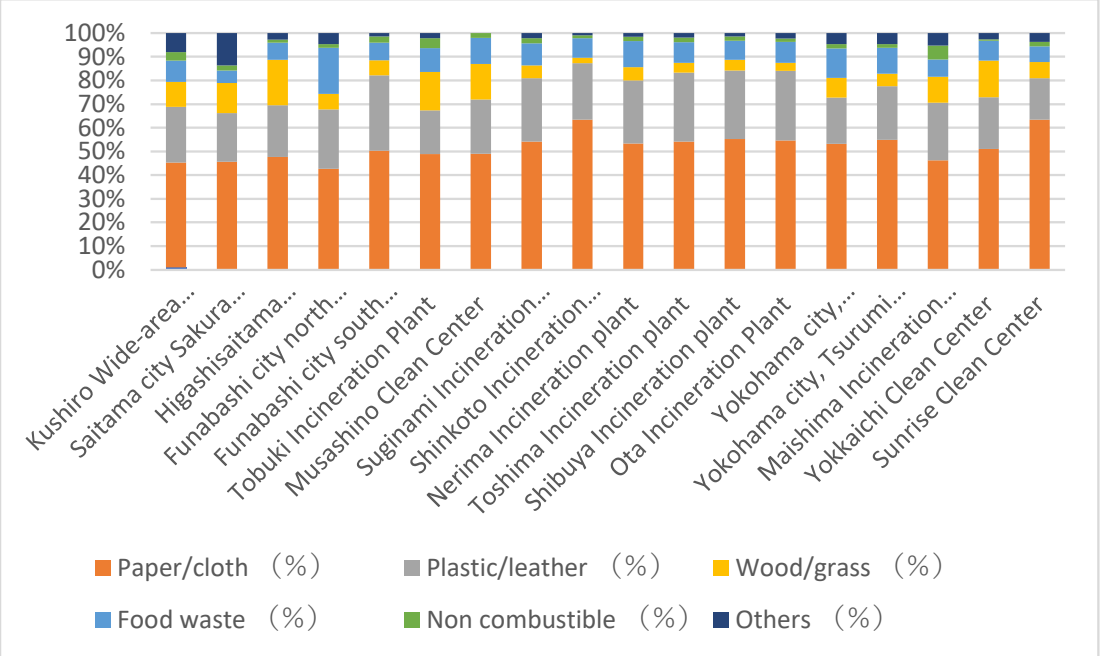
The comparison of physical composition of the target waste of WtE-ACC facility in Japan and Vietnam is shown in **Figure 4.7**. In the case of Vietnam (Can Tho, ID207), the ratio of food waste is 40.3% and pater/cloth is 16.8%. The ratio of plastic and leather is 24.2% in facilities of Japan and 17.5% in Vietnam. The date implies the higher LCV of facilities in Japan, because food waste, which contains more moisture usually, has lower calorie and plastic has higher calorie as shown in **Table 4.5**.

Table 4.4 Physical Composition of the Target Waste in WtE-ACC Facilities in Japan

	Paper/cloth	Plastic/ leather	Wood/grass	Food waste	Non-combustible	Others
Maximum	63.5	32.0	19.3	19.6	5.9	13.6
Average	51.8	24.2	8.8	9.4	2.2	3.6
Minimum	42.6	17.4	2.4	5.3	0.7	0.0

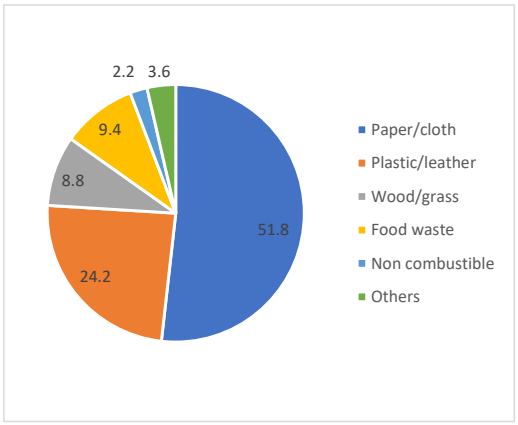
Unit: %

Source: ITWG Subgroup Output1based on the data of Ministry of Environment Japan (2020)



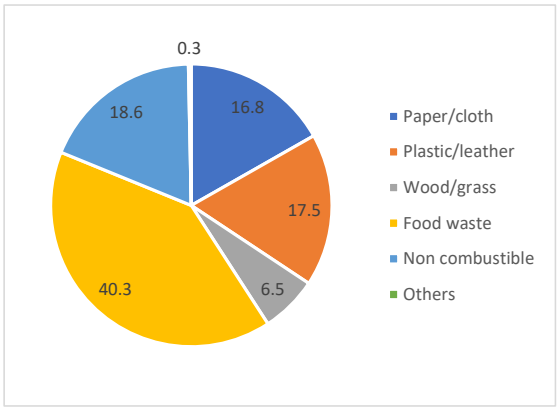
Source: Ministry of Environment Japan (2020)

Figure 4.6 Physical Composition of Waste in the WtE-ACC facilities in Japan



Japan (Average of the Case Study)

Source: ITWG Subgroup Output1 based on the Ministry of Environment, Japan



Can Tho solid waste treatment plant (ID207)

Source: Environmental and Social Impact Assessment Report of Can Tho Waste to Energy Project

Figure 4.7 Waste Physical Composition (the Cases in Japan, Can Tho in Vietnam)

Table 4.5 Lower Calorific Value of Municipal Solid Waste by Material

Material	Lower Calorific Value [kJ/kg] (Dry base)	Lower Calorific Value [kJ/kg] (Wet base)
Paper	14,700	9,400
Kitchen waste	14,300	500
Textile	19,100	14,900
Wood, grass	8,700	5,400
Plastic	34,900	28,900
Leather/Rubber	26,800	25,300

Note: The data is average LCV measured after the separation for each physical composition at WtE-ACC facilities of Metropolis Tokyo

Source: Formula, Model and Numerical Data of Environmental Technology and Science (2004)

4.1.6 Moisture and Combustible and Ash Contents of the Target Waste (Three Components), Bulk Density

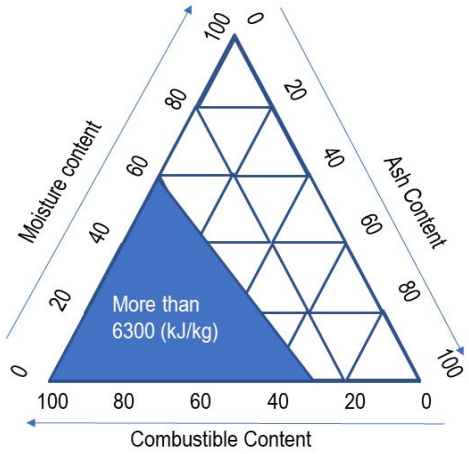
The data of moisture, combustible, and ash ratio of waste, so called “Three Components”, and bulk density are frequently referred to in the planning of WtE-ACC facilities. This information which were only obtained in the case studies of Japan, are shown in **Table 4.6**.

The values of 3 components are used for the design of furnace, heat mass balance and ash discharge systems while bulk density of target waste is to calculate the capacity of pre-treatment facility, waste pit (bunker), and hopper.

According to the research of National Institute for Environmental Study of Japan, moisture content, combustible and ash content should be within the blue triangle zone shown in **Figure 4.8** and LCV should be more than 6,300kJ/kg (1,500 kcal/kg) for suitable combustion. The values of three

components in **Table 4.6** fall in the zone.

The range of three components such as moisture content, combustible, ash content in the target waste is shown in **Table 4.6**. The range of moisture contents is from 33.3 to 52.6 % and the range of combustible is 41.1 to 60.2 % and the range of ash is 4.7 to 10.7 %, and each average of moisture, combustible and ash components is 40.9 %, 52.0 % and 7.1 % of Max contents. The value of bulk density of the target waste ranges from 104. 3 to 235.0 ton/m3 and the average is 145.8 ton/m3 according to information of the Ministry of Environment, Japan (2020).



Source: National Institute for Environmental Study of Japan

Figure 4.8 Values of Moisture, Combustible and Ash Content for Suitable Combustion

Table 4.6 Three Components of the Target Waste (Cases in Japan)

	Moisture (%)	Combustible (%)	Ash (%)	Total (%)
Average	40.9	52.0	7.1	100.0
Maximum	52.6	60.2	10.7	100.0
Minimum	33.3	41.1	4.7	100.0

Source: ITWG Subgroup Output1 based on the data of Ministry of Environment Japan (2020)

4.1.7 Lower Calorific Value of the Target Waste

It is confirmed that most of the average LCV of WtE-ACC facilities design are around 8,000 kJ/kg to 10,000 kJ/kg. In the reference documents of the cases, actually, the maximum and minimum thresholds of acceptable LCV of the facilities are commonly not disclosed though the average value is given.

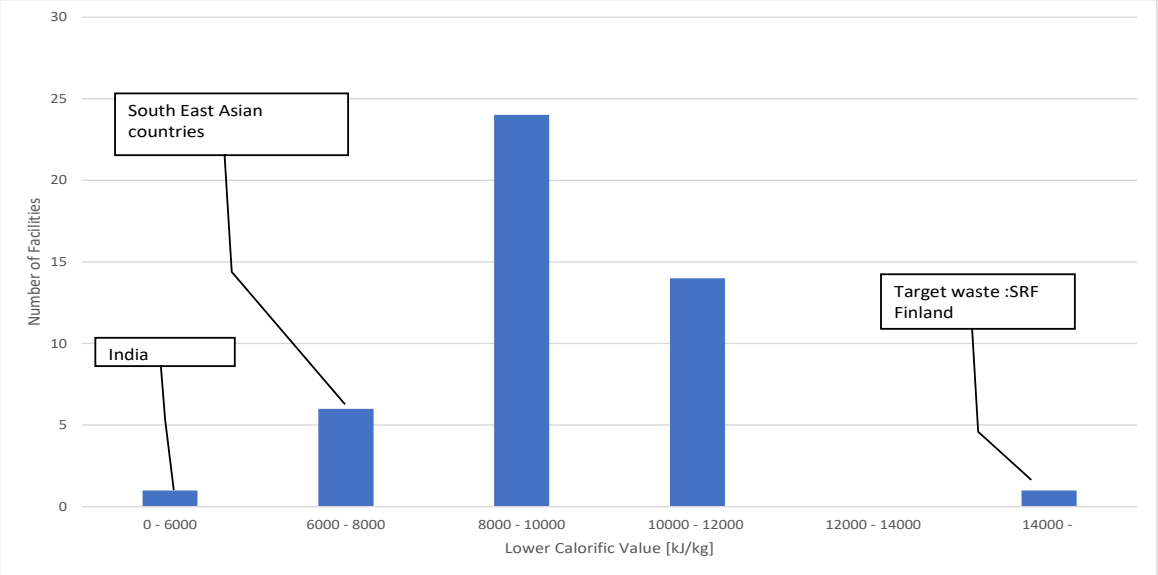
The LCVs of the cases are shown in **Figure 4.9**. In the developed countries such as EU, USA and Japan, it is normal that the LCV is more than 8,000 kJ/kg. The highest value found in the case study is 16,100kJ/kg of the Kymijarvi II (ID309, Finland) which is receiving Solid Recovered Fuel (SRF, higher LCV category of Refused Derived Fuel in EU).

On the other hand, in the cases of countries in Southeast and South Asia, the LCV is less than 8,000 kJ/kg. As a typical case, the reported LCV is only at 4,200 kJ/kg in India (ID209, Jabalpur WtE facility). As seen in **Figure 4.7**, the low-calorie material such as food waste may occupy bigger portion in waste composition in Southeast/South Asia, which could be the reason of lower value of the LCV.

It is described in “The Design and Planning Procedure of Waste Treatment Facility” in Japan published

in 2017 that the LCV normally requires 4,200 to 5,000 kJ/kg at least to maintain suitable combustion conditions, while NIES stated that stable operation requires more than 6,300kJ/kg as shown in **Figure 4.8**. In this sense, the value of the facility in India meets the minimum value in the document. In fact, the LCV of waste in the developed countries could sometimes be less than 4,200 kJ/kg depending on waste materials and its nature such as moisture contents.

The LCV of waste to be treated in the WtE-ACC facilities may meet the facility requirement by incorporating a process to homogenize waste characteristics and to reduce moisture by drying before inputting to the combustion furnace. Even if the waste cannot be well incinerated, supporting combustion functions through an external energy burner by utilizing auxiliary fuel like diesel oil could be adopted. However, frequent use of auxiliary fuel requires more cost. That is why the appropriate waste quality specification are vital for WtE-ACC.



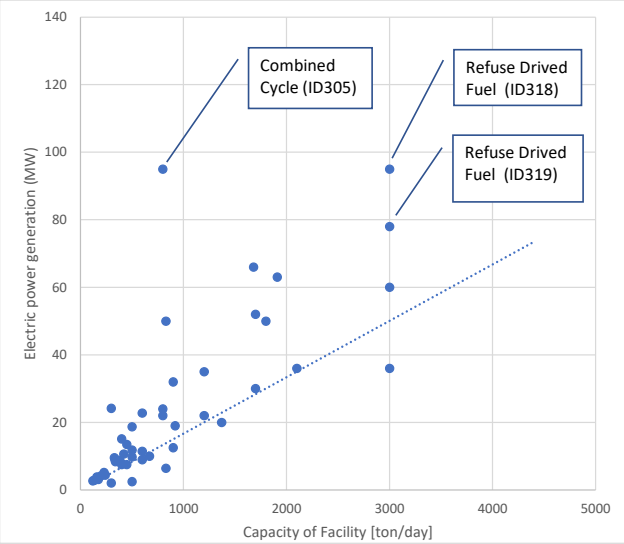
Source: ITWG Subgroup Output1

Figure 4.9 Lower Calorific Value of the Target Waste in WtE-ACC facility

4.1.8 Thermal Energy Recovery Process

(1) Relationship between the Capacity of WtE-ACC and Electric Power Generation

Electric power generation accords on the capacity of the WtE-ACC facility in general as shown in **Figure 4.10**. The bigger treatment capacity is preferable in terms of electricity generation and its efficiency. According to the experiences of WtE-ACC facilities in Japan, the electric power generation efficiency of WtE-ACC facilities of less than 50 tons/day is much lower than the WtE-ACC facility which has the capacity of a few hundred tons per day (See **Table 2.2**).



Source: ITWG Subgroup Output1

Figure 4.10 Electric Power Generation by Capacity of WtE facility

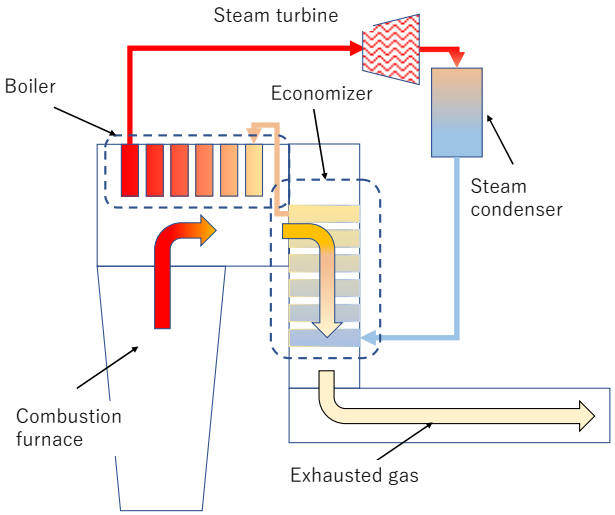
In addition to lower efficiency, in the case of cities which do not generate more than 100 tons/day of municipal waste, the treatment capacity of WtE-ACC facility may be as small as 100tons/day but it will not be able to yield excess electricity to be sold to outside such as power companies. The advantage of having a large-scale combustion facility is that surplus electricity can be sold to an electric power company.

(2) Efficiency of Electricity Generation

Heat exchange rate, effective utilization of exhausted gas and the efficiency of steam turbine system could also affect the recovery rate or efficiency.

In the case of combined cycle, thermal energy of exhausted gas of turbine generator by fossil fuel is utilized in combined system, so that the electric power generation is much higher than normal cases. For RDFs, where the target wastes are higher calorific materials like paper and plastic, the electric power generation is higher than normal cases.

The typical energy recovery process is shown as **Figure 4.11**. In the process of energy recovery, the thermal energy in combustion gas is changed into a superheated steam in the boiler. The superheated steam is transferred to a steam turbine generator, where the steam turns the turbine generator thereby causing electricity generation. The steam from turbine generator is cooled into hot water by the steam condenser. On the other hand, the exhausted gas which exchanged the heat in the boiler, goes to an economizer to preheat the hot water. The heated hot water is transferred to the boiler to exchange the heat to become steam.



Source: ITWG Subgroup Output1

Figure 4.11 Electric Power Generation Process

Steam can also be extracted from the turbine at an intermediate lower pressure stage, which is used in this plant or to export surplus thermal energy to supply a district heating network or to supply other necessary facilities of thermal energy.

Electricity generation efficiency highly depends on stream temperature and pressure. As, in cases in EU and USA, steam temperature and pressure are higher than the cases of Japan, and the electricity generation efficiency in EU and USA is higher than cases in Japan as well. For example, in the case of Afval Energie Bedrijf Amsterdam (ID301, Netherlands), the steam temperature is around 420°C and pressure is around 13MPa, electricity generation efficiency is around 30%. In case of ASM Brescia (ID304, Italy), the efficiency is around 30% with steam temperature is 450– 480°C and pressure is 6 to 7 MPa.

However, it is also noted that high steam temperature and pressure may cause corrosion of the boiler steam tube, which result in corrosion in a shorter period of operation.

From this information, we infer that the replacement period for the boiler steam tube in Japan is longer compared to EU or USA because boiler temperature and pressure are lower in facilities in Japan. In the case of Tsurumi Incineration Plant (ID130, Japan), boiler temperature is around 400 °C and pressure is around 3.9MPa.

The technology options for promoting effective power generation are summarized as **Table 4.7**.

Table 4.7 Technology Options for Efficient Power Generation

Item	Technology	Explanation
- Increase of heat exchange capacity	- Reduction of exit temperature of economizer	- Utilization of lower temperature economizer to reduce the thermal energy of the exhaust gas
	- Lower air ratio combustion or combustion gas recirculation by advanced combustion control	- Use of enhanced process control will maximize the combustion efficiency to ensure maximum burn-out of the organic waste content and reduce excess air levels - Optimum oxygen levels can be achieved using combustion gas recirculation;
- Effective utilization of steam	- No utilization of steam for reheating of exhausted gas after cooling	- Introduction of low temperature catalyst de-nitrogen or high efficiency dry exhausted gas treatment system - In case of wet exhausted gas treatment system, exhausted gas is necessary for reheating which consumes heating energy, and causes the reduction of power generation efficiency
	- No introduction of reheating system of exhausted gas after the treatment to prevent white fume	- In case of the introduction of reheating system of exhausted gas to prevent white fume, thermal energy will be utilized for reheating, which causes the reduction of energy efficiency
	- No utilization of wastewater closed system	- In case of utilization of closed system of water usage, the temperature at boiler exit has to be set at a higher temperature, which will cause the reduction of boiler efficiency.
- Increase of the efficiency of steam turbine system	- Introduction of high temperature and pressure boiler (high steam pressure and superheat temperature)	- Increasing steam pressure and temperature will increase the enthalpy of the steam and allow greater energy to be recovered in the steam turbine. - To increase high temperature and pressure, it is necessary to use corrosion prevention metal and frequent maintenance, or overhaul will be needed for decreasing the lifetime.
	- Introduction of steam condensing turbine	- Steam condensing turbine contribute to the reduction of air pressure in the outlet of turbine which increases energy efficiency
	- Water cooled steam condenser	- Heat energy difference between inlet and outlet by utilizing water cooling method increase will increase energy exchange efficiency. The water in cooling tower waste, river water or sea water can be utilized for that.
	- Combined cycle with fossil fueled-fired power plant (external superheating)	- Exhaust gas from gas turbine generator will add to the energy by combustion gas from WtE-ACC, which cause the increase of energy efficiency
- Increase of thermal energy	- Increase of waste quantity to be incinerated (capacity of WtE-ACC facility)	- Increase of incinerated waste quantity affects the enhancement of energy efficiency. However, it is arguable whether a few of large WtE-ACC facilities or a large number of relatively small WtE-ACC facilities should be constructed. - In case of large capacity of WtE-ACC, there is large impacts of the suspension due to the large maintenance or overhaul activity.

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

(3) Thermal Utilization other than Electricity Generation

The surplus heat recovery from electric energy generation process can contribute to the greater efficiency of thermal energy utilization. Steam extracted from the turbine can be used directly for process heating within the facility, used for other industries, or used to produce hot water for a district heating network.

In EU and USA, incineration power generation is carried out and surplus energy is used as heat at the same time. There are cases where the rate of local heating is bigger than power generation, as in the case of Amager Bakke (ID306, Denmark) and Wien-Spittelau (ID307, Austria).

In Japan, there are many cases of power generation for electricity distribution and the surplus energy is utilized for other uses such as hot water pools (ex. Ozenji Treatment Center, ID118, Japan), spas (ex. Tobuki Incineration Plant, ID106, Japan) and a heating of botanical garden (Shinkoto Incineration Plant, ID 102, Japan).

Source: Hachioji City
SPA in Tobuki Incineration Plant, ID106)

Source: Clean Authority of Tokyo
Heating of botanical garden in Shinkoto Incineration Plant, ID102)

Figure 4.12 Examples of Thermal Utilization other than Electricity Generation

The utilization methods of heat energy other than electricity generation are summarized in **Table 4.8**, which are useful even though the temperature or pressure of steam is not so high as used for electricity generation. They function as demonstrations to illustrate the multiple purpose that WtE-ACC facilities can provide for the community or citizens near the facility.

Table 4.8 Utilization of Thermal Energy other than Electricity Generation

Item		Explanation
Utilization outside of WtE-ACC facility	Heating system for community, botanical garden	Steam or hot water for community Distance from WtE-ACC facility to beneficiary shall be considered for heating system.
	Hot water swimming pool, hot spa	Hot water swimming pool for recreational purposes

Item		Explanation
Utilization inside WtE-ACC facility	Pre-heating of primary air	To promote effective combustion
	Prevention of fume	Re-heat exhausted gas before its release in the stack to prevents white fume of moisture vapor due to increase in the temperature
	Steam or hot water utilization in the building of facility	Thermal energy utilization as steam and hot water in the WtE-ACC facility

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

4.1.9 Environmental Pollution Control

(1) Exhaust Gas Treatment

1) Emission Standard

The compliance to the national emission standards is the requirement to permit the facilities to operate. In fact, all facilities in the case study which provide the data of treated exhaust gas meet the set standards. It is also important to note that in the cases of EU, USA and Japan, facilities set more stringent standards than the national standard. To illustrate, two examples of emission standards are shown in **Table 4.9** and **Table 4.10**. The actual value is even much lower than facility standard in the case of Shinkoto (ID102, Japan) where operational conditions of all WtE-ACC facilities in Japan are open to public. While the mandatory monitoring frequency of Japan and EU are set as in **Table 4.11**, actual monitoring is more frequently conducted also to obtain trust from local community.

Table 4.9 Emission Standard of Exhaust Gas in Japan

Parameter	Japanese Law	Facility standard (Shinkoto, ID102)	Actual
NOx [ppm]	250	60	36 - 41
HCl [ppm]	430	15	<2
SO_2 [ppm]	Area basis	20	<1
Particulates [mg/Nm^3]	80	0.02	<0.001
Mercury [μg/Nm^3]	50	-	<5
DXNs [ng/Nm^3]	0.1	-	<0.00005

Source: Consolidated by ITWG Subgroup Output1

Table 4.10 Emission Standard of Exhaust Gas in EU

Parameter	EU Directive	Facility standard (Isseane, ID303, France)
NOx [ppm]	87.7	28.5
HCl [ppm]	5.5	2.2
SO_2 [ppm]	15.7	7.5
Particulates [mg/Nm3]	9	1.3
Mercury [ppm]	45	13.1
DXNs [ppm]	0.09	0.03

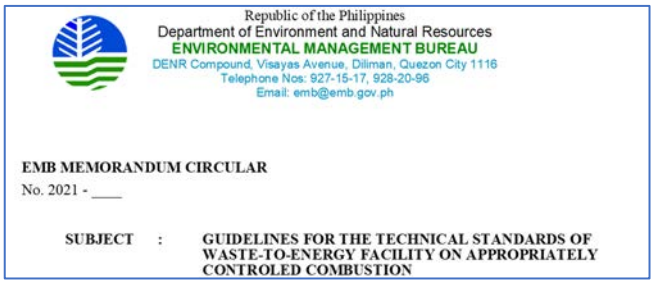
Source: Consolidated by ITWG Subgroup Output1

Table 4.11 Monitoring Frequency of Emission Parameter in Japan and EU

Item	O&M/S in Japan (Section 17 above)	Circular (Kansei 95) MOE Japan	EU Directive 2010-75
	Mandatory	Recommendatory	Mandatory
Capacity of WtE →	All	For >200t/d	
DXNs	1/year	-	2/year
SOx	2/year	6/year	Continuous
Dust	2/year	6/year	Continuous
HCl	2/year	6/year	Continuous
NOx	2/year	6/year	Continuous

Source: Consolidated by ITWG Subgroup Output1

Report Draft EMB MC on "Guideline for the Technical Standards of Waste-to-Energy Facility on Appropriately Controlled Combustion"


Republic of the Philippines
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ENVIRONMENTAL MANAGEMENT BUREAU
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EMB MEMORANDUM CIRCULAR
No. 2021 - ____

SUBJECT : GUIDELINES FOR THE TECHNICAL STANDARDS OF WASTE-TO-ENERGY FACILITY ON APPROPRIATELY CONTROLED COMBUSTION

Draft EMB Memorandum Circular on "Guidelines for the Technical Standards of Waste-to-Energy Facility on Appropriately Controlled Combustion" was crafted by Intergovernmental Technical Working Group for Output 1 of JICA Technical Cooperation Project for Capacity Development on Improving Solid Waste Management (SWM) through Advanced/Innovative Technologies.

This draft Circular is aiming to provide a set of technical standards for the evaluation, establishment, and control of Waste-to-Energy on Appropriate Controlled Combustion (WtE-ACC) Facilities for the proper management of municipal solid wastes in the country to supplement the DENR Administrative Order 2019-21 otherwise known as the "Guidelines Governing Waste-to-Energy (WtE) Facilities for the Integrated Management of Municipal Solid Wastes."

In the draft Circular, exhaust gas standards and its monitoring frequency are stipulated as below;

> 5.3.6. Monitoring frequency of exhaust gas
>
> Aside of requirement of CEMS installation for the monitoring of operation performance of WtE-ACC facilities, all WtE-ACC facilities shall measure and record the concentration of dioxins in the exhaust gas emitted from chimneys at least once a year, and the concentration of exhaust gas (Limited to the substances related to sulfur oxides (SOx), dust, hydrogen chloride (HCl) and nitrogen oxides (NOx)) at least once in 6 months for the purpose to determination of compliance of NESSAP of DAO2000-81.

In the draft, mandatory monitoring frequency is set as 2 times in a year which is same with Japan while Japanese recommendatory requirement is 6 times in a year as shown in Table 4.11

Report Disclosure of Environmental Monitoring Result to the Public Domain

In Japan, all MSW treatment facilities shall be obliged to disclose its operational plan and operation conditions. This is applied for the facilities not only operated by LGUs but also operated by private (through contract from LGUs).

In the website of DBO contractor named Asakawa Environment Technology Corp. (ID 115, Japan), hourly record data of HCl, NOx, SOx, PM and Mercury are disclosed. By this, on January 31st 2021, 170 μ g/m3N of Mercury was confirmed and disclosed to the public which exceed 3 times or more of regulatory emission limit of 50 μ g/m3N. The implementation government agency, Asakawa Seiryu Env. Union associated by 3 cities in Tokyo, immediately disclosed this fact with following response actions. This sincere behavior establishes the trust among LGUs, union, local residents and community.

Table 4.12 Environmental Monitoring Daily Report on 31 Jan 2021

Furnace #	No. 1				
Pollutants	HCL	NOx	SOx	PM	Hg
Unit	ppm	ppm	ppm	g/m3N	μg/m3N
Self-Imposed St.	10	20	10	0.005	50
Mandatory St.	430	250	2700*	0.040	50
2021/1/31 1:00	6	10	0	0	1
2021/1/31 2:00	6	10	1	0	1
2021/1/31 3:00	6	13	1	0	1
2021/1/31 4:00	6	14	0	0	1
2021/1/31 5:00	6	10	0	0	1
2021/1/31 6:00	6	11	0	0	1
2021/1/31 7:00	6	11	0	0	1
2021/1/31 8:00	6	9	0	0	1
2021/1/31 9:00	6	9	2	0	0
2021/1/31 10:00	6	11	3	0	0
2021/1/31 11:00	6	12	3	0	1
2021/1/31 12:00	6	11	1	0	1
2021/1/31 13:00	6	7	1	0	1
2021/1/31 14:00	6	9	2	0	1
2021/1/31 15:00	6	14	3	0	1
2021/1/31 16:00	6	10	2	0	1
2021/1/31 17:00	6	10	0	0	1
2021/1/31 18:00	5	10	0	0	1
2021/1/31 19:00	5	10	0	0	1
2021/1/31 20:00	6	9	0	0	1
2021/1/31 21:00	6	10	1	0	1
2021/1/31 22:00	6	11	2	0	1
2021/1/31 23:00	5	10	1	0	1
2021/2/1 0:00	6	10	0	0	1

Furnace #	No.2				
Pollutants	HCL	NOx	SOx	PM	Hg
Unit	ppm	ppm	ppm	g/m3N	μg/m3N
Self-Imposed St.	10	20	10	0.005	50
Mandatory St.	430	250	2700*	0.040	50
2021/1/31 1:00	4	11	0	0	3
2021/1/31 2:00	4	12	0	0	3
2021/1/31 3:00	4	13	0	0	3
2021/1/31 4:00	4	11	0	0	3
2021/1/31 5:00	4	11	0	0	3
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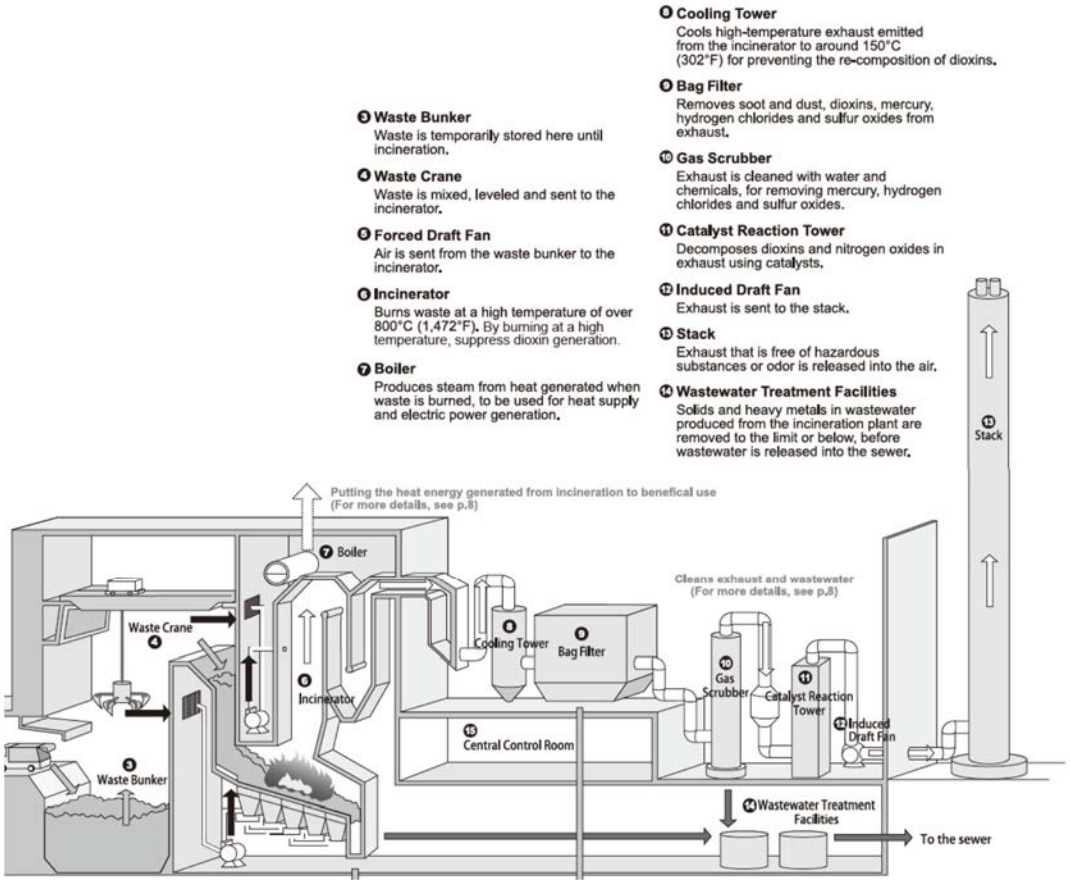
2021/1/31 9:00	3	12	0	0	3
2021/1/31 10:00	3	12	0	0	3
2021/1/31 11:00	3	12	0	0	6
2021/1/31 12:00	4	14	0	0	170
2021/1/31 13:00	4	12	0	0	43
2021/1/31 14:00	4	10	0	0	29
2021/1/31 15:00	5	10	0	0	22
2021/1/31 16:00	5	11	0	0	17
2021/1/31 17:00	5	11	0	0	16
2021/1/31 18:00	5	12	0	0	9
2021/1/31 19:00	5	12	0	0	6
2021/1/31 20:00	5	9	0	0	5
2021/1/31 21:00	5	14	0	0	5
2021/1/31 22:00	4	13	0	0	5
2021/1/31 23:00	3	11	0	0	4
2021/2/1 0:00	4	10	0	0	4

Source: Website of Asakawa Environment Technology Corp. (https://asakawa.ekankyo21.com/)

In the case study outside of Japan, there are some projects which disclose concentration of pollutants in exhaust gas, however, most of them are not updated timely and no one disclose continuous hourly data. In the recent developments of WtE Incineration in Asian countries, there are some articles reporting that exhaust gas of WtE incineration facility exceed its emission limit (Bangkok, Delhi, etc.). While these facilities equip CEMS (Continuous Emission Monitoring Systems), acquired data is not disclosed to the public in timely manner. Timely disclosure of emission data and secure residents to access such data are quite important success key for environmental management and trust building with neighboring communities. This level of environmental strictness can be specified in the technical specification of WtE-ACC in each bidding document of LGU, but should be regulated in national level.

2) Treatment Process

To satisfy the emission standards, WtE-ACC plants equip exhaust gas treatment system consisted by cooling tower, scrubber or bag filter, etc. as shown in **Figure 4.13**. After the boiler, exhaust gas is cooled in a cooling tower and enters a bag filter to remove dust. In case of dry scrubber, activated carbon and lime for the absorption of dioxins and acid gas like HCl and SO2 is added before the collection of the dust at the bag filter. For wet scrubbers, wet scrubber can be installed to remove acid gases at the subsequent stage of the bag filter. After which, nitrogen oxides are removed through Selective Catalytic Reduction (SCR).



Source: Prepared by ITWG Subgroup Output1 based on Waste Report (2020) by Clean Authority of Tokyo

Figure 4.13 An Example of Exhaust Gas Treatment of WtE-ACC facility

The exhaust gas treatment system has to be designed for the emissions limits in the jurisdiction where the plant is located (national and/or local standards), available space, height restrictions and economic factors.

Table 4.13 and **Table 4.14** show pollution control devises for each air pollutant comes from solid waste combustion.

In EU and USA, some WtE-ACC cases, such as Wien-Spittelau (ID 306, Austria) and Amager Bakke (ID307, Denmark), adopt electrostatic precipitator instead of bag filters. There are cases of both dry and wet scrubbers for acid gas treatment such as Afval Energie Bedrijf Amsterdam (AEB) Plant (ID301, Netherland) and Wien-Spittelau Plant (ID306, Austria). There are also cases of Selective Catalytic Reactor (SCR) as Sysav South Scania Waste-to-energy plant (ID312, Sweden) and Palm Beach Renewable Energy Facility (ID318, USA) and Selective Non-Catalytic Reactor (SNCR) for NOx treatment such as Afval Energie Bedrijf Amsterdam (AEB) Plant (ID301, Netherland) and Issy-les-Moulineaux WtE plant (ID303, France).

On the other hand, in Japan, bag filter or dry exhaust gas treatment system is mostly utilized. SNCR and SCR are applied for the treatment system for NOx as well. However, WtE-ACC facilities that require stricter standards usually utilize wet scrubber for acid gases such as HCl or SO_2 Ota Incineration Plant (ID 101), Suginami Incineration Plant (ID103) are examples that adopted the technology. The typical pollution control technologies are explained in **Table 4.14**.

Table 4.13 Typical Pollution Control Technology for Air Pollutant

Air Pollutant	Pollution Control Technologies
Dust/Particulates	Bag filter
Nitrogen Oxides (NOx)	Flue gas recirculation, SNCR and SCR
Acid Gases (Sulphur Dioxide, Hydrogen Chloride, Hydrogen Fluoride)	Wet scrubber, semi-dry scrubber or dry scrubber, bag filter
Heavy Metals (Mercury, Cadmium, Lead, Copper, etc.)	Bag filters, Activated carbon injection
Dioxins and Furans	Flue gas recirculation, rapid cooling bag filter, activated carbon injection

Source: ITWG Subgroup Output1

Table 4.14 Pollution Control of Exhaust Gas

Typical Pollution Control Technologies	Explanation of Each Pollution Control Technology
Bag filter	Bag filters are composed of filter bags, which capture particles in exhaust gas. Bag filters can capture particles with high removal efficiency. Pollutant Particles or gaseous pollutant absorbed with particle are removed effectively. In the bag surface, it is possible to react to neutralize acid gases after the addition of chemical agent. Therefore, bag filter is normally set after the scrubber.
Flue gas recirculation	Flue gas recirculation lowers excess air rate, reduces exhaust gas, and increases thermal efficiency. In addition, it lowers formation of thermal NOx due to lower excess air rate.
SNCR and SCR	SNCR does not use catalytic die to high temperature injection of ammonia or ammonia compound into the flue gas, for example at around 850 - 950°C. SCR operates on the same principle as SNCR, but at a much lower temperature range of 200 – 300°C. This is achieved by the use of a catalyst to accelerate the reaction between the NOx and ammonia at low temperatures. Higher NOx removal is possible, but the costs are higher, and the catalyst is sensitive to other pollutants and therefore the system usually needs to be located on the end of pollution control system.

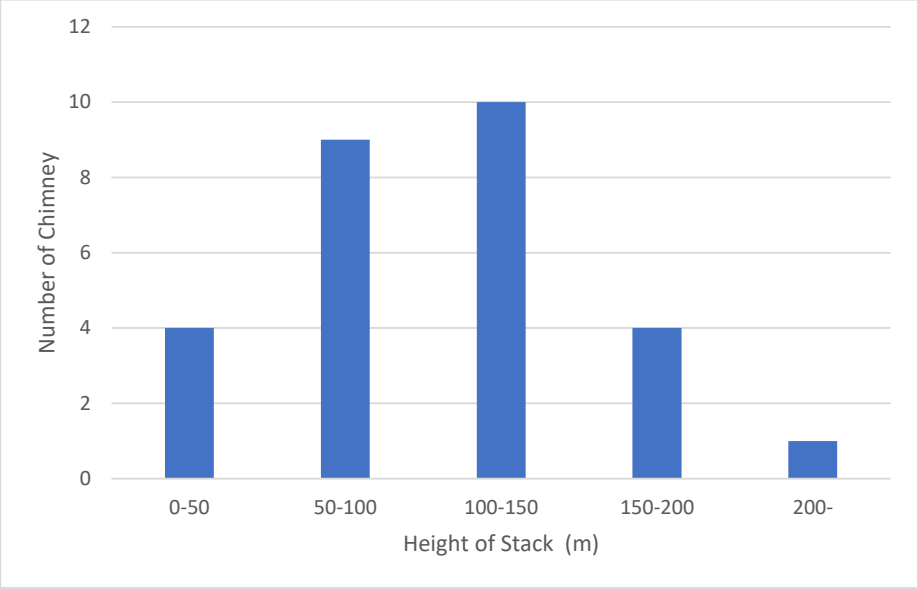
Typical Pollution Control Technologies	Explanation of Each Pollution Control Technology
Scrubber (Wet scrubber, semi-dry scrubber or dry scrubber)	1) Wet Scrubber The exhaust gases are brought into contact with water and liquid reagents, and pollutant gases are absorbed. The wet scrubber is effective at removing acid gases, but is less efficient in thermal energy terms (due to the cooling effect of the water spray) and produces a liquid residue which requires treatment in a water treatment plant 2) Dry and semi dry scrubber Both the dry and semi-dry scrubber type neutralizes acid gases and produce a dry residue. Dry or semi-dry filters are generally preferred as the dry residue is easier to handle but they are less effective than wet scrubber.
Flue gas recirculation	Flue gas recirculation lowers excess air rate, reduces exhaust gas, and increases thermal efficiency. In addition, it lowers formation of thermal NOx due to lower excess air rate.
Rapid cooling	Rapid cooling reduces the risk of dioxin reformation due to the prevention of de novo synthesis by preventing longer retention time of the temperature between 200 and 400°C.

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

3) Stack

By discharging the exhaust gas from the stack, it is expected to diffuse pollutant to the atmosphere for the purpose to reduce this concentration on the ground.

The height of stack confirmed in the case study is shown in **Figure 4.14**. Out of twenty-eight (28) cases which have the information of height of the stacks. 10 cases are the range of 100-150m, 9 cases in the 50-100m. So, about 70% is in the range of 50 to 150 m.



Source: ITWG Subgroup Output1

Figure 4.14 Range of Height of Stack in the Cases of WtE-ACC facility

As shown in **Figure 4.14**, the highest stack confirmed in the case study is Toshima Incineration plant (ID 123, Japan), the height is 210 m. Contrastively, the stack height is sometimes restricted by the regulations such as urban planning, aviation requirements and the requirement to maintain the landscape.

Among the cases studies, there are two cases of less than 30 m height of stack. Issy-les-Moulineaux WtE plant (ID 303, France), its stack height is 21m to maintain Seine river landscapes. Sunrise clean center (ID 108, Japan), its stack height is designed as 25m because of aviation law). In these cases, the stack is not visible as seen in **Figure 4.15**. When the height of stack will be such low, the ground level pollutant concentration may increase due to low diffusion of exhaust gas from the stack. In these plants, stricter emission standards are applied, which of course resulting in a cost increase.

	
Sunrise Clean Center, ID108, Japan Source: Sunrise Clean Center	**Issy-les-Moulineaux WtE plant, ID303, France** Source: SYCTOM

Figure 4.15 An Example of WtE-ACC with Lower Stack

(2) Wastewater

Wastewater is generated from waste pit, washing process of car and platform. boiler, ash treatment, and from domestic facilities. Because the quality of the wastewater from different facility and equipment is so different, it is important to treat separately. In this case the capacity of waste treatment facility can be minimized. A certain type of wastewater can be discharged with little treatment. In addition, if it is possible to discharge sewerage from the facility, the capacity load of wastewater treatment facility can be reduced. The types of wastewater and main treatment process are shown in **Table 4.15**.

Table 4.15 Main Sources of Wastewater and the Characteristics

Item	Wastewater comes from					
	Waste pit	Ash treatment	Wet scrubber	Domestic wastewater	Washing equipment or facility	Washing car
pH	5-7	7-12	5-8 (after treatment)	5-8	7-11	5-8
SS	○	●	●	○	◎	◎
BOD	●	◎	○	○	○	○
COD	○	◎	◎	○	○	○
Oil	◎	–	–	○	○	◎
Salt	–	◎	●	–	○	–
Fe	○	●	◎	–	○	◎
Zn	○	●	◎	–	○	–
Mn	–	●	◎	–	○	–
Cr	–	◎	◎	–	○	–
Cd	–	○	◎	–	–	–
Cu	–	○	◎	–	–	–
Pb	–	◎	◎	–	–	–
Hg	–	–	○	–	–	–

Note: ●: Especially high concentration, ◎: high concentration, ○: some concentration, －: Little concentration

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

Table 4.16 Pollution Control of Wastewater

Wastewater comes from	Characteristics	Treatment
Waste pit and car and platform washing	High organic contents (high BOD) Fluctuation due to change of waste amount and characteristics. Oil in wastewater from car washing	- Organic wastewater can be treated by biological treatment method - Inorganic wastewater can be treated by coagulation/ chelate/ alkali/ sulfide filtration process, etc. - In principle, organic wastewater shall be separated from the inorganic content.
boiler	High temperature, which may affect wastewater treatment process shared with wastewater from other sources	
Wastewater from ash treatment	To be treated as inorganic wastewater in case of low ignition loss	
Wastewater from domestic facility	Wastewater from toilet and kitchen in the administrative office Quality is same as domestic wastewater	

Source: ITWG Subgroup Output1 based on Guideline for Planning and Designing of Waste Treatment Facility Development in Japan (2017)

4.1.10 Ash Treatment and Disposal

The residues from combustion process are classified into bottom ash which is taken from the bottom of combustion furnace, and fly ash which is captured at the cooling process of combustion gases and the air pollution control equipment (i.e. scrubbers, bag filter, etc.), which include a part of boiler ash and air pollution control residues. Fly ash may contain heavy metals with high boiling temperature

and is captured in bag filters or other pollution control devices. Boiler ash are collected in the heat recovery and cooling system including boiler, economizer and superheater and air pollution, is handled as fly ash or bottom ash based on the process in each WtE-ACC facility.

(1) Bottom Ash

Bottom ash consists of relatively large fragments and does not contain heavy metal and dioxins in high concentration as exceeding environmental standards, which makes it relatively easier to handle. Normally, recyclable non-ferrous and ferrous metal scrap in bottom ash is separated by magnetic separator and only inorganic fragment is stored in ash storage facility for bottom ash. Bottom ash can be utilized as a cement ingredient or aggregate, or roadbed material after a melting treatment. Iron scrap and non-ferrous metals are recycled. After the separation, the residue of bottom ash will be utilized as cement aggregate, other construction material such as backfilling material, roadbed after its melting, baking and aging, or other necessary processing. The chloride content in bottom ash inhibits its utilization as a construction material.

In the cases of Japan, bottom ash is utilized as cement ingredient of the cement project called as Eco -cement, in which more than a half of products (as dry base) are made by bottom ash of WtE-ACC facilities. This is practiced in most of WtE-ACC facilities in Metropolitan Tokyo such as Ota Incineration Plant (ID 101) and Shinkoto Incineration Plant (ID102). Bottom ash is taken off for producing Eco-cement with around US$470/ash-ton of payment to the company, which mean that the utilization of bottom ash as cement ingredient can be operational under special condition only and not be a revenue source of LGUs. It could be recognized that the government and society are supporting reduction of ash to be disposed of at the landfill to maintain its life span.

As other example of utilization of bottom ash, through ash melting process adopted in WtE-ACC such as Kushiro Federation WtE (ID 109) and Funabashi City South Incineration Plant (ID 110), material for asphalt pavement, filling material, roadbed material and aggregate is generated.

It is supposed that WtE-ACC cases in EU and USA would also use bottom ash as filling material or aggregate, while the treatment method is not clearly described in the collected case studies.

(2) Fly Ash

The common technique for managing fly ash consists of solidification or stabilization of residues through mixing with cement or inorganic binding agents.

In Japan, fly ash is mainly disposed of after cement solidification as confirmed in Hatsukaichi Energy Clean Center (ID128), chemical treatment in Toshima Incineration plant (ID123) and Musashino Clean Center (ID127).

In EU, the treatment and disposal method of fly ash is basically disposed in hazardous waste landfill site. In the case of Allington Energy from Waste (ID310, UK), Lahti Gasification Facility (ID309, Finland) and Isseane (ID303, France), fly ash is handled as a hazardous waste and disposed in hazardous waste landfill sites. Abandoned salt mining site with solid deep bedrock located in Germany is also used as a hazardous waste landfill site as reported in the case of Wien-Spittelau (ID306, Austria). Fly ash from the WtE-ACC in Italy (ASM Brescia, ID304) also is filled in salt mines in Germany. In Afval Energie Bedrijf Amsterdam (ID301, Netherlands), ash is separated into bottom ash, boiler ash, ash from bag filter, and other types. These ashes are treated separately. It was noted that reacted gypsum or salt is utilized for construction material.

4.2 Institutional and Financial Aspects

In this part, the findings of institutional and financial aspect, in particular, project development procedure, financial information such as CAPEX and OPEX, public involvement, and subsidy programs in neighboring counties are discussed.

4.2.1 Project Development and Implementation

(1) Business Scheme / Project Implementation Framework

Table 4.17 and following box shows typical business scheme (PPP Modality, or Implementation Framework) of WtE-ACC project.

The role and responsibilities for each business scheme such as Traditional business contract (public own and operate), DBO, BTO, BOT and BOO are summarized for each scheme as follows.

Table 4.17 Business Schemes and Responsibility of Public and Private Operators

	PFI			DBO	DBM	Public + Long term contract	Public works
	BOO	BOT	BTO				
Degree of public involvement	← weak						strong →
Role							
Construction							
Design	Private	Private	Private	Public	Public	Public	Public
Construction	Private	Private	Private	Public	Public	Public	Public
Funding	Private	Private	Private	Public	Public	Public	Public
Operation							
Operation	Private	Private	Private	Private	Public	Private	Public
Maintenance	Private	Private	Private	Private	Private	Private	Public
Ownership of facilities							
Construction period	Private	Private	Private	Public	Public	Public	Public
Operation period	Private	Private	Public	Public	Public	Public	Public

□ : Role of the private sector

Notes: In DBO, Public entity orders private contractor to construct the facility.
Source: ITWG Subgroup Output1

◇Public-works projects / Public Build and Operate Project

The public sector is responsible for everything from securing financial resources to designing, constructing, and operating the facility.

◇Design-Build plus Operate separate order scheme, DB+O (Public + Long term contract)

The public sector designs and constructs the facilities, and the private sector is entrusted with the operation of the facilities for multiple years.

◇Design-Build-Operate, DBO

The public sector raises funds through bonds and grants, etc., and comprehensively outsources the design, construction, operation, etc. of facilities to the private sector.

◇Design-Build-Maintenance, DBM

The public sector raises funds through bonds and grants, etc., and comprehensively outsources the design, construction, maintenance, and management of facilities to the private sector.

◇PFI

・Build-Transfer-Operate, BTO

The private sector is responsible for financing, design, construction, and operation of the facility. Ownership will be transferred to the public after completion of the facility.

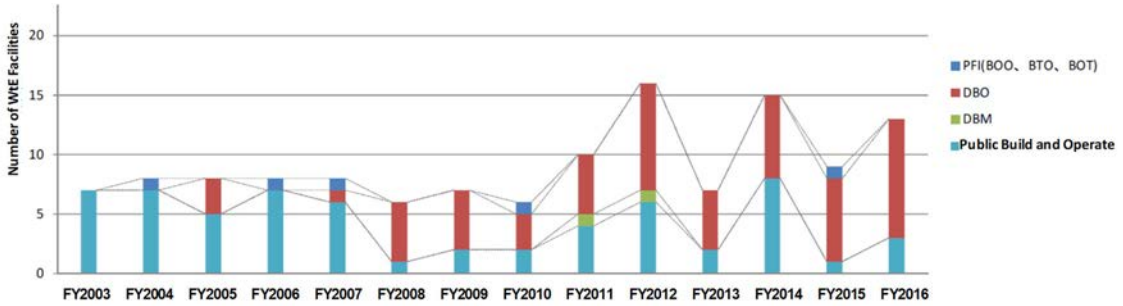
・Build-Operate-Transfer, BOT

The private sector is responsible for financing, design, construction and operation of the facility. Ownership will be transferred to the public at the end of the commissioning period.

・Build-Own-Operate, BOO

The private sector will be responsible for financing, design, construction, and operation of the facility. Ownership will not be transferred to the public even after the end of the commissioning period.

In Japan, WtE-ACC facilities are used to be built under the Public-Build and Operate scheme, however, recent 10 years, Design-Build and Operate (DBO), a shape of PPP schemes is majorly applied for 100 tons/day or more size of WtE-ACC facilities. In these "Public-Build and Operate" and "DBO" schemes, LGUs to budget both construction and operational cost and procure EPC and O&M at once or separately. In Japan, national subsidy for CAPEX (1/3 to 1/2 depends on LGU and facility specification) can be enjoyed for LGUs while operational cost shall be covered by annual budget of LGU.



Note: The facilities which have more than 100ton/day of treatment capacity only
Source: Feasibility Study for PFI project development in Izumo, Japan

Figure 4.16 Historical Transition of WtE-ACC Business Scheme in Japan

Table 4.18 is an analysis of case studies in the aspect of business scheme. Out of 60 cases, 22 cases are public build and operate scheme, in which 13 cases are in Japan and 9 cases are in EU countries. With regard to DBO, 13 cases are found in Japan while only 1case is found in USA. BOT or BOO schemes are applied in Thailand, Taiwan, India, Singapore and Vietnam while no cases in Japan. Cases in Thailand, India and Vietnam are first WtE-ACC installations in each country. In Taiwan[7] and Singapore8, BOT or BOO is not majority of their business scheme in WtE-ACC development.

Table 4.18 Business Schemes applied for the WtE-ACC Case Studies

Business Scheme	Number of cases	In Japan	Outside of Japan	Remark
Public Build (DB) and Operate	21	13	8	Japan, Singapore, Netherland, Italy, Denmark, Finland
DB+O (15yrs)	1	1	0	Japan
DB+O	2	0	2	France, Singapore
DBO (15yrs)	4	4	0	Japan
DBO (20yrs)	10	9	1	Japan, USA
BTO (20yrs)	2	2	0	Japan
BOT (20yrs)	3	0	3	Thailand, Taiwan, India

[7] BOT/BOO are 3 cases (12.5%) out of 24 existing WtEs, and majority is DBO (called as OT), which is 16 cases (67%) in Taiwan as of 2017 (Municipal Solid Waste (MSW) Incineration's Potential Contribution to Electricity Production and Economic Revenue in Taiwan, Journal of Taiwan Energy, Volume 4, No. 1, March 2017).
[8] In Singapore 2 of 4 existing WtEs are public build and operate scheme, and Tuas Nexus WtE, which is being constructed, is DBO based project.

BOO (25yrs)	1	0	1	Singapore
BOO (22yrs)	1	0	1	Vietnam
-	15			Data can't be obtained in this Case Study
Total	60			

Source: ITWG Subgroup Output 1

(2) Development Approach

There are 2 development approaches, namely "Solicited" and "Unsolicited". According to PPP Center, these are explained as below;

Solicited vs Unsolicited Proposals

Solicited proposal

A solicited proposal refers to projects identified by the implementing agency (IA) from the list of their priority projects.

In a solicited proposal, the IA formally solicits the submission of bids from the public. The solicitation is done through the publication of an invitation for interested bidders to submit bids, and selection of the private proponent is done through a public competitive process.

Unsolicited proposal

In an unsolicited proposal, the private sector project proponent submits a project proposal to an IA without a formal solicitation from the government. An unsolicited proposal may be accepted for consideration and evaluation by the IA, provided it complies with the following conditions:

1. It involves a new concept or technology and/or it is not part of the list of priority projects in the Philippine Investment Program (PIP) [Medium Term Public Investment Program, Comprehensive and Integrated Infrastructure Program (CIIP)] and the Provincial/Local Investment Plans;
2. It does not include a Direct Government Guarantee, Equity or Subsidy;
3. It has to go to ICC for the determination of reasonable Financial Internal Rate of Return (FIRR) and approval to negotiate with the Original Proponent; and
4. After successful negotiation, proceed to publication and request for competitive proposals according to Swiss Challenge Rules.

Source: PPP Center Website (https://ppp.gov.ph/ppp-program/what-is-ppp/)

Solicited approach was taken in 51cases (85%) out of 60 cases as shown in **Table 4.19**. Only one case (Afval Energie Bedrijf Amsterdam, ID301, Netherlands) adopted the unsolicited approach in their recent development while first phase of this facility was developed by solicited approach. In the developed countries such as EU and Japan, LGUs budget the front-end cost (project development cost, e.g. concept building, master plan, feasibility studies, and preparation of bidding document) and call for bid of WtE-ACC partner, phased project development can be implemented.

Table 4.19 Development Approach of WtE-ACCs

Development option	Cases	%
Solicited	51	85
Solicited (1993), Unsolicited (2007)	1	2
No information	8	13
Total	60	100%

Source: ITWG Subgroup Output1

On the other hand, there are numerical numbers of submitted unsolicited proposals in Philippines and other developing countries of South East and South Asia, where LGUs don't have enough budget for such front-end cost. However, there are also a mountain of cases which private proposals without enough deliberation of the concept or master plan of LGUs' MSW management will be cancelled or not materialized because of market changing, loss of private interest, administration changes, etc.

As main concern, unsolicited proposal in the absence of LGU's sufficient WtE-ACC plan is mismatching of interests in both parties. Private company normally proposes the project within their interest in terms of technology, capacity and scope of works. If there is not well-engineered LGU's WtE-ACC project plan (conceptual plan, F/S, etc.), LGU cannot evaluate the proposal appropriately because LGUs don't have the project idea, which part of MSW systems to be contracted out to the private sector.

WtE-ACC is a waste treatment project as well as power generation project. Since implementation of municipal solid waste treatment as planned is the obligation of LGUs, LGU shall have right to handle the WtE-ACC project planning and implementation. By reducing the scope of works for private partner, LGUs decision flexibility can be increased. For the purpose to increase the number of private interest, national government shall specify minimum technical requirements and specifications, and local governments shall detail out the facility requirements based on local municipal solid waste management conditions and expectations.

Therefore, it is suggested that LGUs to prepare its MSW facility plan by themselves (not rely on private proposal at beginning). In which, main objectives and expectation of WtE-ACC facility, waste stream, scope of private company shall be at least presented. By this, evaluation of unsolicited proposals can be drastically reduced.

(3) Scope of Project

As discussed earlier, LGU shall be fully responsible for MSW management generated in their jurisdiction. Therefore, some parts of it LGUs can contract out to private partners in their sole

discretion. This case study attempts to figure out the scope of WtE-ACC private partner.

At first, all of LGUs orders construction of WtE-ACC facilities to the plant manufacturer. Since the complexity of the plant facility, not same as drawings-based order system applied in other public infrastructure such as road and bridges, performance-based ordering system is applied in most of WtE-ACCs. This is also called as design-build EPC (Engineering-Procurement-Construction) and in these cases, LGUs mobilize labors to operate and own WtE-ACC facility.

However, such direct operation requires LGU operators enough knowledgeable and experienced and not so practical for small LGUs who owns only one WtE-ACC, so, recently O&M services are also included in the initial procurement which is called as “Design-Build and Operate (DBO)” scheme. Further, while facility’s ownership and financing in DBO is still belonging to the local government, in BOT/BOO schemes financing as well as facility owning are handled by private partner.

Although these differences of business schemes (PPP modalities) are still discussion within WtE-ACC scope, **Table 4.20** shows the task allocation throughout the waste management flow (from collection to disposal of WtE-ACC residues) in each local government. Out of selected 11 WtE-ACC cases, there are no case which LGs contracts to WtE-ACC partner to do municipal solid waste collection and transportation services.

Table 4.20 Case studies on Scope of Works between Public/Private

Scope	Business Scheme	Collection	Transp.	Processing	Energy Sale	Bottom Ash	Fly ash	Remarks
Suginami Incineration Plant (ID103)	Public Build and Operate	LG	LG	CAT23 (Public)	CAT23 (Public)	CAT23 (Public)	Tokyo Metropolitan Government	
Kushiro Wide-Area Federation WtE Facility (ID109)	DB+O (15yrs)	LGs	LGs	Federation (Public)	Federation (Public)	Federation (Public)	Federation (Public)	
Funabashi South Incineration Plant (ID110)	DBO (15yrs)	LG	LG	SPC	LG	LG	LG	
Mito city incineration plant (ID111)	DBO (20yrs)	LG	LG	SPC	LG	SPC	SPC	
Tuas South WtE Plant (ID202)	Public Build (DB) and Operate	NEA	NEA	NEA	NEA	NEA	NEA	
Keppel Seghers Tuas WtE Plant (ID204)	BOT (25yrs)	NEA	NEA	SPC	SPC	NEA	NEA	
Nong Khaem WtE plant (ID205)	BOT (20yrs)	BMA	BMA	SPC	SPC	BMA	BMA	
Afval Energie Bedrijf Amsterdam (AEB) (ID301)	Public Build (DB) and Operate	AEB+LGs	AEB+LGs	AEB	JV with energy grid	AEB	AEB	
Issy-les-Moulineaux WtE plant (Isseane) (ID303)	DB+O	SYCTOM	SYCTOM	Private	SYCTOM	Private	Private	
Amager Bakke (ID307)	Public Build (DB) and Operate	LGs	LGs	ARC	ARC	ARC	ARC	
Palm Beach Renewable Energy Facility 2 (ID318)	DBO (20yrs)	SWA	SWA	PBRRC	PBRRC	SWA	SWA	

Notes) ■: responsibility of public entity, ■: responsibility of private partner,

(4) Implementation Schedule

Table 4.21 shows the required periods for the development of WtE-ACC by case study. Average project implementation timeline is 2.9 years for preparation of bid, 4.0 years for construction (including design) according to the cases in operation.

2.9 years from planning to bid announcement seems a bit longer. However, considering the longest case takes 5.3 years and there are a lot of projects which are not materialized, implementation bodies must know that due deliberation of facility plan as well as bidding document must be taking time.

With regard to the construction period, since most of facilities are ordered based on design-build basis, designing, construction and commissioning requires 4.0 years in average, at maximum 6.6 years. In minimum a case shows 2.0 years but this case only has the information of year, so actual construction period might be longer than 2 years.

In Japan, most of facilities are constructed/operated in line with the time schedule as planned, this eases local government projects future budget requirement and increases readiness of private partners participation.

With regard to the concession period of DBO contract, most of the cases range from 15 to 20 years and 20 to 25 years for BOT/BOO contract.

Table 4.21 Case Studies on the Duration of Original Plan to Bid and Construction

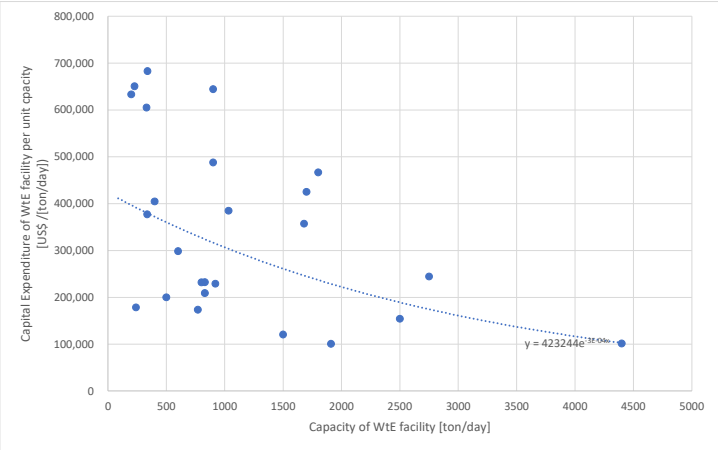
Duration (Years)	Effective number	Average	Maximum	Minimum*
Plan to Bid	15	2.9	5.3	1.0
Construction (incl. design)	37	4.0	6.6	2.0

Note: Some cases don’t have the month of bid or completion of construction so minimum years might be deliberated more.

4.2.2 Finances of WtE-ACC projects

(1) Capital Expenditure (CAPEX)

It is difficult to obtain the capital expenditure of WtE-ACC facilities. The few data that have been gathered are summarized in **Figure 4.17**. In Japan, only the aggregated project cost of DBO projects including O&M cost were obtained. Therefore, such DBO projects are removed from the estimation of CAPEX. The range of capital expenditure is from US$100,000 to US$700,000 per ton/day. As described in **Figure 4.17**, the capital expenditure per capacity tends to decrease as the capacity of WtE-ACC facility increase. Larger capacity WtE-ACC facility is recognized as more cost effective. In this sense, it is better to gather municipal solid wastes from plural LGUs if conditions to cluster can be satisfied such as consensus among LGUs on a reasonable cost of waste transportation.



Source: ITWG Subgroup Output1 based collected case studies

Figure 4.17 CAPEX of each WtE facility

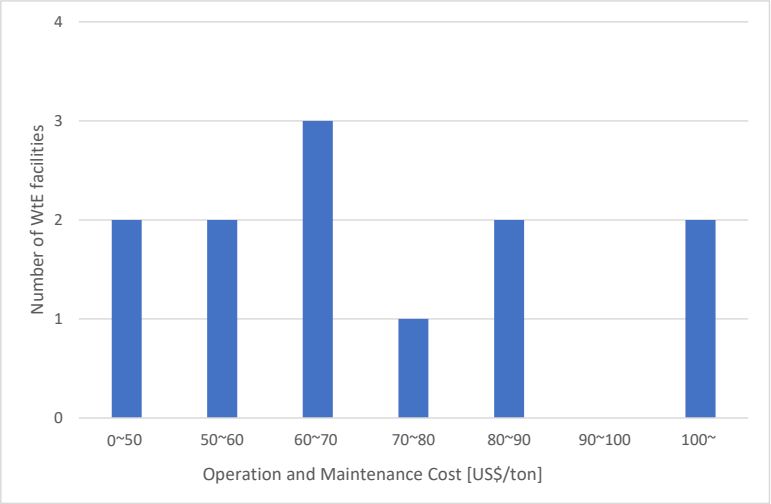
(2) Operation and Maintenance Expenditure (OPEX)

Operation and maintenance expenditure include fuel, electrical and material cost for chemical agent and personnel cost. In the case of WtE-ACC facilities, many parts of the operation are implemented automatically including combustion control, power generation, cooling system, pollution abatement system. The maintenance cost of combustion chamber or electric power generation is expensive.

The operation and maintenance cost of WtE-ACC facilities, especially in EU and Asian countries other than Japan are not published and are difficult to access. However, according to the data collected in Japan, the OPEX of incineration is approximately US$50 - 100/ton. There are two cases of more 100 US$, which will include overhaul maintenance cost. The data includes the DBO projects and Public Build and Own projects. There is no indication of significant differences between the costs of DBO projects and Public Build and Own projects.

The examples of breakdown of the O&M cost of WtE-ACC facility in cases of Japan are shown in **Table 4.22**.

In case of Shinkoto and Toshima, the ratios of maintenance cost are respectively around 37% or 44% of total cost. On the other hand, it is only 13% in case of Ota WtE-ACC facility. In case of Ota WtE-ACC plant, the rate of others is high including outsourcing of operation. The reason of low ratio of personnel cost like only 5% will be also due to the outsourcing of operation of the WtE-ACC.



Source: Consolidated by ITWG subgroup opuput1

Figure 4.18 OPEX of each WtE facility

Table 4.22 Examples of Operation and Maintenance Cost of WtE-ACC Facility (Japan)

Item	Unit	Shinkoto (ID102)		Toshima (ID123)		Ota (ID101)	
Personnel cost	million US$	7.0	22%	1.9	13%	0.7	5%
Utility cost	million US$	2.3	7%	0.8	5%	0.9	6%
Maintenance	million US$	13.8	44%	5.2	37%	2.0	13%
Ash handling	million US$	4.7	15%	1.3	9%	3.2	21%
Others	million US$	3.6	12%	5.0	35%	8.3	55%
Total O&M cost	million US$	**31.4**	**100%**	**14.2**	**100%**	**15.0**	**100%**
O&M cost	US$/ton	76.4	-	154.1	-	86.8	-
Wase amount	1,000 ton/yr	411.6		92.1		173.1	

Source: Clean Authority of Tokyo (2019)

4.2.3 Public Involvement, Information, Education and Communication (IEC)

Consensus with public, and public involvement is an essential part of the smooth implementation of WtE-ACC project. Most of the countries have their own EIA systems, which facilitates the public involvement process of the project. As part of the process of EIA, public hearing and public consultation meetings are held during the planning and design stage. In case of Japan, the procedure of public consultation meeting for WtE-ACC project is stipulated in the act or ordinance of either National or local government. A public consultation meeting is open to anyone including residents near the site, NGO, academic experts. The meeting date or venue and the project profile are disseminated before a certain day and the project so that the participants have time to prepare the questions or explain their opinions.

In the EIA procedure, normally, regular environmental monitoring including the relevant information of WtE-ACC operation, especially quality of exhaust gas, water quality, if it is discharged, is

mandatory.

WtE-ACC facilities accept facility tours by the public including residents, NGOs and students so that the WtE-ACC operator can verify their environmental compliance and performance of municipal solid waste treatment. The tour is often utilized as an opportunity of environmental education to visitors as well. The visitors of WtE-ACC are reminded and encouraged to think about solid waste issues, their lifestyle and behavior in daily life. Some pictures from a WtE-ACC facility tour exhibiting the environmental education area, air quality monitor in a WtE-ACC facility is shown in **Figure 4.19**.

<table>
<tr><td> 
</td><td>  </td></tr>
<tr><td>WtE-ACC Facility Tour for Residents</td><td>Exhibition Zone for Visitors</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Explanatory Panel for Visitors</td><td>Disclosure of Quality of Emission Gas from WtE-ACC</td></tr>
</table>

Source: Clean Authority of Tokyo

Figure 4.19 Examples of Environmental Education and Information Disclosure at WtE-ACC

4.2.4 Cost-Sharing Scheme for WtE in Neighboring Countries

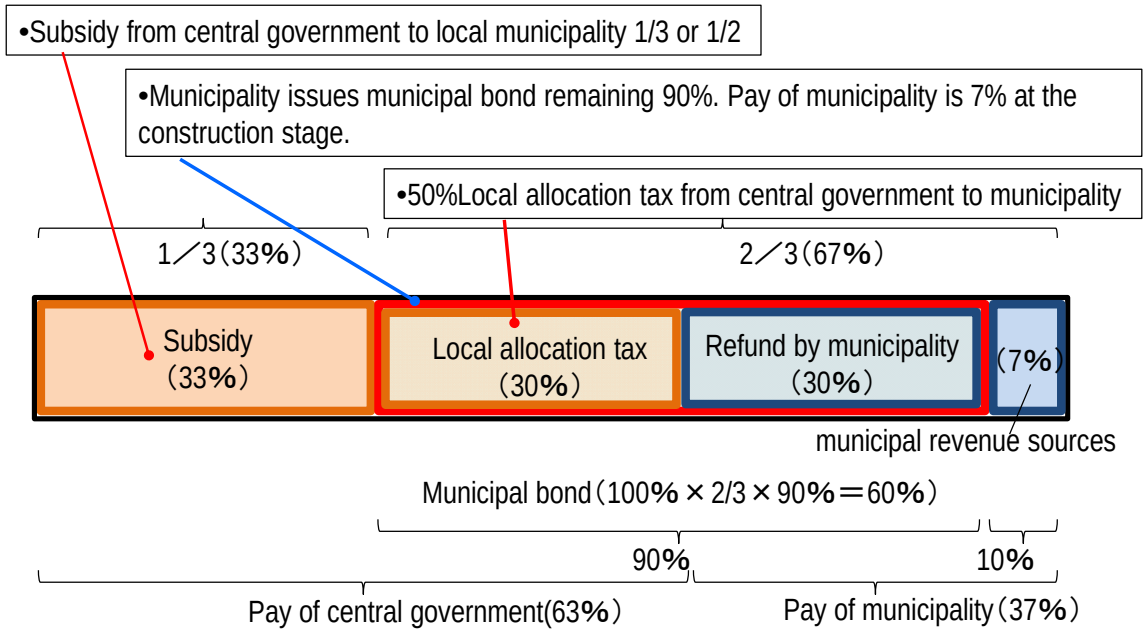
(1) Funding support for SWM facilities by National Government in Japan

In Japan, to promote a sound material cycle society, the National Government grants one thirds of the initial investment if SWM facilities including WtE-ACC facility meets certain conditions. The outline of Japanese funding support scheme for SWM facilities is summarized in **Table 4.23**. Besides, a half of the portion funded by municipal bonds will also be reimbursed by the local allocation tax from the National Government as shown in Source: ITWG Subgroup Output1

Table 4.23 Summary of Japanese Funding Support Scheme for SWM Facilities

Objective	・ Supporting municipalities for establishing a sound material-cycle society
Eligible facilities	・ Material recycling facility ・ Incombustible and plastic recycling facilities, stockyards, etc. ・ Energy recovery type waste treatment facility ・ Waste power generation facilities, heat recovery facilities, biogas facilities, etc. ・ Organic waste recycling facility ・ Facilities for recycling human urine & organic waste ・ Septic tank ・ Final disposal site
Grant rate	・ 33% of facility construction cost (50% in case of advanced facility)

Source: ITWG Subgroup Output1 by referring to the website of Ministry of Environment Japan



Source: ITWG Subgroup Output1

Figure 4.20 Funding Support Scheme for SWM Facilities in Japan

(2) WtE-ACC project promotion by PPP scheme in Indonesia

The Government of Indonesia declared promotion of WtE-ACC projects in the country and designated the 12 priority areas for development of WtE-ACC facilities by the Presidential Decree No. 35 enacted in 2018. Although the WtE-ACC facility is not yet operational in Indonesia, some local governments are currently preparing to develop WtE-ACC projects.

The following policy instruments were installed in Indonesia to promote WtE-ACC projects by PPP scheme:

A) Viability Gap Funding (VGF): Government's subsidy for investment cost of PPP projects
A financial support funded by Ministry of Finance, to support establishment of PPP projects by providing part of construction cost for projects with high social benefits but low profitability.

- Form of payment: cash.
- Eligibility for payment: part of construction cost.
- Timing of payments: stipulated in PPP project agreement.
(Certain stages during construction period and commercial operation date.)
- PPP projects implemented by LGUs can be funded from LGUs' fund in addition to VGF.

B) Availability Payment (AP): Government's subsidy for operational cost of PPP projects.

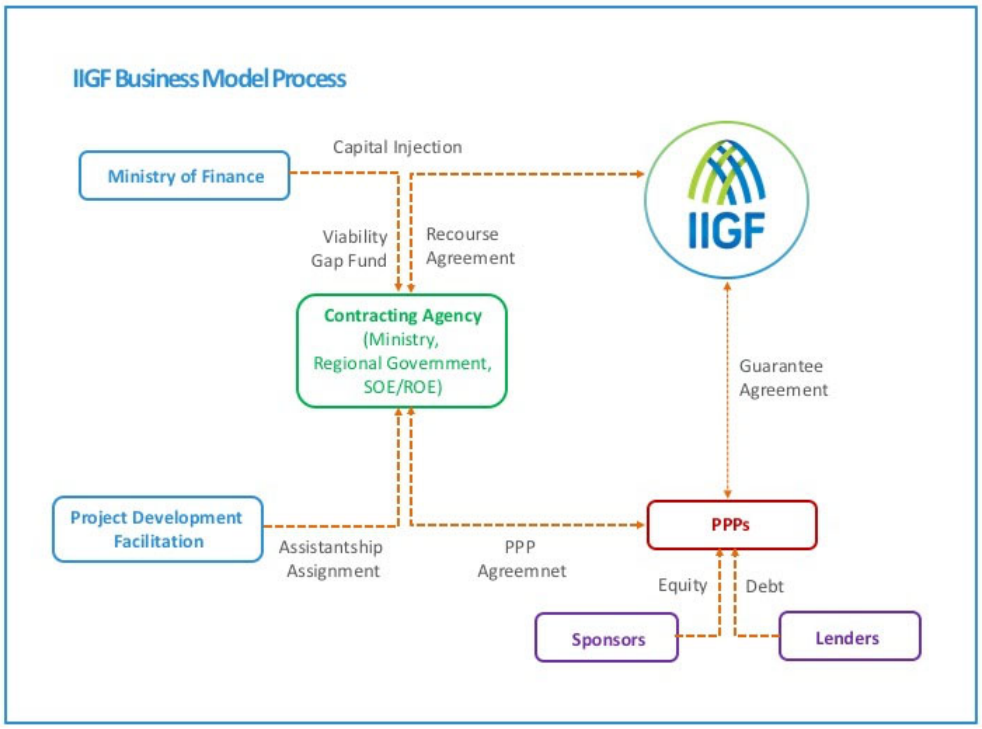
A system whereby Government Contracting Agency (GCA) promises a fixed payment to the private operator in return for the provision of infrastructure services at a specified quality under a PPP contract. Adequate return on investment for PPP projects involving operation & maintenance of infrastructure over a long term can be guaranteed from private operator's perspective.

C) Feed-in-tariff: set at US¢13.35/kWh

D) Indonesian Infrastructure Guarantee Fund (IIGF): Government's guarantee for PPP project

IIGF is a public guarantor established and 100% owned by Ministry of Finance. IIGF guarantees the performance of GCA in PPP projects and promises financial compensation on behalf of GCA in case GCA defaults on its obligations, thus making a significant contribution to reducing risk of private operators. In PPP projects where IIGF guarantee contracts are signed, three types of contracts (i) PPP project contract, (ii) guarantee agreement, and (iii) recourse agreement are basically signed by private sector, GCA, and IIGF. **Figure 4.21** illustrates the business model process of IIGF.

- PPP Project Contract:
  A PPP project contract is concluded between Private Operator and GCA, which stipulates rights and obligations related to a PPP project.
- Guarantee Agreement:
  IIGF and Private Operator will conclude a guarantee agreement for a PPP project. This agreement will guarantee performance of a PPP project contract by GCA.
- Recourse Agreement:
  In addition to the above, IIGF will enter into recourse agreement with GCA. If certain requirements are met, IIGF will make payments to Private Operator on behalf of GCA in response to payment requests by Private Operator. Then, IIGF will collect recourse payments from GCA under this Recourse Agreement.



Source: IIGF, Indonesia

Figure 4.21 IIGF's Business Model Process

(3) Feed-in-tariff (FIT) for WtE

Feed-in Tariff (FIT) is a policy mechanism under the Republic Act No. 9513 or the Renewable Energy Act of 2008 which is designed to accelerate development and investment in renewable energy (RE) technologies by offering long-term contracts to renewable energy producers. It is one of the regulatory tools to promote private sector investments in renewable energy. Under this scheme, RE generators are guaranteed purchase of their power generation at a cost-based price with reasonable rate of return on investments over a long period of time.

The FIT Rules was promulgated by the Energy Regulatory Commission (ERC) on 12 July 2010 per ERC Resolution No. 16, Series of 2010. FIT is a Non-Fiscal incentive scheme that offers guaranteed payments on a fixed rate per kilowatt-hour for electricity sales for qualified renewable energy producers. The ERC further issued Resolution No. 10 Series of 2012 on 27 July 2012, approving the FIT rates and equivalent degression rates corresponding the installation target set per RE technology.

After the 3-year FIT regime which ended on December 2017, Installation target for run-of-river (ROR) hydropower and biomass technology were undersubscribed and reasons for such include issues on permitting and licensing. With this, the FIT System for the two (2) technologies were extended until end of 2019 or until full subscription of the installation targets. As of 31 December 2019, the period for qualification of FIT for biomass has ended and fully-subscribed. Meanwhile, the extension of the FIT System for ROR hydropower shall continue until full subscription of the 250 MW installation target is achieved.

The FIT scheme applied for WtE projects in the Philippines as well as for other Southeast Asian countries is summarized in **Table 4.24**. It is noted that the Republic of the Philippines had applied FIT scheme for renewable energy such as wind, biomass (including WtE-ACC), solar and run-of river hydropower pursuant to ERC Resolution No. 10 Series of 2012. Application of the FIT for WtE-ACC project as one of biomass energy is already expired as the set installation target was achieved.

Table 4.24 FIT applied to WtE Project in the Southeast Asian Countries

Country	Enforcement	Tariff (US cent/kWh)	Condition, Remarks
Indonesia	2018	13.35	Capacity: < 20MW
		14.54 – (0.076 * [Capacity])	Capacity: > 20MW
Thailand	2015	20.9	Capacity: < 1MW
		19.2	Capacity: 1~3MW
		16.8	Capacity: > 3MW
Vietnam	2014	10.05	Applied for incineration
		7.28	Applied for landfill gas
Malaysia	2011	6.5 – 7.4	Applied for biomass/biogas
Philippines	**2013**	**13.3 (0.5% degression rate after 2years from effectivity of FIT)**	**Installation target – fully subscribed Period for qualification – ended on 31 December 2019**
Japan	2019	23.8	

Source: ITWG Subgroup Output1

Chapter 5. Lessons for WtE-ACC Facility in Philippines

5.1 Summary of Case Studies

The main results of the case studies regarding technical, institutional and financial aspects are described **Table 5.1** and **Table 5.2**.

Table 5.1 Summary of Technical Aspects of Case Studies

Item	Confirmations in the Case Study
(1) Capacity	- The capacity of WtE-ACC ranges from less than 100 ton/day and may reach to a few thousand ton/day, adopting multiple lines of combustion furnace in the case of large capacity facilities. - A maximum of 4,400 ton/day is confirmed. - The capacity is decided according to the waste amount estimated by the municipal solid waste management and facility plans. - A maximum treatment capacity of a single furnace of stoker type was confirmed 1,000 ton/day in the study.
(2) Combustion Technology	- The stoker type of furnace is adopted in 78% of cases (47 out of 60 cases). This trend is confirmed in all regions in the study. - The moving grate enables the movement of waste promoting a more efficient and complete combustion. - Fluidized bed yields a liquid-like state through contact with a fine solids and sand to promote combustion state.
(3) Area	- A range of 2 to 4 ha is needed for every 1,000 ton/day of generated waste, and additional space is necessary for larger capacity facilities. - The WtE-ACC facility can be constructed even in the urban area by minimizing area and appropriate pollution control measures.
(4) Target Waste	- Target waste of WtE-ACC is mostly municipal solid waste which is decided for every WtE-ACC facilities. The definition of target waste cannot be uniformly same for all facilities. - Segregated waste may be fed to the WtE-ACC facility while the furnace may combust most of type of substances. - Segregation is practiced all LGUs in Japan, Mechanical Biological Treatment (MBT) or MRF is commonly operated in EU for segregation before combustion. - While main target is municipal solid waste, some cases accept sewerage sludge or industrial waste in addition to the municipal solid waste.
(5) Physical Composition of the Target Waste	- Physical composition data obtained from Japan cases and Vietnamese case clarified that the combustion technology can offer flexibility of physical composition of municipal solid waste, but the LCV of the targeted waste must be checked during the facility planning stage to design the facility accordingly.
(6) Lower calorific value	- The range of average designed LCV is 4,200 (India case) to 14,000 kJ/kg (Finland case) which also verify the technical flexibility of combustion technology. - The value of the cases in Southeast and South Asian countries are lower than those in the developed countries. It is supposed that this is due to the condition of economy and application of separate waste collection.
(7) Energy Recovery	Electricity Generation Efficiency - Combined cycle is applied in some cases for high efficiency of electricity generation. In these cases, steam turbine generates electricity by using 1) exhausted gas from waste incineration, and 2) exhausted gas from gas

Item	Confirmations in the Case Study
	turbine generation by other energy sources at the same time. - Higher steam temperature and pressure, which enable high electricity generation efficiency are confirmed in cases of EU. These temperature and pressure may cause corrosion of boiler pipe in a shorter operation time. Maintenance measures may also help in keeping the boiler pipes in good condition. Thermal energy utilization - Hot water supply to spa/swimming pool and heat supply to botanical garden are practiced.
(8) Ash treatment	Bottom ash - Bottom ash is treated in a bottom ash treatment unit in a series of steps which separate metal from the ash. Iron scrap and non-ferrous metals are recycled after the separation. - Many facilities try to recycle bottom ash as cement material or construction material. - Bottom ash is utilized as a material for cement processing construction material as confirmed in Japan cases, - In the case of EU, it is used for construction material as substitute materials for aggregates. - Recycling of bottom ash may require additional cost to be accepted by off-takers as practiced in Japan. Fly ash - Fly ash is handled in methods such as ash melting, chemical agent, disposal in hazardous waste disposal site. - In some cases in EU, fly ash is being disposed in the closed mine as well as in landfill sites after stabilization.
(9) Pollution control (Exhausted Gas)	- Facility standards stricter than the environmental standards set by the government are adopted in most cases. - Application of the stricter standards may ease the public acceptance.
(10) Pollution control (Wastewater)	- In the closed system of wastewater, wastewater treatment facility is not required in the WtE-ACC. The facility does not discharge wastewater to public water body, which is recognized as a good practice for the environment, and also has positive repercussions to the O&M cost. - Discharge to sewerage system eases the operation load of wastewater treatment in the WtE-ACC facility.
(11) Waste segregation before combustion	- All cases of Japan apply source segregation of municipal solid waste. - In the cases of EU commonly apply Mechanical Biological Treatment (MBT) or MRF to segregate municipal solid waste to be treated by WtE-ACC.

Source: ITWG Subgroup Output1

Table 5.2 Summary of Institutional and Financial Aspects of Case Studies

Item		Confirmations in the Case Study
Financial scheme		- In the case of Japan, most of the collected case studies are Public Own & Operate or Public Own & Private Operate (subcontract) - In the case of EU, around half of the case studies are BOT, however, there are many cases with no clear description of project scheme
Development approach (Solicited or unsolicited)		- A solicited approach was taken in about 80% of cases (51 out of 60 cases). - In the case of solicited approach, LGUs are involved in the establishment of WtE-ACC facilities as early as the planning stage, therefore, they have detailed knowledge of the parameters and the capacity that will be developed. Therefore, fundamental plan of municipal solid waste management should be prepared in the early stage of LGUs.
Implementation schedule		- Planning (2-3 years), Design (around 1-2 years), Construction (2-4 years), - More than five years from planning to operation commencement - Operation period is around 20 to 30 years
Financial Aspect	- Subsidy from national government	- In the case of Japan, supporting municipalities for developing WtE-ACC facility to establish a sound material-cycle society - In the case of EU, there are some subsidies from EU or European Investment Bank (EIB)
	- Revenue	- In the case of Japan, most of the revenue come from the tax of local government, the benefit by selling electricity, heat energy and recyclable - In the case of EU, most revenue will be the benefit by selling electricity and heat energy, and local government compensate the deficit by availability payment
	- Capital Expenditure (CAPEX)	- The range of capital expenditure is from US$100,000 to US$700,000 per ton/day. - The local financial situation, type of WtE-ACC facilities, etc. will affect the capital expenditure.
	- Operation expenditure (OPEX)	- The range of OPEX is around from US$50/ton to US$100/ton. This will be affected by labor cost, utility cost as well as type of combustion technology, project scheme including contract condition, etc.
Public Involvement, IEC		- During the planning process, through the EIA or SEA, public consultation meetings have been held. - To obtain the community acceptance, architectural design or supplemental facility by utilizing surplus thermal has been considered and applied. - There are some cases of dissemination of environmental monitoring data through panel display.

Source: ITWG Subgroup Output1

5.2 Lessons

Through the analysis of case studies, the trend of best adaptable techniques and best environmental practices have been grasped. The following points will be mainly utilized for WtE-ACC development process in the Philippines as good practices.

(1) Target Waste

- The LGUs shall decide or check the target waste to be treated in their WtE-ACC facility according to their municipal solid waste management plan so that the responsibility to manage the municipal solid waste generated and collected in their jurisdiction can be taken.

- Same as stipulation by DAO2019-21, nowadays, the waste segregation practiced commonly before treatment by WtE-ACC facility. The segregation practice, methodology and technology in the countries where WtE-ACC facilities are already operated can be references to the LGUs in the Philippines, while LGUs have to evaluate if such ways are appropriate for their municipal solid waste management.

(2) Combustion Technology and Treatment Capacity

- Stoker (moving grate) is the most commonly adopted because of track record, historical success, and variety of treatment capacity. this technology is more reliable due to long term experience and can handle a large amount of solid waste. Since, the operation period of WtE-ACC facility is long as 20 years or more, the technology shall be evaluated carefully.

- One thousand (1,000) tons of solid waste per day can be treated by a single furnace of stoker type. The treatment capacity of a combustion furnace of fluidized bed combustion is much smaller (200ton/days is confirmed in the case study) than stoker type while it has strong point in a smaller space requirement than stoker type. The LGUs shall evaluate which type of furnace is appropriate for their municipal solid waste amount.

(3) Area

- The area can be minimized according to availability of land and the conditions of the surrounding area. Although it is confirmed that the area of 2 ha per 1,000 tons/day is necessary, it is also confirmed that the WtE-ACC facilities have been constructed and operated in the populated and urbanized area.

(4) Energy Recovery

- The electricity generation efficiency has been improved as the treatment capacity of WtE-ACC facilities become bigger.
- However, to achieve very high efficiency of electricity generation, higher cost could be required.
- The following procedure could contribute to improve the efficiency of energy recovery;
  - Increase of exchange capacity such as utilization of low temperature economizer
  - Increase of boiler temperature and pressure, effective utilization of steam
  - Increase of the efficiency of steam turbine system such as introduction of steam condensing turbine and combined cycle with thermal power plant, etc.
  - Increase of thermal energy by increase of waste quantity and LCV.

(5) Pollution Control

- Environmental standards of WtE-ACC facility is set as stricter than the National standards in the case of the developed countries. It means that such stricter standards can be met by installing appropriate pollution control technology and eases making public consensus for its development.

(6) Ash Handling

- Bottom ash and fly ash shall be separately handled and treated.
- In the case of bottom ash, after the separation of recyclable, the residue of bottom ash may be utilized as cement aggregate, or other construction use such as backfilling material, roadbed after its melting, baking and aging. While the solid waste amount for disposal can be reduced by these utilizations, such utilization sometime requires additional cost and could be revenue source depending on the market condition of the reused materials.
- Because fly ash contains heavy metal or other toxic materials, it should be stabilized by cement solidification, chemical treatment, or dispose at hazardous waste landfill site.

(7) Business Scheme

- During the planning and design stage, local government should prepare or evaluate an overall plan for the WtE-ACC facility, along with the technical specifications.

- It was confirmed that a solicited approach was adopted in almost all cases in the case study. This is the fact that the WtE-ACC projects took this approach could reach to the construction and operation. Proposals from the private sector are based on the private sector's technical and financial capacity, which may not be best for the improvement of solid waste management in the LGUs unless appropriately oriented before preparation of the proposal.

(8) Public Involvement and IEC

- During the planning process, public consultation should be implemented. The EIA including public consultation are executed in the WtE-ACC development, which facilitates the citizen's understanding on the project as well as situation of municipal solid waste management of their LGUs.

- As practiced in the developed countries, environmental monitoring reports for WtE-ACC operation should be regularly prepared and disclosed. The information relevant to WtE-ACC operation, such as air quality monitoring of exhaust gas or water quality monitoring of wastewater are to be reported.

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REPUBLIC OF THE PHILIPPINES
PUBLIC-PRIVATE PARTNERSHIP CENTER

Knowledge Sharing Session (KSS) on Waste-to-Energy Best Available Technologies (BAT)/ Best Environmental Practices (BEP) Guidelines

Background

The PPP Center has identified solid waste management (SWM) as one of its emerging sectors due to the increase in both public need and private interests. As part of its initiative to contribute in the advancement of the sector, the PPP Center has actively participated in the Technical Cooperation Project (TCP) entitled, "Project for Capacity Development on Improving Solid Waste Management through Advanced/Innovative Technologies in the Republic of the Philippines" headed by the Department of Environment and Natural Resources (DENR) and the Japan International Cooperation Agency (JICA).

The TCP includes the issuance of DENR Administrative Order (DAO) 2019-21, a guideline on evaluation, establishment, operation and decommission of WTE facilities for integrated management of municipal solid waste. Currently, the TCP also covers the development of the Best Available Technologies (BAT)/ Best Environmental Practices (BEP) Guidelines for WTE which will provide information on some of the best available technologies and best environmental practices through a survey of cases studies in Asia, Europe and America with more detailed technical, institutional and financial information on WTE.

A Work Plan for the technical assistance of the JICA Expert Team to the PPP Center was finalized on July 28, 2021 which includes the conduct of a KSS on SWM for the PPP Center employees and the assistance in developing SWM projects.

Resource Persons

Representatives from the JICA Expert Team, DENR-Environmental Management Bureau (EMB) and the PPP Center will be the resource speakers for the KSS.

Participants

- The PPP Center employees and consultants are the target participants for the KSS.
- Invitations to implementing agencies and local government units will also be extended

Schedule and Location

The KSS will be scheduled on November 22, 2021 (Monday) and will be conducted through MS Teams.

Program

Time	Activity	Resource Person
1:30PM – 1:45PM	House Rules and Introduction	Program Moderator
1:45PM – 2:00PM	Welcome Remarks	**Atty. Mia G. Sebastian** Assistant Secretary and Deputy Executive Director, PPP Center
2:00PM – 3:00PM	Highlights of the DAO 2019-21	**Ms. Elvira S. Pausing** Program Manager, Solid Waste Management Division, DENR-EMB

2:30PM – 3:00PM	Overview of the BAT/BEP Guidelines	**Mr. Takahiro Kamashita** Chief Advisor, JICA Expert Team
3:00PM – 3:30PM	Incorporating the BAT/BET Guidelines to the Minimum Performance Standards and Specifications (MPSS) in PPP Projects	**Mr. Jon Alan M. Cuyno** National Consultant, PPP Center
3:30 – 4:00 PM	Private sector participation in SWM Projects through PPP arrangement	**Atty. Lerma L. Advincula** Director IV, Project Development Service, PPP Center
4:00PM – 4:30PM	Open Forum and Wrap-up	Program Moderator

Guide on Assessing Unsolicited Joint Venture Proposals of Waste-to-Energy Projects

1. Background

One solid waste management solution that is gaining interest among LGUs is waste-to-energy (WTE) projects that are implemented through the PPP scheme. The private sector also recognizes the viability of these projects. As number of LGUs have been receiving unsolicited proposals to implement Waste-to-Energy (WTE) projects through a joint venture (JV) scheme. A knowledge product is thus needed to guide LGUs in evaluating these proposals.

Commented [Makoto1]: Let us correctly understand the JV scheme in Philippines, is it co-investment to the SPC by equity in money or equity in-kind (such as land) and LGU will keep some part of shareholding ratio thru the project scheme?

2. Objectives

The objective of the guide is to capacitate LGUs in reviewing unsolicited JV proposals of WTE projects, including assessing the risks and mitigating measures involved in these projects.

3. Scope and limitations

a. The Guide shall focus on the review and assessment of unsolicited JV proposals of WTE projects covered by the LGU's local PPP Code.

b. It is assumed that the guide shall be used by LGUs with an enacted local PPP Code and have received unsolicited JV proposals of WTE projects focused on the treatment of waste.

Commented [Makoto2]: It might be better to focus on Municipal Solid Waste (not industrial and hazardous).

c. The Guide excludes WTE projects undertaken under Republic Act No. 7718, or the BOT law. It also excludes a discussion on the most appropriate WTE technology.

Commented [Makoto3]: Pls kindly let us know the meaning of this "c", why the guide is excluding BOT (are there such big difference between BOT and JV)?

4. Definition of terms

a. **Joint Venture-** an arrangement whereby a private sector entity or a group of private sector entities on one hand, and an LGU or group of LGUs on the other hand, contribute money, capital, services, assets (including equipment, land, intellectual property or anything of value), or a combination of any or all of the foregoing, to undertake an investment activity. The JV involves a community or pooling of interests in the performance of an investment activity, and each party shall have the right to direct and govern the policies in connection therewith with the intention of sharing both profits and risks and losses, subject to agreement by the parties.[1]

Commented [Makoto4]: By this explanation, we understand JV scheme contains LGU's contribution to SPC's shareholding.
If so, QC ISWMF (deems 5% of share will be given to QC as the royalty) is also JV and not BOT?

b. **Unsolicited proposal -** refer to project proposals submitted by the private sector not in response to a formal solicitation or request issued by the local government unit.[2]

5. Guiding principles

[1] Joint venture as defined in Section 5.1.2 of DILG- PPP Joint Memorandum Circular(JMC) 2019-01, basing the definition provided under the "Guidelines and Procedures for Entering into Joint Venture Agreements Between Government and Private Entities" issued by the National Economic and Development Authority in 2013

[2] Section 5.1.2(b) DILG-PPP JMC 2019-01

a. In undertaking WTE PPP projects, the principles of the waste hierarchy, waste minimization, source segregation and collection, as described in RA 9003, shall be followed[3].

b. In all cases, WTE PPP projects must be consistent with the local SWM plans as approved by the National SWM Commission[4]. Said projects must ensure the protection of public health and the environment, and utilize environmentally-sound methods that maximize the utilization of valuable resources and encourage resources recovery, among others[5].

c. In evaluating WTE-PPP projects, LGUs shall encourage healthy competition and a level playing field among qualified private sector proponents[6].

d. Pursuant to its mandate[7], the PPP Center shall assist LGUs in reviewing WTE- PPP projects. Such assistance shall include: assistance in assessing the readiness of the LGU to implement the project, and the eligibility of the private sector proponent to undertake the proposed SWM-WTE- PPP project, as well as reviewing the technical and financial viability of the project, as well as its legal compliance. Assistance of the PPP Center also extends to other stages of the PPP life cycle including negotiation, procurement and competitive challenge stage.

6. Readiness Assessment

a. The LGU should assess if it is ready to undertake a WTE project. This may be done by answering the readiness assessment in *Annex 1*. If the LGU is able to address the questions listed in Annex 1, and is confident that all the conditions are met, then it may proceed to the next step.

b. ~~Ideally, prior to reviewing an unsolicited proposal, baseline SWM information should be available in the LGU's approved 10-year SWM plan,[8] or if applicable, in the LGU's Integrated SWM Plan. The minimum baseline information required is provided in *Annex 1*. While the Annex is not an exhaustive list, it should provide the LGU with a perspective of the relevant data requirements, as well as any additional surveys, e.g. willingness-to-pay surveys, market surveys, etc. to be carried out. The LGU may also refer to the FS for these information (something like this) having this will help the LGU review the FS.~~

7. Completeness check of the Unsolicited Proposal

a. The purpose of checking the completeness requirements of an unsolicited proposal is to ensure that the LGU has the complete set of documents to evaluate the eligibility of the private proponent to undertake the project, as well as the merits of the project. LGUs should therefore review if the submitted unsolicited proposal is complete upon receipt of the unsolicited proposal.

[3] Republic Act No. 9003, Section 2(c),
[4] Ibid., Section 5(b)
[5] Ibid., Section 2(b)
[6] R.A. 9184 (Government Procurement Reform Act), Section 3(b); Department of the Interior and Local Government (DILG) Memorandum Circular No. 2016-120 (Guidelines for the Implementation of PPP for the People Initiative for Local Governments [LGU P4]), Section 10
[7] Executive Order (E.O.) No. 8, series of 2010 (Reorganizing and Renaming the Build-Operate-Transfer Center to the PPP Center Of The Philippines and Transferring Its Attachment from the Department Of Trade And Industry to the National Economic And Development Authority And For Other Purposes) and E.O. No. 136, series of 2010 (Amending Certain Sections of E.O. No. 8, series of 2010)
[8] For more information on the data that should be contained in a 10-year SWM Plan, please refer to the DENR-EMB's Guidebook for Formulation of Solid Waste Management Plan.

Commented [Makoto5]: To be accurate, this part suggest to be replaced by;
"waste minimization by waste avoidance and volume reduction, as described in RA9003, shall be followed."
Segregation and collection is not directly contribute volume minimization in fact.

Commented [Makoto6]: At this moment, does PPPC have any support to LGUs for the monitoring activities in construction and operation phase?

Commented [Makoto7]: You are?

Commented [AM8R7]: Are they really to undertake?
It is for the LGUs to determine their readiness

Commented [Makoto9]: It is also repeatedly mentioned in Annex 1, JET strongly recommend LGUs to have their facility plan (as public side feasibility study) which at least figure out the expected capacity of WtE, technology(ies) to be applied for, then how to prepare input WtE feedstock as well as how to dispose output WtE residues in LGU side.
LGU is responsible for WHOLE waste management system in their jurisdiction so it is highly recommended to specify which part of the system will be ordering to the private side.

Commented [TK10R9]: JET understand the capacity limitation of LGUs for elaboration the feasibility study. JET does recommend LGU to utilize the experienced consultant to elaborate the public side feasibility study under LGU's supervision.

Commented [Makoto11]: To craft the 10 years plan with WTE, LGU might need advice by WTE experts as Kitakyushu City of Japan is supporting Davao.
It is deemed impossible for other LGUs to prepare 10 years plan with practicable WTE system without such assistance.

Commented [Makoto12]: We recommend that simpler check should be primary done which of course include technical expert evaluation (full FS as well as draft PPP agreement are not necessary at this stage). LGUs in Philippines often spend a lot of time to evaluate legality and financial viability of the project as if the project is already approved while technical realism is not evaluated appropriately. JET evaluates it is caused by no resources for WTE engineer in the Philippines. But early involvement of WTE expert gives reality.

Commented [TK13R12]: Simple check list prior to completeness check could be included in this guide.

b. To determine whether the submitted unsolicited proposal is complete or not, LGUs must examine if the submitted unsolicited proposal meets the completeness requirements identified in their respective PPP Codes. In the absence of such provision in their PPP Code, the LGU may refer to *Annex 2*.

c. If needed and allowed under the LGU's PPP Code, the LGU may request for additional documentation in order to support/clarify initial documents submitted.

d. The LGU shall inform the private proponent whether the proposal is complete or incomplete within the stipulated period in the PPP Code. In the event there is no stipulated period, LGUs are recommended to adopt the 15-day period under Republic Act No. 11032 or the Ease of Doing Business and Efficient Government Service Delivery Act of 2018.

e. In the event the proposal is deemed complete, the LGU may proceed in evaluating the eligibility of the proponent and the project. Should the LGU deem the submission incomplete, the proponent is allowed to resubmit an unsolicited proposal with complete documents, provided such is not prohibited in the LGU P4 code.

Commented [Makoto14]: What is this?

8. Eligibility Assessment

a. An eligibility assessment is necessary to ensure that the private proponent has the necessary legal, technical and financial capability to undertake the WTE project. The general eligibility of private proponent is determined by the provisions of the LGU P4 Code. In the absence of such provision in their PPP Code, the LGU may refer to *Annex 3: Eligibility Checklist* for guidance.[9]

Commented [Makoto15]: In many cases in WTE, financial provider as investor and technical provider as plant manufacturer are different. So, it's highly recommendable for LGU to request BOT proponent to provide a certainty which reliable technology will be employed with evidence (e.g. basic design and cost estimation from technical provider). Again, only investor's experience is not enough to assess the technical eligibility.

Commented [PFD16]: We would like to ask JICA if you would be able to assist us here.

Commented [Makoto17R16]: Yes, we can draft this Annex for your reference. Basic concept is shown below for your comment;

This should be for both investor (JV leader) and EPC (or core engineering parts provider in case if EPC will be local partner).
JV leader must have same or similar project experience in Philippines and/or worldwide.
Plant designer must have EPC or EP experience (with provision of performance guarantee) for same specific technology in his home country at least 10 or more and internationally 3 or more, for example.
Ideally, successful operation durability is also better to have, which is normally same duration with proposed PPP contract period.

In both cases, authenticity check must be conducted by interviewing and certifying by the governmental body who provide PPP contract/waste.

b. For WTE projects, the following must be considered in assessing the eligibility of the private proponent:

i. **Legal compliance.** The private proponent must be able to meet existing legal requirements for an entity to undertake a WTE project. This includes complying with nationality, ownership and registration requirements under existing laws

ii. **Technical capacity/WTE Experience of the private proponent**. The LGU must examine if the private proponent has done WTE projects in the past, whether locally or internationally. If there is a local precedent, the LGU may consult the said municipalities or cities, to gather feedback on the private proponent's performance. The LGU may also refer to Annex ___ containing the minimum technical capacity required for WTE project.

iii. **Financial capacity to finance the construction, operation and maintenance of the WTE project**. Given the capital-intensive nature of WTE projects, it is important for the private proponent to have good financial standing and maintain this throughout the duration of the project. This can be assessed by (1) examining the financial statement/s, and latest tax returns of the private proponent, and (2) asking the private proponent to submit a letter testimonial from a domestic universal/commercial bank attesting to its good financial standing and ability to obtain the credit accommodation needed for the proposed WTE project.

iv. **History of the private proponent's compliance/non-compliance with social, environmental and gender laws, rules and regulations**. The LGU must also check if the private proponent has any previous history of health, safety, environmental and

Commented [Makoto18]: Agree, but how to check health, safety, environmental and social violations in the other countries? It will not be disclosed such negative information normally so some functions should be developed.
With regard to the environmental compliance, for example, JV who can provide hourly exhaust gas measurement data (of course they're complying with standard) will be given higher scoring point compare with JV who can't provide same.

Commented [TK19]: How about other laws/rules?

[9] Reference: Annex A, Section IV.2 of the 2013 NEDA JV Guidelines and Section 17 of Annex 1 of JMC No. 2019-01)

social violations. WTE projects come with environmental and social risks. It is best for the LGU to partner with a private proponent who can safeguard these concerns.

c. The LGU may also refer to *Annex G: Frequently Asked Questions in the Prequalification of the USP Proponent of the PPPGB Guideline on Management Unsolicited Proposals Under Republic Act No. 6957* of the for additional information.

d. Once the LGU has established that the private proponent is eligible, it may proceed with the detailed evaluation of the project.

9. Evaluation of the Unsolicited Proposal

a. An unsolicited proposal shall be evaluated in terms of socio-economic, technical, financial, legal and institutional merits pursuant to the provisions of the LGU PPP Code. In the absence of such provision, the LGU may refer to Annex 4"Guide Questions for LGU Assessment of an Unsolicited Proposal for reference

b. During the detailed evaluation, the LGU may request for additional documentation to clarify or support the submission of the proponent, provided such is allowed under the LGU PPP Code.

c. For WTE projects, the LGU must also take note of the following**:**

i. **Technical Assessment.** For WTE projects, the LGU must ensure that the following items are considered:

1. Waste Quantity and Quality and Energy Output- The success of a WTE project depends on the type and characteristics of solid wastes generated by the LGU. It is therefore important for the LGU to validate its waste composition data, and that it has sufficient waste for the project. This may be assessed through the Waste Analysis and Characterization Study (WACS) in the Feasibility Study submitted by the private proponent.

2. Site Location – Site availability, both in terms of size of land needed as well as appropriateness of the location, are critical for a WTE facility.

3. Social, Environmental and Health Factors – The LGU must also examine the social, health and environmental impact of the project and ensure that the proposal includes mitigating measures to ensure these risks are managed

   Guide questions for a detailed technical analysis is attached as *Annex* ___.

4. Minimum Performance Specification Standards (MPSS)– The MPSS presents the minimum technical specifications and performance levels based on the feasibility study, industry standards, service levels, and existing laws. LGUs may refer to DENR-EMB Guidelines for the Technical Standard of Waste-to-Energy Facility on Appropriately Controlled Combustion with Power Generation for guidance.

5. Contingency measures - Given the scale of WTE projects, it is best if WTE projects include contingency measures in the event the WTE facility encounters operation concerns.

ii. **Financial Assessment**. The LGU must examine the commercial viability, profitability and bankability of the WTE based financial indicators such as the Net Present Value

Commented [Makoto20]: Agree

Commented [Makoto21]: Frankly, how does LGU evaluate private WACS result if LGU doesn't do it by itself?

Commented [Makoto22]: Frankly, site provision is not mandatory if LGU can provide.

Commented [TK23]: Shall?

Commented [PFD24]: For DENR-EMB to confirm if the 2020 version was published

Commented [TK25R24]: FYI, It is discussed in the EPTWG to create JAO of DOST, DOE and DENR. DAO2019-21 shall be referred too.

(NPV) and Financial Internal Rate of Return (FIRR)[10]. For WTE projects, the following must be considered"

1. **Capital contribution and revenue sharing.** The contribution of each party should be identified and the LGU must evaluate if it is amenable to the capital contribution being asked by the private proponent (i.e. land, cash, etc) and if the revenue sharing proposed is commensurate to the share of the LGU.

2. **Cost breakdown.** The LGU must examine if the following costs are considered in the calculation of the WTE project, and if the cost assumptions are acceptable to the LGU:
    - Cost per ton of waste feedstock to be treated
    - Pre-treatment and disposal cost
    - Cost of energy generation
    - Government incentives[11]
    - Government guarantees, if any

3. **Payment conditions**. Should the project require any payment from the government, the LGU must examine if it can meet the set pre-conditions, as well as comply with the schedule of payments, and fees. For example, WTE projects would usually involve a gate fee. The LGU must clarify if the gate fee is already considered in the project cost. If not, the LGU must inquire how the said fee will be paid, and it must examine if it the source of payment is feasible and doable for the LGU.

4. **Other revenue sources.** The LGU must consider the sources of revenue of the project and assess if the estimated revenues are accurate. The LGU may opt to undertake a market survey to verify the sources of revenue identified by the private proponent. For guidance, the following are possible sources of revenue:
    - ~~Service payments from the LGU for collection and transportation of solid waste;~~
    - Availability payments from the LGU (i.e., for assets acquired and/or constructed facilities);
    - ~~Tariffs or fees levied on various waste generators (usually based on the weight of the municipal solid waste (MSW).~~
    - ~~Surcharge levied on waste generated by specific users, e.g. commercial users;~~
    - Tipping fees from the LGU or third-party collection contractors, as applicable;
    - Revenues from sale of recyclables recovered from MSW; and
    - Revenues from sale of by-products (e.g., compost, refuse-derived fuel and power) from processing/treatment of MSW

Guide questions for a detailed financial analysis is attached as *Annex 4*

[10] NPV and FIRR are based on a project's cash inflows and outflows over its entire concession period in terms of today's money (i.e. in present values). The NPV of a project is defined as the sum of its net cash flows over time discounted by the Weighted Average Cost of Capital (WACC) or Cost of Equity. Meanwhile, the FIRR computes for the rate that makes NPV equal to zero, or in other words, the rate that equates the present value of revenues to the present value of the costs of the project. There are numerous articles that explain how to conduct an financial analysis. A very detailed explanation is provided by the Asian Development Bank in its Guidelines on Financial Management and Analysis of Projects.

[11] LGUs may refer to the incentives listed under RA 9513 (Renewable Energy Act)

Commented [Makoto26]: Highly appreciated on this conditions. Tipping fee or gate fee are necessarily required in usual cases of WTE projects. If zero T/F proposal are given, careful assessment for whole SWM system must be carried out.

Commented [Makoto27]: And estimated in realistic manner.

Commented [Makoto28]: It is also necessary to review the cash flow and sustainability of the off-takers' business model. For example, power off-taker (DU) may be able to off-take technically but how many kwh in the year? How much tariff will be applied? Such kinds of things should be analysed.
Other than power, in case of digestate (digestive fluid) from wet-biomethanation system, huge amount of digestate will be produced form the system so how to offtake such mass, who and how much tariff will be imposed, etc. should be importantly evaluated. Compost, RDFs are also same, availability of market, off-takers, price, they're going to off-take all of products? This is we deem one of key success points of waste treatment projects.

ii. **Economic assessment.** The LGU must also evaluate the net benefit of the project to the economy and society as a whole.[12] Sample economic benefits may include: [13];

i. cost savings (i.e. from hauling and other O&M expenses);
ii. kilometre-tons saved (time savings and cost savings);
~~iii. less disposal of residual waste to sanitary landfill and prolonging landfill lifespan;~~
~~iv. increased efficiency in the separate collection and composting of biodegradable waste;~~
v. savings from potential cost of reconstruction/rehabilitation from flooding or landslide because of mitigating or risk reducing measures that are part of the design of the SWM facility;
vi. savings from income from operation stoppage due to disasters; and
vii. implications on market value of surrounding properties.[14]

Guide questions for economic analysis is attached as *Annex 4*

iii. Legal Assessment

1. **Project structure.** The legal and institutional analysis should include the organizational structure (legal and financial; hierarchy of authority, etc.) of the joint venture, and justification why a joint venture arrangement is being proposed, and why it is being structured as a corporate or contractual joint venture, whichever is applicable. The legal and regulatory requirements of the WTE project must also be identified. The LGU may refer to *Annex 5: Relevant Consents and Permits* for guidance.

2. **Government guarantees.** The LGU must identify what guarantees are expected from it, such as minimum tonnage of municipal waste, waste quality and composition, payment of gate fees, etc. and examine if it can commit to it for the entire duration of the operation. For cluster-based WTE projects, the LGU must first coordinate with the neighbouring cities/municipalities if they are willing to commit the expected deliverables from them (i.e. committed waste)

3. **Risk allocation.** Risks should be allocated to the party that can best manage the associated risks. Kindly refer to *Annex 6: Risk Allocation Matrix for reference.*

Commented [Makoto29]: If LGU wants to demonstrate E-IRR accurately, it's a bit tough for it. Because LGU shall evaluate how much LGU damages to the society and the environmental by their present improper waste management. Open dump systems causes odor pollution, untreated leachate causes downstream water pollution, how much economical/social impact they're causing at now? Economic analysis is a comparison between such baseline analysis with future project condition how such negative impact will be improved.

Commented [Makoto30]: This is one of the difficulties for WTE project, even if LGU guarantees, sometimes their credit is not enough for SPC or SPC's lender to lend the money. So, to make it bankable, national government guarantee system must be considered because WTE is local governmental project.

[12] There are numerous articles that explain how to conduct an economic analysis. A very detailed explanation is provided by the Guidelines for Economic Analysis of Projects of the Asian Development Bank.
[13] The economic assessment of an SWM project should "include estimates of willingness to pay for services as a basic benefit yardstick, augmented by cost savings due to public health improvement, livelihood opportunities, more efficient land use, and increase in tourism among others. Special attention should be paid to the large informal sector in waste management and its economy, and how much people are paying for informal waste collection services. Livelihood issues should not be underestimated, but different models of engaging people in a comprehensive waste management system should be explored." (Cities Development Initiative in Asia)
[14] This benefit may not be applicable in the presence of "not in my backyard phenomenon." However, if the project site is not obstructive to traffic flow, or near residual areas, the additional benefits to food, lodging, manufacturing, fabrication and services industries nearby brought about by increased activities during construction and operation periods would potentially outweigh negative sentiments.

10. **Amendments.** These Guidelines may be amended and/or modified from time to time by the PPP Center, in consultation with the LGUs.

11. **Effectivity.** These Guidelines and any subsequent amendments or modification shall take effect fifteen (15) calendar days from the date of publication in the PPP Center website.

References

- RA 9003
- Cities Development Initiative of Asia (CDIA) Sector Guidelines for Pre-Feasibility Studies on Solid Waste Management - https://cdia.asia/2015/03/02/check-out-our-new-downloads-sector-guidelines-for-pre-feasibility-studies/
- World Bank Toolkit Private Sector Participation in Municipal Solid Waste Management. S. Cointreau, P. Gopalan, and A. Coad. SKAT, St. Gallen, Switzerland, 2000. - https://ppp.worldbank.org/public-private-partnership/sector/solid-waste/toolkits
- ADB Integrated Solid Waste Management for Local Governments: A Practical Guide - https://www.adb.org/documents/solid-waste-mgt-local-gov \
- Global Infrastructure Hub PPP Risk Allocation Tool for Waste-to-Energy Projects - https://ppp-risk.gihub.org/risk-allocation-matrix/water-waste/waste-to-energy-plant/
- ADB Gender Checklist on Resettlement. https://www.adb.org/sites/default/files/publication/28731/gender-checklist-resettlement.pdf
- Rapid Assessment Tool Waste-to-Energy
- +items that were hyperlinked in the footnotes

Acknowledgements

- DENR Environmental Management Bureau Solid Waste Management Division
- National Solid Waste Management Commission
- Department of Energy
- Institute for Global Environmental Studies and Ministry of Environment of Japan
- Japan International Cooperation Agency
- Infrastructure Asia
- Economic Research Institute for ASEAN and East Asia
- Environweave
- Netherlands Embassy in Manila
- +other institutions we will work with in the online public consultation

Annex 1: Questions To Determine LGU Readiness to Implement an SWM-WTE Project

Readiness aspect	Key questions for the LGU	Yes	No
Availability of SWM data	• Does the LGU have an approved 10-year SWM plan? If not yet approved by the National SWM Commission, what is the status of the plan? • Does the LGU have a record of its waste volume? • Does the LGU have demography with historic population growth and future projections? • Does the LGU have current waste management process and problems/challenges faced which the proposed project would need to address?		
Land availability	• Does the LGU have a comprehensive land use plan? • ~~Does the approved Comprehensive Land Use Plan (CLUP) of the LGU designate land for a solid waste management facility, where the project requires such land allocation?~~ o ~~If yes, were climate and disaster risks mainstreamed in the approved CLUP?~~ • What is the current land availability for WTE facility? • Does LGU have candidate sites list for WtE facility?		
Technical assessment	• ~~Is the proposed project aligned with the LGU's existing policies and SWM plan~~? • Does the LGU have the technical personnel / engineer who could study the proposed unsolicited proposal. • ~~Is the LGU looking for a technological solution to resolve its waste management problems?~~ • ~~Is the proposed project aligned with the technological vision of the LGU in terms of solid waste management?~~ • ~~Does the LGU have an existing landfill or disposal facility?~~ • ~~Who operates and own the land and facility?~~ • ~~What assets are available for solid waste management for the LGU?~~		

Commented [Makoto31]: At first, LGU shall be aware of why does it want to have WTE as the "necessity". E.g., to solve the piled up waste amount, environmental concerns caused by waste such as odor, leachate, flies, etc.
LGUs shall have clear objective(s)/needs and priority because such shall be compared with it's financial requirement and be compromised.
Transaction Advisor shall balance such objectives/needs and cost then find out optimal options which is best for LGU.

Commented [Makoto32]: Based on JET evaluation in TCP, 10 years SWM Plan in Philippines doesn't have practical future plan backed by annual budget outlays.
Then most of the plan will not be actually realized and monitored. This is also one of big issues in Philippines we think.

It may be discussed in later on, most of WtE systems (not only incinerator) requires increase of capital or annual budget of NG/LGUs so, to demonstrate bankable LGUs' budget plan (for T/F) with some kind of guarantee shall be required.

Commented [Makoto33]: This kind of information is "critical" for reasonable facility plan and public/private task allocation.
It's better to have "Tonnage" rather than "Volume", with chronological data (daily, monthly, yearly and historical tendency) so that LGU and private entity can forecast seasonal and future fluctuation of MSW quantity.

It is also strongly recommended to LGUs to have historical waste quality survey data (WACS). In addition, WACS data should be the shape of "Report". In Philippines, there are many WACS results we can refer, however, information such as who, when, how to sample, etc. which are important to convert it to the WTE design factors are not usually attached with.

Commented [Makoto34]: Does the LGU figure out current waste mass balance flow (value chain) analysis and same in future with expected WtE facility?
The rough capacity and expected technology (ies) shall be basically determined by LGUs in the bid.

Commented [Makoto35]: Propose to add because land issue is definitely risen thru the public consultation process so it is ideal to be solved directly by LGUs (as first option).
Letting private partner to procure, should be subordinate because such arrangement leads long and uncertain process.

Commented [Makoto36]: JET recommend to keep this part because;
JET recommend that LGUs shall have own WTE size and technology options in their mass balance flow of MSWM 10 years plan.
It is quite difficult for the tech personnel / engineer to evaluate proposed unsolicited proposal is fit with LGUs or not if LGU doesn't have such preparation.
Meanwhile, if such are mentioned in LGU's Master Plan, it is easier for investor and LG side to discuss / propose for such specific technology and sizing.

PPP capacity	• Does the LGU have a local PPP code? • Does the LGU have an existing PPP unit? Planning unit? o If no PPP unit, does the LGU commit to establish an organic technical working group? • ~~Does the LGU have the financial resources to pay for the tipping fee in the proposed project?~~ • ~~What is the annual budget surplus of the LGU?~~ • Is there fiscal space to accommodate higher tipping fees and other costs that may arise from proposed WTE project? ~~Can the LGU obtain and support loans to support any costs that may arise?~~		
Regulatory readiness	• Does the LGU have current waste management policies, projects and programs? • ~~Is the LGU able to comply and implement its SWM policies and projects?~~ • Does the LGU have the needed technical, financial and legal representatives to monitor the proposed WTE project? • ~~Does the LGU have the needed permanent/plantilla personnel from the legal office to manage and oversee the project?~~ • ~~Does the LGU have the needed permanent/plantilla personnel from the Environmental office to manage and oversee the project?~~		
Stakeholder Readiness	• Has the LGU assess the social impact of the project? • Who are the stakeholders for the project? Do you know who your main stakeholders are? • Are your constituents aware of the need to introduce solid waste management, specifically a WTE-PPP project? •		
~~**Waste generated**~~	• ~~Does the LGU have the required waste quality and amount needed to sustain the project?~~ • ~~Does the proposed project's need correspond to the quantity and type of waste the LGU is currently collecting, or does the project require the LGU to extend its collection service?~~	•	•

Commented [Makoto37]: Tipping fee level of 20-50USD/t are broadly required (subject to power tariff and VGF if any) in the urban area of other SE Asian countries. Zero T/F is fantasy.
LGU and NG Environmental Bureau shall consider without WTE or other advanced treatment methods, how much LG sacrifice the environment. If all of such environmental burden shall be addressed, huge government budget shall be flowed in, this is the baseline to compare with WtE price.

Commented [Makoto38]: What does this compare with?

Commented [TK39]: To introduce WTE in waste flow of LGU, LGU is probably required upgrade the exiting practice of collection, transportation final disposal etc. So, cost increase is not only for WTE project.

Commented [Makoto40]: Similar to this, JET recommend to put "Considering the low credit of LGU, does the LGU obtain any national governmental guarantees to pay the T/F?"

If Philippines would like to attract internationally reliable investors and plant manufacturers, this LGUs' credit enhancement system shall be addressed.

Commented [Makoto41]: This question is good we deem because most of LGUs in Philippines doesn't comply with RA9003 yet. Some HUCs contract waste removal to private firms and let private to comply. But in fact, most of them doesn't treat leachate and flow out to the river, it's reality. LGUs has to pay more T/F even for landfill because it needs huge opex if properly operate.

Commented [Makoto42]: This is not necessary to have before the procurement of WTE. Followings 2 (deleted) are also same.

Commented [Makoto43]: Same with abovementioned reasons, LGUs to consider local social effect caused by the project.
Therefore, before receiving unsolicited proposal, LGUs to address this in their FS then requires market to propose in narrow scope of work.

Commented [Makoto44]: This is quite important we suppose.

Commented [Makoto45]: Agree to delete.
Based on the waste quantity, there are technologies which can be applied.
So, LGUs shall be aware first that waste quantity to be treated and what types of technology can be suitable for themselves.

Annex 2: Completeness Checklist for Unsolicited Proposals[15]

	Present	Absent	Remarks
a. Cover Letter indicating the basic information of the USP such as: a. Expected Output and Outcome b. Implementation Period c. Other relevant information-			
b. Company Profile			
c. Complete Feasibility Study *Refer to Annex 2.1: Feasibility Study Checklist*			
d. Draft PPP Contract consistent with the PPP Code of the LGU, relevant DILG circulars and other relevant laws, rules and regulations. *Refer Annex 2.2: Draft PPP Contract Checklist for the detailed evaluation of the contract*			
e. Other documents that are needed even if proprietary in nature			
Note: Feasibility study, draft PPP Contract and other documents even if proprietary in nature shall be submitted in a sealed envelope.			

Annex 2.1: Feasibility Study Checklist for Unsolicited Proposals[16]

Feasibility Studies shall include, but not be limited to, the following sections:

	Present	Absent	Remarks
1. Project Background/Description of the Project a. Project objective/s b. Discussion how the project is aligned with the LGU's SWM Plan c. Project Location is consistent with the LGU's zoning ordinance d. Proposed payment scheme e. Contractual arrangement and length of concession/cooperation period f. Project Scope g. Total Project Cost h. Area Impacted by the Project			

[15] Based on BOT Law IRR Sections 10.1; 10.2; 10.5; 2.3

[16]Based on ICC Project Evaluation Forms[16], and Solicited Feasibility Studies

Commented [Makoto46]: As written in the main body, JET recommends 2 stages of evaluate at least.
First one is very simplified review of the project whether LGU and private entity jointly develop the project or not. On that time, together with legal, financial expert, WTE technical expert shall be invited.

Following comments are given for the 2nd stage of evaluation (detail evaluation).

Commented [Makoto47]: Is this UnSolicited Proposer?

Commented [Makoto48]: Complete FS should not be required at initial stage (don't let private to spend a lot of money and time).

Even for the detail evaluation stage, I think Philippines governments gets too used to relying on the private proposal. Private proposal sometimes isn't enough for the market evaluation, financial estimation, technology selection, but how LG evaluate them?
Our suggestion is LGU to establish own FS by their cost (not so expensive level) then figure out the capacity (possible tonnage to provide), budget (how much tipping level can be paid), technology preference, etc. If such FS can be disclosed, globally reliable investors must approach to the city. After that, LGU can request private to prepare FS in the narrowed down scope of work.

	Present	Absent	Remarks
i. Project linkages with the national and regional development thrusts, goals, gender and development and the environment j. Estimated Economic Life of Project k. Government Undertaking l. Legal and Institutional Analysis m. Stakeholder Analysis n. Project Proponent Composition (possible consortium members; contractor; financier; supplier; operator, etc.)			
2. Technical Study a. Technical Design b. Demand Forecast c. Waste Analysis and Characterization Study (WACS) d. Waste sources e. Appropriateness of the project to the quantity and type of waste the LGU is collecting f. Technical and Operational Analysis/Feasibility (including interface with government's masterplan and other infrastructure projects)			
3. Financial Viability Assessment a. Complete Financial Model (cash flow, income statement, balance sheet, assumption sheets) b. Project and Financing Milestones			
4. Project Economic Viability Assessment a. Estimated Economic Cost and Benefits b. Methodology Employed c. Benefit-Cost ratio (B/C Ratio) d. Net Present Value (NPV) of Net Benefits e. Sensitivity Analysis			
~~5. Value for Money Analysis~~ ~~a. Assumptions and sources of data~~ ~~b. Public Sector Comparator~~ ~~c. Results of VfM Analysis~~			
6. Risk Allocation Matrix[17] (may include, as applicable, the following:) a. Site Risk b. Design, Construction, Commissioning Risk			

[17] Based on the Generic Preferred Risk Allocation Matrix (GPRAM) issued by the NEDA ICC-CC in August 2016. Accessible through https://ppp.gov.ph/wp-content/uploads/2017/02/GPRAM_2Aug2016.pdf

Commented [TK49]: Also, analysis on by-product, final disposal of residue is required.

Commented [Makoto50]: In many cases, result of these C to E will define threshold of public and private boundary, which means that this will require Gov. to guarantee.
So, LGU shouldn't highly rely on these private made data and should have own study beforehand or during due diligence.

Commented [Makoto51]: FS shall demonstrate that proposed WT tech is the best (or better) by the maturity, reliability, off-take sustainability comparison in the aspect of total solid waste management system of LGU.
(In some private FSs, they demonstrate maturity and financial advantage only focusing on their SOW and other cost, e.g. cost and method for safe disposal of fly ash, which LG shall shoulder, is not clearly stipulated.)
In this part, same with "number 1. k. Government Undertaking", clear role demarcation shall be listed out. Even though, I believe Philippines LGs (even Japanese LGs) can't detect fake proposals.

Commented [Makoto52]: Authenticity of Capex and Opex shall also be evaluated by similar size of existing cash flow, etc.

Commented [Makoto53]: For F-IRR side, while it is proponent side business, it is better for LGU to know the analysis result of sensitivity of their business because their sustainable financial healthy would be key for the sustainable long-term PPP arrangement.

Commented [Makoto54]: Does this mean economic analysis where how much economic improvement to LGU and Philippines will be made by the Project?
If so, it is also necessary to understand baseline (present) economic burden by improper waste treatment correctly otherwise it is not able to evaluate real value of the Project.

Commented [Makoto55]: In Japan, VfM analaysis (comparison between public project with PPP project) should be normally necessary to determine project scheme for LGU. Why do you delete this?

Commented [Makoto56]: This kind of high degree of important risk is primarily taken by public (if public entity wants to pursue the project) to avoid uncertainty.

Commented [TK57R56]: If such risk cannot be removed, project schedule must be affected very much and operation will not be commenced as LGU expected. It means that LGGU can not achieve and comply the approved SMW plan.

	Present	Absent	Remarks
c. Sponsor and Financial Risk d. Operating Risk e. Demand Risk f. Network and Interface Risk g. Industrial Relations Risk h. Legislative and Government Policy Risk i. Force Majeure Risk j. Asset Ownership Risk			
7. Environmental Impact Assessment a. Environmental Risk Analysis b. Proposed Mitigation Measures c. Climate Change Adaptation Measures d. Disaster Risk Reduction Measures e. Environmental monitoring and Management Plan			

Note: The Proponent should also submit copies of the financial and economic models, in traceable format.

Annex 2.2: Draft PPP Contract Checklist for Unsolicited Proposals[18]

	Present	Absent	Remarks
a. Specific contractual arrangement, term and scope of work			
b. Project technical specifications and system features			
c. Implementation milestones including those for securing other approvals, project completion date			
d. Cost recovery scheme via proposed tolls, fees, rentals, and charges, as the case may be			
e. Liquidated damages			
f. Performance and warranty bonds			
g. Minimum insurance coverage as may be required for the project			
h. Acceptance tests and procedures			
i. Warranty period and procedures (after transfer)			
j. Grounds for and effects of contract termination including modes for settling disputes			
k. Manner and procedures for the resolution of warranty against corruption			

[18] *(Based on Sec. 4.3 and 4.4 of the BOT Law IRR)* [18]

Commented [Makoto58]: These will be contracted to private normally.

Commented [Makoto59]: In case of WTElec, off-taking security is cared by DOE's policies however residues off-take (whether value or non-value) shall be considered well. Other technologies, e.g. RDF, biogas, compost, marketability as well as residue treatment/disposal method shall be addressed more carefully.
(One of the biggest reasons of failed projects)

Commented [Makoto60]: What are they?

Commented [Makoto61]: Should be taken by LGU normally.

Commented [Makoto62]: Normally taken by private.

Commented [TK63]: Firstly, impact prediction and evaluation for each environmental aspect is necessary.

Commented [Makoto64]: I don't think all of items in this Annex 2.2 can be proposed from private proponent. Basic dispute settlement, performance guarantees, termination procedures, etc. shall be provided.

Commented [Makoto65]: Does this require to private to propose?

Commented [Makoto66]: Does this require to private to propose?

Commented [Makoto67]: Does this require to private to propose?
For LGU side if this kind of facility acceptance standard procedure, it shall be included in as the public side requirement.

Commented [Makoto68]: In case of BOT, facility's warrantee will be provided from EPC to BOT proponent so may I confirm if LGU would like to require BOT such warrantee period?

	Present	Absent	Remarks
l. Compliance with all other applicable laws, rules, and regulations			
m. Minimum Performance Specifications and Standards (MPSS) and Key Performance Indicators (KPIs)			

Annex 3: Eligibility Checklist of the Private Proponent[19]

	Pass	Fail	Remarks
I. Legal Requirements			
1. The prospective private sector participant shall comply with nationality and ownership requirements under the Constitution and other applicable laws and issuances.			
2. In the event there is a facility operator, the nationality and ownership requirements shall also comply with the Constitution and other applicable laws and issuances			
3. For purposes of pre-qualification, the Contractor proposed to be engaged by the Project proponent to undertake the Construction of the Project must be duly licensed and accredited by the PCAB, in the case of a Filipino Contractor, or by an equivalent accreditation institution in the Contractor's country of origin, in the case of a foreign Contractor. Once the Project proponent is awarded the project, such foreign Contractor must secure a license and accreditation from the PCAB.			
4. Duly notarized sworn statement stating the private sector proponent has no history of any health, safety, environmental and social violations.			
5. Duly notarized sworn statement stating that the private sector participant has accepted the qualification criteria established by the LGU and that it waives any right it may have to seek and obtain a writ of injunction or prohibition or restraining order against the LGU to prevent or restrain the qualification proceedings related thereto, the award of the contract to a successful private sector participant, and the carrying out of the awarded contract.			

[19]Compilation of the eligibility requirements in DILG- PPP JMC 2019-01 and 2013 NEDA JV Guidelines

	Pass	Fail	Remarks
6. Latest tax clearance certificate			
7. Proof that the proponent has no pending case involving any health, safety, environmental and social issues			
II. Experience or Track Record Requirements			
1. Project proponent or its contractors must have successfully undertaken similar or related WTE project, whose value, adjusted to current prices using the National Statistics Office (NSO) Consumer Price Index (CPI), must be at least Fifty Percent (50%) of the total proposed project			
2. Single Largest Completed Contract (SLCC) in the last ten (10) years, similar to the proposed project of at least Twenty-five Percent (25%) of the project cost.			
3. Statement of all its ongoing and completed government and private sector contracts similar or related to the JV activity subject of the selection process, including contracts awarded but not yet started, if any.			

Commented [Makoto69]: Means at least one track record?

Track record requirement as owner? Plant manufacturer? Operator?
Our recommendation is that track record should be required for the SPC (investor) as well as plant engineering company for key part such as grate, combustion furnace, boiler and gas treatment equipment. And not only one. For plant engineering firm requires at least 10 otherwise challengers can be come into the market.
Once Philippines gov. piled up the experience, you can invite such challenger as the demonstrative project.

	Pass	Fail	Remarks
III. Financial Capability Requirements			
.			
1. Proof of ability of the prospective partner to provide a minimum amount of equity to the JV activity, measured in terms of the net worth of the company, market capitalization or a deposit equivalent to the minimum equity required set aside or ear-marked for the proposed JV Activity. The following documents shall be submitted by the prospective JV Partner: i. Audited financial statements for the past three (3) calendar years. If the prospective JV Partner is Filipino, the audited financial statements to be submitted must be stamped "received" by the Bureau of Internal			

Commented [Makoto70]: For investor as well as plant engineering company.

	Pass	Fail	Remarks
Revenue (BIR) or its duly accredited and authorized institutions; and ii. Latest tax returns, if the JV Partner is Filipino			
2. Have a combined Net Worth amounting to twenty-five percent (25%) of the total project cost of the Unsolicited Proposal.			
3. Letter testimonial from one or more domestic universal/commercial banks or one or more international banks with a subsidiary/branch in the Philippines or any international bank recognized by the BSP attesting that the Proponent and/or members of the Consortium (if the Proponent is a consortium) are banking with them and that they are in good financial standing, and qualified to obtain credit accommodations, the amount of which is a significant percentage of the indicative project cost of the Unsolicited Proposal.			

ANNEX 4: Guide Questions for Agency/ LGU Assessment of an Unsolicited Proposal [20]

In the detailed evaluation of the merits of the USP, the Agency/LGU may consider the following guide questions:

Area	Questions
Socio-Economic Analysis	a. Are the assumed economic cost and benefits reasonable? b. Did the Unsolicited Proposal demonstrate how it will create additional economic activity and jobs, or meet unmet community needs, and how it assists with the achievement of the Agency/ LGU's strategic priorities? c. Has the willingness to pay survey been conducted?
Technical Study	a. Is the Unsolicited Proposal described in sufficient detail to determine the type and size of the project, the location, all proposed interconnections/interface with other projects, the communities/stakeholders that may be affected, and alternatives (e.g. alignments) that may need to be evaluated? b. Is the proposed project technically feasible? c. Is the required waste quality and amount needed to sustain the project feasible for the LGU? ~~d. Has the LGU confirmed the accuracy of the waste composition data used in the unsolicited proposal?~~ e. Does the LGU's waste quality and quantity meet thermal WtE requirements? f. Is the proposed project's need correspond to the quantity and type of waste the LGU is currently collecting, or does the project require the LGU to extend its collection service? g. Can the LGU sustain the WTE facility for the entire duration of the project even if it does not extend its collection services to other areas? h. Is the MPSS at par with industry practice? i. Is the proposed project site/location available? j. Has the geographical limitation of the site/location been taken into consideration in the design and scale of the project? k. What is the actual land use of the nominated sites for the facility and the adjacent land uses? l. Is there enough space in the site/location for appropriate size of buffer area? m. Are there existing roads to the site/location? n. Is the proposed site located at least 500 meters downwind of nearest settlement? o. Are the impacts of proposed technology on air manageable with respect to implementation and cost?

Commented [TK71]: What rule does require this distance?

[20] *ICC Project Evaluation Forms[20], and Solicited Feasibility Studies*

Area	Questions
	p. For WtE facilities utilizing thermal process whether bum or non-bum: Were the content of dioxins and furans in the material passed? q. Are there provisions in the proposed technology / systems to minimize GHG emissions? r. Does the LGU/the proposal include a contingency measure in case of complete damaged of the facility? s. Is the project site location far from any surface water bodies? t. Who are the current users of the access routes of the site/location? u. Is the concession period/cooperation period reasonable? v. Is the time frame for project completion clearly outlined? Is the proposed schedule reasonable given the scope and complexity of the project? w. Does the Proponent present a reasonable plan for operation of the project or facilities that are included in the project? x. Does the Unsolicited Proposal set forth a plan to secure all property interests (ROW/ Site Acquisition) required for the project? y. Are there any potential interface/interoperability issues during construction and O&M? Are there other infrastructure projects on which the project relies on for it to be ready in time? z. Are there known or foreseeable negative technical impacts arising from the project? If so, does the Unsolicited Proposal outline a plan to address those negative impacts? aa. What are the technical surveys/studies conducted and completed? bb. Is this an Unsolicited Proposal relating to known public needs that can, within reasonable and practicable limits, be acquired by known and conventional competitive bidding methods?
Environmental and Social Analysis	a. Has sufficient consideration been given for the safe treatment and disposal of by—products of the WTE facility? b. Will the proposal entail displacement? c. In case of displacement, does the proposal include where the displaced people will be relocated? d. Is the proposed option adaptable to climate change? e. What are the direct and indirect environmental impact of the project? f. What are the proposed environmental protection and mitigation measures? g. Is the proposed project consistent with applicable environmental statutes and regulations? h. Does the proposed design meet applicable environmental standards? i. Does the Unsolicited Proposal adequately address environmental issues identified? j. Are there known or foreseeable negative environmental impacts arising from the project? If so, does the Unsolicited Proposal outline a plan to address those negative impacts? k. Based on historical data/previous experience, can the LGU confirm that the project site is safe from flooding, earthquakes, storm surge, liquefaction, soil erosion or other natural hazards?
Financial Analysis	a. Does the Unsolicited Proposal present a sound base case financial model? Are the assumptions in the financial model reasonable and realistic? (i.e. inflation, costs, interest rates, etc.) b. Are the capital contributions of the parties proportionate to their respective shares?

Commented [TK72]: LGU should have a contingency plan
1)in case, facility does not perform the treatment as planned.
2)In case, the facility will not be developed as scheduled.

Commented [TK73]: What rule does require this? "Far" means xx m or xx km?

Commented [TK74]: ?

Area	Questions
	c. Is the revenue sharing mechanism commensurate to the share of each party? d. Are the planned sources of funding and financing realistic? Does the Proponent adequately identify sources of funding that it anticipates including in the project financing, and does the Proponent provide adequate assurance of the availability of those funds and the reliability of the funding sources? e. Does the Unsolicited Proposal include an appropriately conducted life-cycle cost estimate of the proposed project and/or facility? f. Is the estimated cost of the project reasonable in relation to the cost of similar projects? g. Does the LGU have the financial resources to pay for the tipping fee in the proposed project? h. What are the returns of similar projects within the sector in the country and in other jurisdiction? i. Are the returns considered fair, given the project risks? j. Are there potential contingent liabilities that may arise from the Unsolicited Proposal? If so, have they been quantified? k. Are there any possible regulatory issues on the financing of the Unsolicited Proposal? l. Are there any government undertakings expected? m. Does the Unsolicited Proposal ensure integrity in the model (i.e. Balance check; sources vs uses; etc.) n. Are the assets fully depreciated by the end of the concession period? o. Are there any unpaid liabilities at the end of the concession period (term loans; payables; bank overdraft, etc.)? p. Is the proposed debt equity ratio consistent with industry counterparts? q. Are there known or foreseeable negative financial impacts arising from the project? If so, does the Unsolicited Proposal outline a plan to address those negative impacts? r. Will there be support needed from development banks? s. What is the tax regime applicable to the project? t. Will the project generate reasonable returns despite the absence of direct government guarantee, equity, or subsidy such as Viability Gap Funding? If no, the LGU must examine if it can provide the needed government guarantee, equity or subsidy u. Will the Unsolicited Proposal deliver VFM and a net benefit to the Government? If not, the LGU must re-examine if it wishes to push through with the project. v. Has a Public Sector Comparator been developed? Is it the basis for assessing VFM on the project? w. What discount rate was used and what was its basis? Was it uniformly and consistently used for comparing the public and PPP procurement options? x. Were all relevant 'whole of life' costs considered? y. Were the project risks assigned to the party best able to handle it and were they appropriately reflected in the VFM calculation? z. Was competitive neutrality considered in the VFM calculation? aa. Have the project-specific risks been identified? bb. Are the risks associated with the Unsolicited Proposal acceptable to Government?

Area	Questions
	cc. Is the risk allocation proposed consistent with the GPRAM[21]? (as applicable for Unsolicited Proposals) dd. What are the proposed measures to mitigate the identified risks?
Legal and Institutional	a. Is the Unsolicited Proposal in conflict with any government policies and procedures/laws? b. Is the Proponent qualified to undertake the project pursuant to local PPP Code? c. Is the repayment scheme and project structure consistent with all relevant rules and procedures? d. Did the Proponent conduct stakeholder analysis? Are the roles and the responsibilities of these stakeholders clearly identified? e. Are there known or foreseeable legal and institutional negative impacts arising from the project? If so, does the Unsolicited Proposal outline a plan to address those negative impacts? f. What is the nature of the intended public use? g. What is the justification of public use/public interest? h. Are the expected output and outcome clearly stated and reasonable? i. Who are the stakeholders and what are their initial feedback to the project?

Annex 5: Relevant Consents And Permits

Permit	Responsible Party	Comments
Local Government Unit (LGU):		
Municipal/City LGU Endorsement		
• Approval of the Sanguniang Barangay/Panlungsod/Bayan/Panlala-wigan Endorsement of the Project, whichever is appicable in the form of resolutions passed by host local government unit	LGU, with technical	The endorsement is obtained after the joint venture is executed, thus, it is presumed that the LGU would be keen to secure the endorsement. As the LGU exercises supervisory/moral authority over the barangay, the LGU would be better placed to facilitate securing the endorsement.
• Approval of the Sangguniang Panglungsod/Bayan/Endorsement of the Project in the form of resolutions passed by the City/Municipal Council/s of the host local government unit/s	LGU, with technical	As stated above, it is presumed that the joint venture has already been consummated, and as such, the Sangguniannng Panlungsod/Bayan would have previously issued a resolution authorizing the mayor to sign the joint

[21] Generic Preferred Risk Allocation Matrix (GPRAM). NEDA ICC-CC. 2016. Accessible through https://ppp.gov.ph/wp-content/uploads/2017/02/GPRAM_2Aug2016.pdf

		venture agreement. There should be no conflict of interest for the LGU, which in all likelihood will be represented by an officer underthe Office of the Mayor or withthe Joint Venture Selection Committee, to secure this endorsement
• Integration of the Waste to Energy Facility into the approved 10-year Solid Waste Management Plan ("SWMP"), if applicable	LGU	To the extent that the LGU hasapproved its SWMP pursuant to R.A. No. 9003, the LGUought to have considered the interplay of the WTE joint venture with its SWMP.
Building Permit: • Dumping Clearance • Health Permit • Mechanical Permit • Zoning Permit • Electrical Permit • Fencing Permit (if fences will be put around the Project) • Excavation and Ground Preparation Permit • Boring, Plumbing, and Drilling Permit • Certificate of Final Electric Inspection • Certificate of Final Plumbing or Sanitary Inspection	PSP, with the assistance/endorsementof the LGU	Securing the permit will require the technical expertise of the PSP. LGU would also be exercising a regulatory function, hence, there may be aconflict of interest if the LGU were to take the lead in securing the permit.
Provincial LGU Endorsement		Applicable only of the LGU isnot a highly urbanized city.

• Approval of the Sangguniang Panglungsod/Bayan/Endorsement of the Project in the form of resolutions passed by the City/Municipal Council/s of the host local government unit/s		If the JV is with the province, the same principle would apply for securing Sangguning Bayan/ Panlungsod approval. If the proposal is to the City/Municipality, the LGU would be in a better position to secure the endorsement

		given that the City/Municipality would need to coordinate its solid waste management program with the province, and in particular, with the Provincial Solid Waste Management Board.
Land Reclassification of Project Site		
• Municipal Reclassification of Project Site, if applicable	PSP	In this case, the LGU would beexercising a regulatory function, hence the PSP shouldtake the lead. Note that during the course of evaluating/negotiating the joint venture project, the LGUshould ideally have already assessed the viability of the project site and the likelihood of securing this permit and advise the PSP accordingly.
• Provincial Ratification of reclassification, if applicable	PSP	See above.
Department of Agriculture (DAR) Conversion of Site (if agricultural land subject to agrarian reform) or Exemption Order. DAR may require submission of thefollowing: • **National IrrigationAdministration (NIA)**Certification, as applicable • **Housing and Land Use Regulatory Board (HLURB)** Certification, as applicable • **Department of Agriculture** (DA) Certification, as applicable	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.
National Commission on Indigenous Peoples • Certificate of Non-Overlap / Free Prior and Informed Consent (FPIC)/ Memorandum of Agreement with Indigenous Cultural Communities / Indigenous Peoples, if applicable	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP. However, in theevent that an FPIC is required,the assistance of the LGU would be ideal given that the process will be done within theterritorial jurisdiction of the LGU.

Department of Science and Technology(DOST) • Environmental TechnologyVerification (ETV)	PSP, with the assistance/endorsementof the LGU	Securing the permit will require the technical expertise of the PSP.
DOLE • Permit to Construct / Operate Elevators or Manlift or Dumbwaiter, if applicable • Permit to Operate internal combustion engine, boiler and pressure vessels, standby generators, hoist way and use of gates or doors, water pumps and sewerage pumps, if applicable • Certificate of Accreditation for Practitioner in Occupational Safety and Health	PSP	These permits relate to constructing and operating thefacility. Securing the permit will require the technicalexpertise of the PSP.
Department of Environment and NaturalResources (DENR)		
• Environmental ComplianceCertificate (ECC)	PSP, with the assistance/endorsementof the LGU	Securing the permit will require the technical expertise of the PSP.

Various environment permits and specialland use arrangements, as applicable: • Permit to operate air pollution source, management, and control facilities • Permit to operate water pollution source, management, and control facilities • Permit to operate hazardous waste source, management, and control facilities • Registration as a hazardous wastegenerator • Permit to handle, store, treat, transport, and dispose of hazardous materials • Wastewater Discharge Permit • Permit to Cut Trees, if applicable • Foreshore Lease Agreement, SpecialLand Use Permit, Forest Land Use Agreement, Special Use Agreement in Protected Areas, and similar permits, if applicable • Certificate of Accreditation of Pollution Officer	PSP, with the assistance/endorsem entof the LGU	Securing the permit will require the technical expertise of the PSP.
Philippine Coconut Authority (PCA) • Permit to Cut Coconut Trees, if applicable	PSP, with the assistance/endorsem entof the LGU	Securing the permit will require the technical expertise of the PSP.
Department of Public Works andHighways (DPWH) • Authority / clearance for the construction of dams and other impounding facilities, bridges, and other structures in, across or those which may interfere with the flow ofnavigable or floatable water, if applicable • Road Right-of-Way Clearance forthe Project, if applicable • Road Right-of-Way Clearance fortransmission lines required for the Project, if applicable • Excavation Permit, if applicable	PSP, with the assistance/endorsem entof the LGU	Securing the permit will require the technical expertise of the PSP.
Housing and Land Use Regulatory Board(HLURB) • Locational Clearance, if applicable	PSP, with the assistance/endorsem entof the LGU	Securing the permit will require the technical expertise of the PSP. See earlier note re:

		DAR Conversion/Exemption Order.
Philippine Contractor's AccreditationBoard (PCAB) • EPC Contractor/s' License/s • Subcontractor/s' License/s, if applicable • Registration of constructionequipment	PSP	Technically, this should be secured by the contractor. However, the PSP should ensure that the contractor has been issued the applicable PCAB license.
Register of Deeds (RD) • Registration of right to use Project Site, if applicable • Titling of Project site lands in the name of the Project Company, if applicable • Registration of right of way for the project and/or the transmission lines required for the Project, if applicable • Registration of real estate mortgage in relation to financing of the project.	PSP	Property will be owned by or right to use will be granted in favor of the JVC/SPC, where the PSP will likely have majority control. Financing of the project is typically the responsibility of the PSP. Hence, the registration of the mortgage should be its own responsibility.
Land Transportation Office (LTO) • Registration of vehicles, if applicable • Registration of any chattel mortgageand its supplements on motor vehicles, if any	PSP	Property will be owned by or right to use will be granted in favor of the JVC/SPC, where the PSP will likely have majority control. As regards the registration of the chattel mortgage, whether this is in relation to the acquisition of the vehicle itselfor for the financing of the project, as they relate to financing activities that typically are the primary responsibility of the PSP, thenthe PSP should be the one to secure such registration.
Department of Energy (DOE) • Certificate of Registration as a Renewable Energy Developer • Certificate of Confirmation of Commerciality • Biomass Operating Contract	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.

National Water Resources Board(NWRB) • Provisional Water Permit • Final Water Permit	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.
National Grid Corporation of thePhilippines (NGCP) • Identification of IntendedConnection Point • SIS Technical Study • Facility Study • Inclusion of the Project in the Transmission Development Plan • Memorandum of Agreement on the construction of transmission or sub-transmission asset • Certificate of Approval to Connect • Connection Agreement / Interconnection Agreement and all relevant agreements relating to the construction of transmission lines, assets, and facilities • Grid Impact Study	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.
Civil Aviation Authority of thePhilippines (CAAP) • Height Clearance Permit	PSP	Securing the permit will require the technical expertise of the PSP. Permit is required prior to construction based on the design of the facility, which in turn is the responsibility of the PSP.
Bangko Sentral ng Pilipinas (BSP) • Registration of the direct foreign equity investments in the Project Company, if any • Registration of foreign currency loan, if any	PSP	These are matters that relate tofinancing that the PSP will provide for the project.
Bureau of Customs (BOC) • Certificate of Registration, if applicable • Certificate of Accreditation asImporter, if applicable	PSP, with the assistance/endorsement of the LGU	Relates to importations for theconstruction/operation.
Philippine Ports Authority (PPA) Permit to Operate a Private Port, if applicable	PSP	Port is a private port.

Bureau of Immigration (BI) • Alien Certificate of Registration (required before hiring foreign employees, if applicable) • Non-Immigrant Visa and Special Work Permit (required before hiring foreign employees, if applicable)	PSP	Foreign employees are engaged through the PSP.
Philippine National Police (PNP) • Permit to Transport Explosives, ifapplicable	PSP	If construction will involve blasting, this may be required.
Board of Investments (BOI) • Application for InvestmentIncentive (BOI/CREATE) • BOI Registration of the Project Company • Specific authorization to import capital equipment • Specific authorization to employ non-Filipinos as supervisors, if applicable	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.
Energy Regulatory Commission (ERC) • Power Purchase Agreement • Certificate of Compliance • Decision approving the application for authority to develop, own and operate dedicated point-to-point limited facilities for the Project to connect to the distribution system or transmission system of NGCP, if applicable	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.
Wholesale Electricity Spot Market (WESM) • Market Participation Agreement • WESM Registration	PSP, with the assistance/endorsement of the LGU	Securing the permit will require the technical expertise of the PSP.

Source: Abuda Asis & Associates, PPP Center Legal Advisor TA-7796

Annex 6: Risk assessment and PPP structure

Risk category	Description	Suggested Party to Manage the Risk
Waste amount	Constantly providing certain amount of waste for the project; The risk of waste amount levels	LGU

	being different to forecast levels; the consequences for revenue and costs. Forecast should take into consideration current and future waste reduction initiatives to properly assess the waste amount	
Quality of waste	Risk of the waste composition and calorific value of waste being different to forecast levels which in turn have consequences for revenue and costs	Both parties
Political risk	Risk of a change in waste management policy direction due to political realities such as a change in the local chief executive	LGU
Land availability, access and site risk	The risk associated with selecting land suitable for the project; providing it with good title and free of encumbrances; addressing indigenous rights, if any; obtaining necessary planning approvals; providing access to the site; site security; and site and existing asset condition. This risk also includes consideration of potential geologic hazards such as earthquake and landslides as well as climate risks such as flooding and rain-induced landslides which can be heightened by impacts of climate change	Private Sector Proponent
Social risk	The risk associated with the project impact on adjacent properties and affected people (including sex and age disaggregated data, income data, public protest and unrest); resettlement (cost of resettlement, income provision, and materials provision); indigenous land rights; and industrial action, provision of other services to improve well-being and status of Project Affected persons (additional training, livelihood options)	LGU
Environmental risk	The risk associated with pre-existing conditions such as contaminated soil; obtaining consents from the residents and relevant stakeholders; compliance with laws; conditions caused by	Private Sector Proponent

Commented [Makoto75]: As the viewpoint of technical expert, this waste quality risk can be managed only by LGU. Most of the cases, private side can propose (1) LCV range and (2) unacceptable waste types. If a predetermine period of average LCV (e.g. monthly, etc.) is lower than agreed LCV range, LGU shall pay shortfall LCV, at the same time, SPC can refuse higher LCV waste than predetermined LCV as well as unacceptable waste type. There is some reasonable methods to protect both party.

Commented [Makoto76]: We don't believe so. Sometimes LGU has own lot or LGU can select, so depends on the project.

	the project (i.e. pollution and cause of fire)t; external events, including force majeure; climate change (such as increase in temperature, sea level rises, drought etc).	
Design risk	The risk that the project design is not suitable for the purpose required; approval of design; and changes.	Private Sector Proponent
Construction risk	The risk of construction costs exceeding modelled costs; completion delays; project management; interface; quality standards compliance; health and safety; defects; intellectual property rights compliance; industrial action; and vandalism.	Private Sector Proponent
Variations risk	The risk of changes requested by either party to the service which affect construction or operation.	Both parties
Operating risk	The risk of events affecting performance or increasing costs beyond modelled costs; performance and standards and price; availability of resources; intellectual property rights compliance with maintenance standards; industrial action; and vandalism.	Private Sector Proponent
Financial markets risk	The risk of inflation; exchange rate fluctuation; interest rate fluctuation; unavailability of insurance; and refinancing.	Private Sector Proponent
Strategic/ partnering risk	The risk of the Private partner and/or its sub-contractors not being the right choice to deliver the project; Contracting Authority intervention in the project; ownership changes; and disputes.	Private Sector Proponent
Disruptive technology risk	The risk that a new emerging technology unexpectedly displaces an established technology or the risk of obsolescence of equipment or materials used.	Private Sector Proponent
Force majeure risk	The risk that unexpected events occur that are beyond the control of the parties and delay or prevent performance.	Both parties

Commented [Makoto77]: In case of PPP, force majeure risk should be in government side isn't it?

MAGA risk	The risk of actions within the public sector's responsibility having an adverse effect on the project or the Private Partner.	LGU. If MAGA done by the Executive Branch, then both parties
Change in law risk	The risk of compliance with applicable law; and changes in law affecting performance of the project or the Private Partner's costs.	Private Sector Proponent for Changes in Law by the Executive branch and the Judiciary
Early termination risk	The risk of a project being terminated before its natural expiry on various grounds; the financial consequences of such termination; and the strength of the Contracting Authority's payment covenant.	Both parties
Condition at handback risk	The risk of deterioration of the project assets/land during the life of the PPP and the risk that the project assets/land are not in the contractually required condition at the time of handback to the Contracting Authority.	Private Sector Proponent
Technological Risk	Risk that the chosen technology is not applicable for the quantity and type of waste generated, type of off-takers, land availability , amongst others	Private Sector Proponent

Source: Institute for Global Environmental Studies, Global Infrastructure Hub

Commented [Makoto78]: What's this?

Commented [TK79R78]: Material Adverse Government Action (政府による重大な侵害行為)

Conceptual Framework for the Development of Solid Waste Management PPP Projects

Table of Contents

1. Background

Municipal solid waste (MSW) management chain involves three major scopes: segregation, collection and/or pre-processing, and disposal and/or treatment. Incorporated in the three major scopes are the transportation and storage of the MSW. Segregation is the sorting of wastes generated by the source into different classifications mentioned in the Ecological Solid Waste Management (SWM) Act of 2000 (RA 9003). Collection and/or pre-processing involves gathering the wastes generated by the household as mandated in the Local Government Code of 1991 (RA 7160) and processing it prior to final disposal and/or treatment. Lastly, disposal and/or treatment ensure safe storage and destruction of wastes through environmentally sound and compliant technologies.

2. The Conceptual Framework for the Development of Solid Waste Management (SWM) PPP Projects

2.1. Coverage

This framework is designed as a guide in identifying potential components of the SWM cycle which can be developed and implemented via Public-Private Partnership (PPP). The framework presents the three major scopes of the SWM chain and its components. It does not cover waste generation and only starts with waste segregation. As a guide, the framework, provides an assessment criterion for identifying components in the SWM cycle that could be undertaken or developed for PPP implementation.

The framework will be applicable for the assessment of PPP projects which will be implemented via Republic Act (RA) No. 6967, as amended by RA 7718 or the Build-Operate-Transfer (BOT) Law, the Revised NEDA Joint Venture (JV) Guidelines, the local government PPP Code, and other relevant laws and issuances.

This framework also identifies examples of SWM PPP projects that the implementing agencies may explore. It is consistent with RA 9003, which mandates

as a policy of the State the adoption of a systematic, comprehensive, and ecological SWM program. It is noteworthy that other components and technologies pertaining to SWM may also be considered through the development of a comprehensive study. Moreover, the PPP Center may update this framework based on relevant best practices that may occur after its first distribution.

2.2. Objective

This framework is intended as a tool to be used by Local Government Units (LGUs) in the conduct of preliminary assessment during the project development phase (see Figure 1). At the preliminary assessment stage, the LGUs may conduct an initial market study to estimate demand and determine possible revenue streams; preliminary market sounding to measure private sector interests; multi-criteria analysis; and preparation of a project concept note.

At the end of the assessment, the LGU should be able to determine the initial scope of PPP project and the possible role of private sector partner, which are appropriate for and responsive to the sustainable and long-term solution to their SWM challenges. This framework also aims to discuss the available technical assistance that the PPP Center may provide to LGUs in PPP project conceptualization and development.

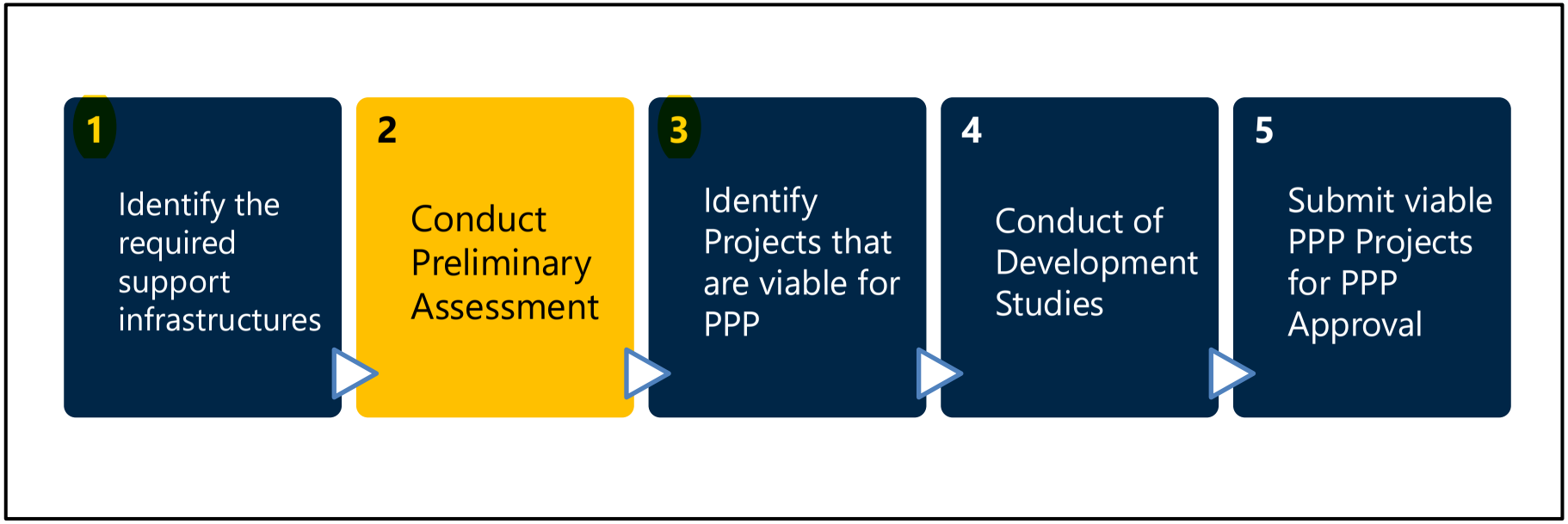


Figure 1. Project Development Stages

Appendix 9

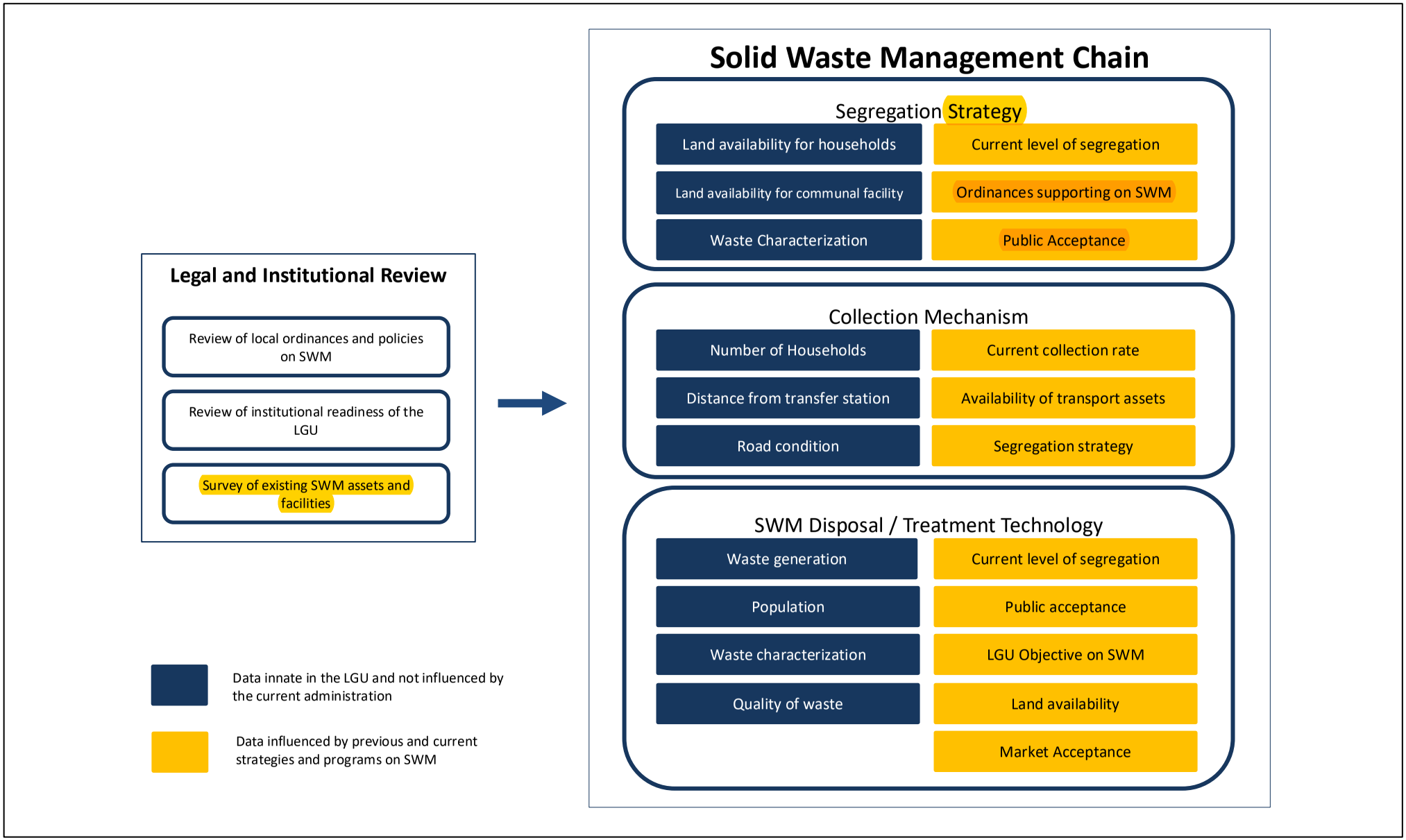


Figure 2. Conceptual Framework for Developing SWM PPP Projects

Appendix 9

2.3 Framework Design

The overview of the framework is provided in Figure 2 on page 6. It is designed to prescribe holistic approach in analyzing the MSW of LGUs and subsequently assess the potential of these practices to be implemented via the different modalities of PPP. The components of the framework are discussed individually below.

2.3.1. Legal and Institutional Review

Before proceeding to the analysis of the SWM chain and its components, it is recommended to conduct a thorough assessment of the legal and institutional environment of the LGU. This shall include, but not limited to, the review of local ordinances and policies related to SWM, review of the institutional readiness of the LGU (e.g., current number of employees and offices with mandate related to SWM, their employment status, capacity and expertise to handle SWM programs), and a survey of existing SWM assets and facilities, among others.

Below is a set of guide questions that may be used by LGUs as reference in conducting a legal and institutional review.

Area	Questions
Local ordinances and policies on SWM	a. Does the LGU have its local PPP Code? b. Does the LGU have existing local ordinances prescribing guidelines and regulations regarding the SWM practices in the area? c. Does the LGU have an approved 10-year SWM plan? If yes, is there an update to the approved plan?
Review of institutional readiness of the LGU	a. Does the LGU have an existing PPP selection committee / implementing office committed to managing PPP projects? b. Has the LGU implemented successful PPP projects in the past? If none, does the LGU have the capability to do PPP or willingness to undergo PPP training?

	c. Is the LGU willing to abide by the PPP best practices? d. Does the LGU have an existing office dedicated to managing its SWM operations? 1. How many employees are dedicated to perform SWM-related tasks? 2. What is the employment status of these employees? 3. What is the capacity / level of expertise of these employees in terms of handling SWM programs?
Survey of existing SWM facilities	a. What are the existing SWM facilities owned by the LGU? b. What are the machineries and equipment dedicated to SWM operations owned by the LGU? c. What is the current situation for each component of the waste management chain?

2.3.2. Overview of the SWM chain

There are two categories of relevant parameters in determining the applicable scheme and project for SWM PPPs. As shown in Figure 2, the items indicated in the blue boxes are data in the LGU that are based on surveys and studies that include population, waste characterization, land availability and others. The other set of data in yellow boxes are based on situations influenced by strategies and programs on SWM implemented by the LGU, and other external considerations.

2.3.2.1. Segregation Strategy

Determining the segregation strategy is vital in determining the succeeding steps in the MSW management chain. This initial step's goal is to determine whether the segregation should happen at the household level, the barangay, the municipality or provincial level. It would also dictate the types of wastes to be segregated. The population density, land availability, characteristics and amount of wastes, the regulatory framework, public acceptance and knowledge are some of the considerations that LGUs should take into account in their decision making. The most ideal scenario is having the segregation done nearest to the source or at the household level. This so because as segregation goes farther the source and management chain, it becomes more expensive.

Population density and land availability are related parameters that should also be considered in determining the ~~segregation strategy and~~ waste management. The density of the population determines whether land is available in the household level. A high-density population would have less space to manage the wastes they generate and could rely heavily on LGU support. This is where land availability for communal waste segregation facilities would then be suitable. The more households present in an area, the bigger the facility should be.

The waste characterization and quantity would determine the level of segregation required and the need for waste management disposal and/or technologies. For example, most of the areas in the country generate more than 50% of

biodegradables from households. This means that waste management strategy should focus primarily on addressing this type of waste generated in households, which could be through backyard or in-house composting, livestock feed preparation, communal composting, or communal biogas facility. If in-house segregation is the strategy chosen, then the segregation strategy should accordingly focus on separating the biodegradables and not collecting them.

The regulatory framework would indicate what ordinances are in place to support waste management and determine what segregation strategy should be done to comply with regulations. Public behavior and acceptance influence the selection of the strategy as well as its implementation. The LGU and the general public should be knowledgeable with regard to the different types of wastes.

2.3.2.2. Collection Mechanism

Establishing a proper collection mechanism sets the stage for solving waste management challenges. This is the link connecting a good segregation strategy to a properly thought of waste disposal and/or treatment technology. Uncollected segregated waste affects the quality of life of the community and reduces moral of the general public.

The number of households, their distance to existing or proposed waste management facilities and the road conditions, determine the size and type of waste collection mechanisms to use. The quantity of wastes generated is also crucial to determine the size and type of the collection vehicle, and the required number of trips. The segregation strategy and technologies involved also influence the collection mechanism. A small community generating a minimal amount of waste and utilizing a landfill as its final disposal strategy would need less and smaller collection vehicles compared to a medium sized community in an urban setting generating more wastes and utilizing a composting facility, refuse-derived fuel (RDF) plant, and a landfill.

2.3.2.3. SWM Disposal and/or Treatment Technology

A sustainable waste management strategy should consider segregation and collection mechanisms in determining the most appropriate disposal and/or treatment technology. The disposal and/or treatment technology, in turn, should take into account the amount of waste generated, the population, waste characterization, quality of waste, ~~segregation strategy~~, collection strategy, ~~public acceptance~~, land availability, the LGU's objectives in SWM, and external considerations. An example of external consideration is if the objective in SWM involves generating products out of waste.

In the determination and prioritization of the SWM technology, the quantity of waste generated and its type, the hazards to the general public and the environment, and the ease of implementation, should be studied. Given these considerations, one of the priorities for SWM is the management of biodegradable wastes.

Providing a proper biodegradable management technology will alleviate the burden on waste management system considering that as mentioned earlier, more than 50% of the quantity of waste generated are biodegradables. Composting technology would benefit areas with agricultural activity both in the household level and community. Considerations such as acceptability of composting to the community or presence of off-takers / purchasers of composts as soil conditioner should be studied. Biogas digesters are used in communities with communal areas that can be designated as social cooking facilities. In the Philippine setting, these communal cooking facilities can be useful in times of emergency or disaster-related situations or for community charitable activities for the less fortunate residents.

Residuals waste management is another priority to be addressed. For residuals, landfilling is a common and acceptable technology used even in more advanced countries. Landfilling is a cost-effective solution in storing wastes for the long term. Although sanitary landfills should be equipped with necessary controls to ensure environmental protection like gas collection and leachate collection and treatment, not all types of waste must end up in landfills as this greatly reduces landfill life.

Notably, sanitary landfills require land or substantial space to be able to set up a properly designed facility.

Another disposal strategy is the use of waste-to-energy technologies which require a minimum quantity of feedstock. A waste-to-energy project requires a significant amount of investment which can be made feasible through economies of scale. Moreover, the use of waste-to-energy technologies must take into account compliance with relevant environmental regulations, such as ensuring emissions standards prescribed are met.

A waste-to-energy technology utilizes sorted or unsorted MSW, generates heat from the wastes through thermal oxidation, and uses the heat to generate electricity which it can give back to the power grid. This is a good way to utilize MSW into a resource needed by the public – electric power. The major considerations for this type of project are the minimum feedstock requirement, the high investment and operating cost, and the general public acceptance of the use of waste-to-energy technology that is perceived as effectively, incineration, and therefore could be bad for the environment.

RDF production facilities involve the segregation of waste materials received and focus on getting the combustible fraction to convert it to low-grade fuel that can be utilized by energy intensive industries like cement, steel, or glass manufacturing. An RDF facility would require a moderate amount of investment and operating cost. These facilities are recognized in DENR Administrative Order 2010-06 indicating the guidelines for use of alternative fuels such as cement kiln co-processing. An RDF facility treats the waste and provides alternative to coal, bunker fuel oil or diesel as fuel. Main considerations for this type of technology are the level of segregation, quality of waste generated and willingness of off-takers to take in or purchase the product.

2.3.3. Potential for PPP Implementation

PPPs are compelling when the private sector can implement the objectives of a project more effectively and efficiently than the government. This is particularly true when any of the following applies or is present:

a. Innovative designs available only from the private sector;
b. The operation and maintenance of the assets to be used by the project requires skills, systems and processes that are either lacking or not inherent in the implementing government agency;
c. There is a need to maximize the value that can be captured by the project and that the skills needed for value capture lie within the private sector; and
d. When minimizing life-cycle costs is a dominant consideration.

The choice of whether to use PPP or traditional procurement for a particular project or a sub-component of a project lies with the LGU, taking into account the efficiencies that can be gained and monetized from entering into PPPs.

2.3.3.1. Multi-Criteria Analysis Approach

To assist the LGU with decision-making on whether its SWM project may be undertaken through PPP, the PPPGB issued the Guidelines on the Identification, Selection and Prioritization of Public-Private Partnership (PPP) Projects which prescribes the use of the Multi-Criteria Analysis (MCA) approach to determine potential PPP projects.

The drivers and evaluation criteria in the MCA approach considers market acceptability, manageable life cycle costs, appropriate risk sharing, and institutional readiness of the LGU, among others. The LGU may assign specific weight per driver and evaluation criteria as appropriate. If the project passed, the LGU may proceed with the project preparation and development of a study that is suitable for PPP projects.

2.3.3.2. Project Concept Note Development

The LGUs may also develop a project concept note (PCN) that contains the following information:

Section	Guide
Indicative Project Title	Include tentative project title (e.g., [LGU] Integrated Solid Waste Management Facility Project)
LGU and key focal person/unit	Indicate the local government unit and specify the office assigned to develop the project
Background and rationale	• Provide status of project development activities, including challenges/issues encountered. • Mention previous or ongoing project studies undertaken. Provide the recommendations, and highlight the decisions or actions undertaken by the LGU based on the recommendations.
Project objectives and targets	• Describe the current local issue/problem that the project seeks to address. • Determine the objectives of the LGU in implementing the project (short term, medium term and long term, if possible).
Project description	• Describe the following: o Major component/s or features of the project o Selected project site, if any o Possible legal framework of the project (PPP modalities under the Amended BOT Law and its revised IRR, JV, etc)

	• Private sector participation o Role of the private proponent o Possible obligations of the private proponent (design, finance, build, operate and/or maintain)
Work plan/ project investment requirements	• Enumerate the activities required and timelines to implement the project (Enactment of a local PPP/JV code for JVAs, setting up of LGU project team, procurement of consultants for FS preparation, etc). • Indicate what LGU resources will be required for the project. • If government subsidy is expected to be required, how will it be funded.

2.3.3.3. Initial Market Study

The LGU may also conduct an initial market study to proactively analyze the market demand for the proposed project.

A market sounding activity may be done wherein stakeholders (e.g., experts, banks, developers, operators) are interviewed or gathered to solicit inputs and suggestions to make the project viable and attractive to the private sector. After the activity, the results shall be analyzed by the LGU and thereafter reflected in the initial project terms. It may also be further studied during the preparation of the feasibility study.

2.3.3.4. Waste Segregation Projects

Under the Implementing Rules and Regulations (IRR) of RA 9003, barangays shall be responsible for the collection, segregation, recycling of biodegradable, recyclable, compostable and reusable wastes. Materials Recovery Facilities (MRFs) will be

established in every barangay or cluster of barangays which shall receive biodegradable wastes for composting and mixed non-biodegradable wastes for final segregation, re-use and recycling.

The financing, construction, operations and maintenance of MRFs are not usually undertaken by the private sector because they are relatively small in scale compared to other aspects of the MSW management chain. Moreover, the repayment scheme to the private sector partner in an MRF project is yet to be studied. However, LGUs may explore the feasibility of bundling the segregation aspect with collection and treatment; or bundling the segregation aspect for several LGUs located contiguously in a specific area (i.e., clustering between various LGUs). In addition, there are schemes allowing municipality-level MRFs to cluster all barangays which could also double as a pre-processing facility.

An additional vital scope to PPP projects is the inclusion of training programs for households on proper waste management and segregation and capacity building for LGU officials in-charge of waste management. Trainings and workshops on RA 9003 and relevant provisions of the Local Government Code are necessary. Waste workers also need to be trained on proper waste handling. The objective is to have a household that understands and implements proper waste segregation, a government unit who can create ordinances and programs addressing waste management challenges, and waste workers who safely and effectively handle wastes.

2.3.3.5. Waste Collection Projects

The collection aspect of SWM services is currently the area in which the private sector has most participated in as contractors of the LGU under the traditional mode of public procurement.

For efficient collection services planning, LGUs should take into consideration other related aspects of the SWM plan, including programs on waste minimization and waste segregation as well as existing policies on waste containers.

Availability of the following data from the LGU will be beneficial in analyzing whether waste collection may be considered eligible for PPP implementation:

a. Solid waste collection area
b. Waste sources
c. Characterization of wastes and LGU policy on waste segregation and handling of special wastes
d. Designated collection points (household level, MRF or LGU designated area) and the current status of road network from the collection point to the disposal area or MRF
e. Land use in collection routes
f. Current type, design and size of collection vehicles
g. Current odor management
h. Frequency of collection
i. Operations and maintenance costs

2.3.3.6. SWM Disposal and/or Treatment Projects

RA 9003 requires LGUs to close their existing open dumpsites by year 2006 and to establish controlled disposal facilities or sanitary landfills (SLF). Notably, to date, a lot of LGUs have not complied with this directive.

Access to sanitary landfill is mandated by law and is applicable for LGUs with low to high waste generation rate.

Availability of the following data from the LGU will be beneficial in analyzing whether the waste disposal may be considered eligible for PPP implementation:

a. Geotechnical assessments

b. Existing standards for disposal facilities
c. Current dumpsite remediation
d. Controlled landfill sizing and design guidelines
e. Existing standards/practice/facilities
f. Current landfill life and life extension
g. Lining systems, leachate collection systems and treatment, and lagoon issues, etc.
h. Environmental impact assessment, management and monitoring
i. Landfill gas management
j. Stormwater runoff management
k. Litter management
l. Fire and pest management
m. Waste pickers or scavengers
n. Reporting and complaints register
o. Operations and maintenance cost

Following the waste management hierarchy in Figure 3, LGU waste management projects should focus on maximizing avoidance, reduction and reuse efforts, prior to moving into treatment and disposal technologies. These should be considered as requirements in developing proper waste management for LGUs. If this concept is followed, several technologies can be considered after proper segregation of wastes.

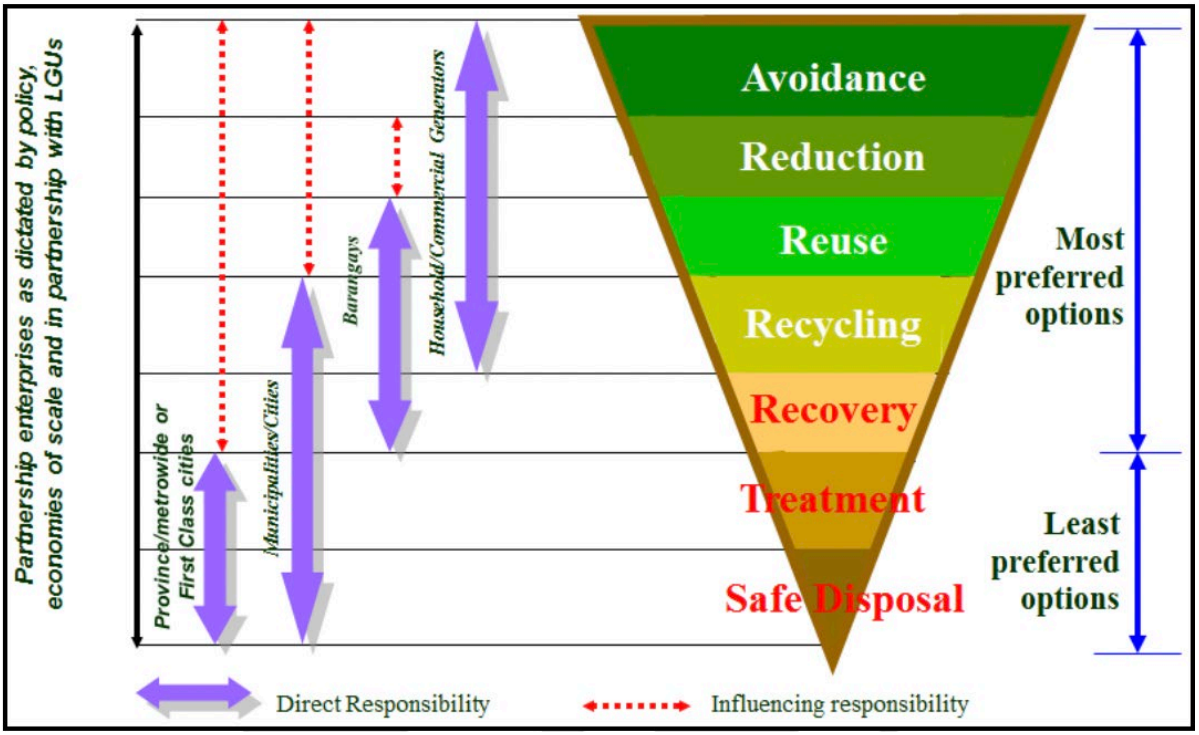


Figure 3. Overall policy of RA 9003 based on waste management hierarchy[1]

The following are the possible disposal and/or treatment technologies that the LGUs may consider in developing their SWM PPP projects:

- **Waste-to-energy facilities** mostly caters to LGUs that fall into the large waste generation category to create a feasible business case. Waste-to-energy facilities use municipal solid waste as its feedstock to heat up a boiler to produce steam which would be used to generate electrical power. It is important to consider the November 26, 2019 issuance of the Department of Environment and Natural Resources (DENR), the Administrative Order No. 2019-21 with the subject "Guidelines on waste-to-energy facilities for the integrated management of municipal solid wastes."

[1] https://emb.gov.ph/wp-content/uploads/2018/09/3-Solid-Waste-1.8.pdf

For a specific type of WTE, the Department of Energy (DOE) issued Department Circular 2022-02-0002, also known as Policy Program for the Enhancement of Biomass WTE Development, on February 2022, which took effect on March 18, 2022. As defined in the Circular, biomass WTE is the process of converting biomass WTE resources to produce heat, steam, mechanical power, or electricity through either thermochemical, biochemical, or physico-chemical processes, or through such other technologies which shall comply with the prescribed standards pursuant to RA 9513, also known as Renewable Energy Act of 2008. The Circular prescribes the policies and programs to promote and enhance the development of biomass WTE facilities in the country. Most importantly, the Circular classifies the biomass WTE resources as compliant to the definition of renewable energy resources under Section 4(uu) of RA 9513, and as such, shall also be considered as a renewable energy resource.

The critical considerations for WTE facilities are the sizing of the facility, land requirement or location, the technology to be used and the viability of the price of sale of power generated. The sizing heavily dictates the project cost and impacts return on investment. The technology impacts the cost as well and, more importantly, the environmental compliance of the project. Lastly, the sales scheme would influence the return on invested capital. Usually, waste-to-energy facilities would still need significant tipping fees and could not rely on sales of electric power to sustain its operation.

- **Waste-to-value technologies** can be tapped for medium to high waste generating LGUs. LGUs with low waste generation might have challenges in getting a decent return on investment for waste-to-value facilities. The general concept of waste-to-value facilities is the reprocessing of wastes and preparing it for use of industries or other technologies. The usual business model in waste-to-value is the generation of revenues from tipping fees and, potentially, sales of the waste-to-value product/s. These products may range from compost for soil conditioners of households or commercial establishments, sorted or shredded municipal solid waste for cement kiln co-processing, and pellets or briquettes for energy generation.

- A **communal facility** can handle the organics through composting or bioreactors. Composting facilities hasten the decomposition process and use waste as soil conditioners, while bioreactors capture the methane produced for use in cooking at a small scale and electricity generation on a large scale. These facilities are usually tied up or bundled with an MRF or SLF.

2.3.3.7. Private Sector Participation through PPPs

LGUs are mandated under RA 7160 to discharge functions and responsibilities necessary, appropriate, or incidental to the efficient and effective provision of basic services, including solid waste disposal systems and services or facilities related to general hygiene and sanitation. The discharge of such functions and responsibilities may be financed by the LGUs through private sector participation or its internal revenue allotment (IRA), among others.

The indispensable role of the private sector is acknowledged in the 1987 Philippine Constitution and the creation of the LGU's PPP Code is recognized under the Department of Interior and Local Government (DILG) Legal Opinion No. 8, s. 2014 and Department of Justice (DOJ) Opinion No. 18, s. 2012. Private sector participation will augment the financial and technical limitations of the LGUs in implementing SWM projects. On the other hand, with the implementation of the Mandanas-Garcia Ruling in 2022, the total IRA of LGUs is expected to increase by more than 27%. LGUs may allocate the increase in IRA for the implementation of its priority projects – including SWM components that may not be appropriate for PPP implementation.

In undertaking SWM PPP projects, the principles of waste hierarchy, waste minimization, source segregation and collection, as described in RA 9003, shall be followed. In all cases, SWM PPP projects must be consistent with the local SWM plans as approved by the National SWM Commission. These projects must ensure the protection of public health and the environment and utilize

environmentally sound methods that maximize the utilization of valuable resources and encourage resources recovery, among others. In developing SWM PPP projects, LGUs shall encourage healthy competition and a level playing field among qualified private sector proponents.

The LGU must also define the specific role of the private partner to the project as seen in Figure 4. For example, the private sector may undertake the financing, construction, operations and maintenance of an SWM technology-specific treatment PPP Project since the cost requirement is high and technical expertise for its operations and maintenance is also needed. Further, the private sector's repayment scheme must also be determined.

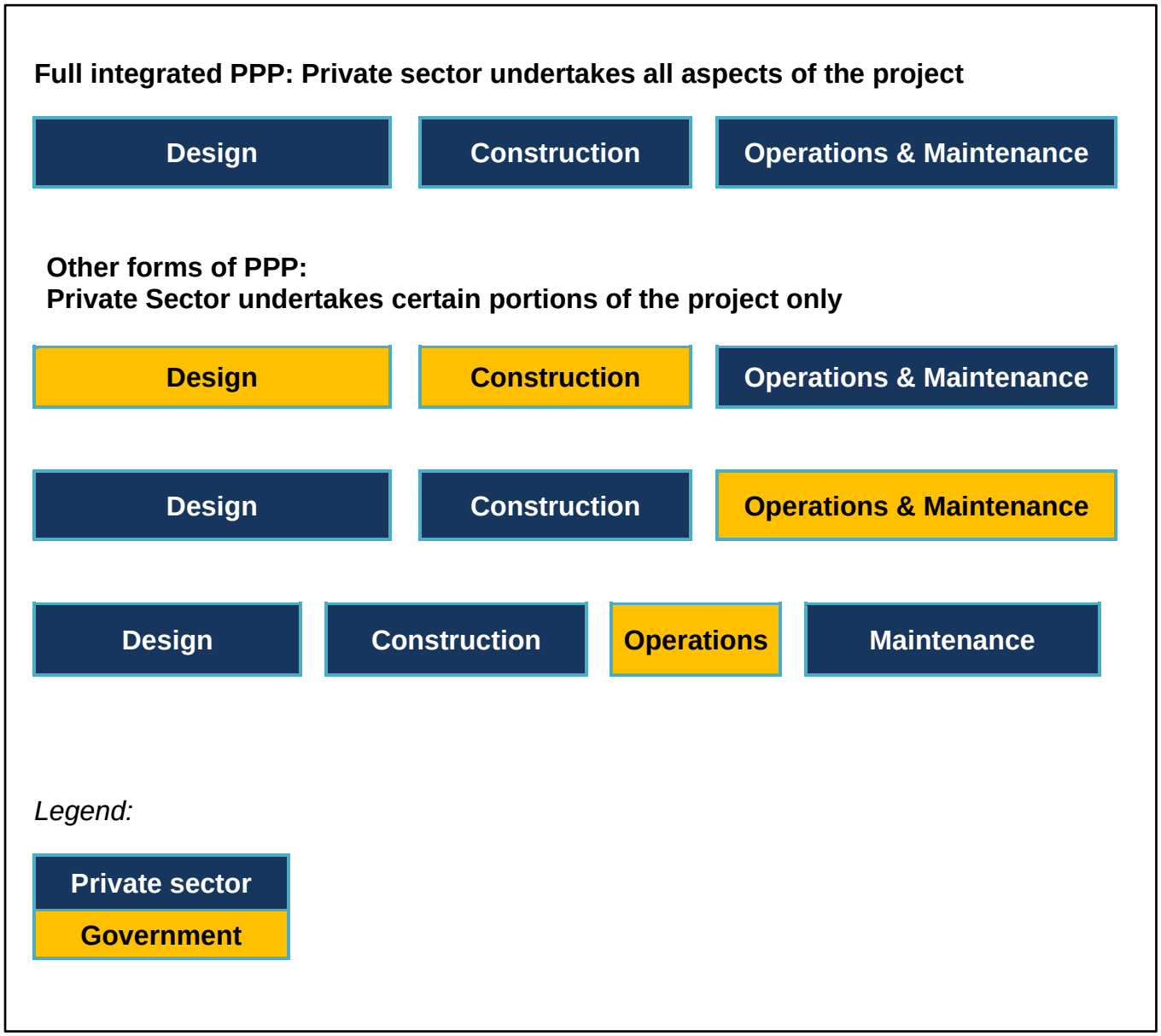


Figure 4. Potential Private Sector and Government Roles in PPP Projects

2.3.3.8. Potential PPP Structuring of SWM Projects

As shown in Figure 5, SWM PPP projects may be implemented following the respective SWM major scope or by bundling the various scopes into one PPP project. This may be determined during the PPP structuring stage wherein the risks identified are allocated to the party that can best manage the associated risks.

PPP structuring helps develop a combination of contractual arrangements, specify the extent of private sector participation, appropriate risk allocation, and type of government support that will likely make the project bankable. It is possible that more than one PPP structure/option may be found suitable for a specific project. The financing framework and concession period of the project should be analyzed and established at this stage, including determining whether the project should be bundled with other similar PPP projects for economies of scale and marketability, as well as the preferred PPP contract model (Build-Operate-Transfer, Build-Transfer-Operate, etc.). The structure of the potential SWM PPP projects may be determined by the LGU through a comprehensive study of the Project.

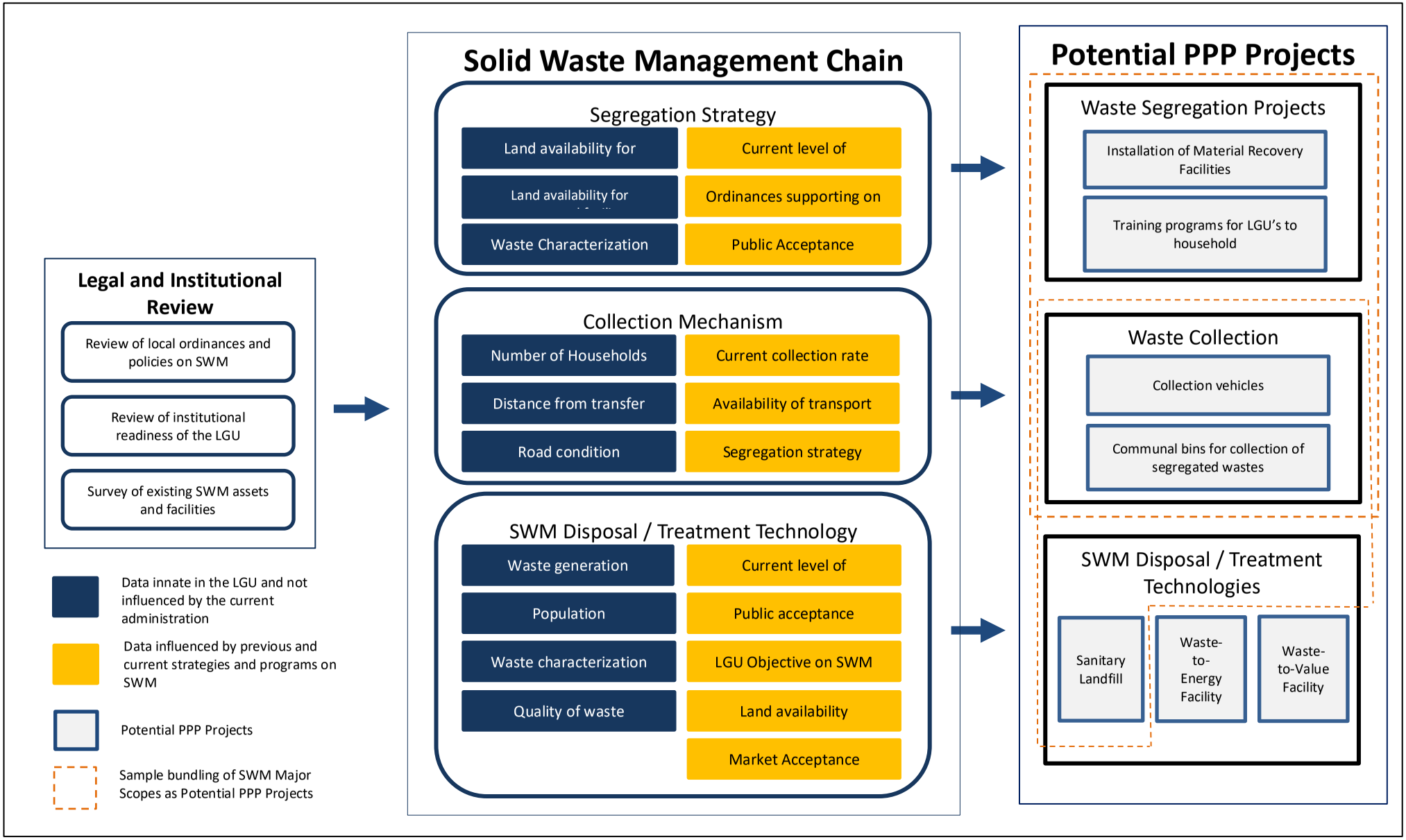


Figure 5. Conceptual Framework with Potential SWM PPP Projects

Appendix 9

3. Synthesis

LGUs may determine the appropriateness to undertake an SWM PPP project by assessing its SWM Plan and other available data. The most common aspect of the solid waste management chain which attracts interested private sector participants is the disposal/treatment since it requires high capital expenditure in its construction and technical expertise in its operation and maintenance.

The most suitable PPP structure for SWM PPP projects may vary based on the analysis of the available data and result of the feasibility study and/or business case conducted by the LGU and the experts.

4. Support from the PPP Center

The PPP Center provides support to LGUs through its various services. These services include project support in the development, procurement, evaluation of unsolicited proposals, monitoring during implementation; project support through the Project Development and Monitoring Facility (PDMF); and capacity development.

Project support through the Project Development Service (PDS)

The PDS may assist LGUs in the development and/or review of feasibility studies and tender documents for solicited SWM PPP projects. Further, the team may also assist the LGU in the evaluation, negotiation, and management of unsolicited SWM PPP projects.

For solicited SWM PPP projects, the PDS may assist in the conduct of business case via a Technical Assistance Agreement (TAA) to be signed by and between the PPP Center and the LGU concerned. The in-house team is assisted by international and national experts from the PPP Center's development partners.

Project support through the PDMF

LGUs may also tap the Project Development and Monitoring Facility (PDMF) to engage advisors and consultants for project development, managing transactions during procurement including those involving unsolicited proposals, and for obtaining independent assessments or advice during any of the phases of project implementation (construction, operation and maintenance, transfer).

The PDMF is a revolving fund whereby the project development costs (including costs of transaction advisory services) are repaid or reimbursed by the winning bidder of a PPP project. If the PDMF is used for independent assessment or advisory during project implementation, then the cost of an independent consultant is shared 50-50 by the LGU and the private partner.

LGUs needing support for the kinds of consultants and advisors that the PDMF can provide may contact the PDMF through pdmfs@ppp.gov.ph.

Capacity development

The PPP Center also conducts trainings and seminars depending on the development needs and requirements of the implementation agency/LGU. Such topics include:

- Introduction to PPP concepts or PPP 101
- Concept note formulation
- Project prioritization
- Management of unsolicited proposals
- Financial and economic analysis of PPP projects

For more details on PPP Center assistance to projects, please visit https://ppp.gov.ph

Appendix 10: Online Training

10-1 : Summary Report
10-2 : SWM in Japan
10-3 : Dioxin Analysis
10-4 : Japanese Experience of WTE Development
10-5 : Examples of WTE in Tokyo

Appendix 10-1: Summary Report

1. Training Objective

The objective of this training is to share Japanese technologies and practices on Solid Waste Management (SWM) and Dioxin (DXN) Analysis with the trainees who are involved in the project activities.

It is expected that the knowledge obtained through the training will be helpful for implementation of the activities in the remaining project period.

2. Training Program

The training program is shown in Table 1.Online Training was held on November 15th-18th, 26th and December 3rd, 6th and 10th. The lectures and trainings are classified as either SWM/WTE Courses and Dioxin Analysis Courses. This training program was initially planned to be conducted in Japan, but due to the travel restrictions brought by the COVID-19 pandemic, the mode of delivery was opted to be facilitated through synchronous online sessions instead.

Date and Time: November 15th-18th, 26th and December 3rd, 6th and 10th

Training Course: SWM/WTE Courses and Dioxin Analysis Courses

Session Platform: Microsoft Teams

Language: Japanese and English (Sequential Interpretation)

Table 1 Program of Online Training

Schedule (PHT)	Category	Lecture/Training	Lecturer	Number of Participants
November 15, 2PM-4PM	SWM	• Solid Waste Management /Legal Framework, Roles of Each Entity in Japan	Nippon Koei Co., Ltd.	38
November 16, 10AM -12NN	DXN Analysis	• Pre-conditioning of Capturing/ Adsorbent Materials and Sampling Train	Eurofins Nihon Kankyo K.K.	24
November 17, 10AM -12NN		• Procedure of Sample Recovery from the Sampling Train		20
November 18, 10AM -12NN		• Initial setup of GC/HRMS and DIOK Operation		19
November 26, 9AM -11AM	WTE	• PPP for Waste to Energy (WTE) project	Eight-Japan Engineering Consultants Inc.	24
December 3, 9AM -11AM		• Online Visit to Suginami Incineration Plant • Environmental Consideration in the WTE Facility	Clean Authority of Tokyo	26
December 6, 9AM -11AM		• Outline of Solid Waste Management in Tokyo 23 Wards • Public Consultation and Consensus Building • Suitable Waste Segregation and Promotion • Operation of Waste to Energy Facilities	Clean Authority of Tokyo	22
December 10, 9AM -11AM		• Outline of WTE Technology • Requirements of WTE Projects	Eight-Japan Engineering Consultants Inc.	25

Source: JICA Expert Team

3. Summary of Questionnaire Result

In order to make the project activities fruitful, a post questionnaire was conducted for each training category. The summary of questionnaire results is shown below. The details are shown in Appendix.

(1) SWM Session

The session management and lecture content were well received by the participants. Participants also reported to have deep understanding and appreciation of the topics covered, and were particularly interested on topics on "Laws related to waste management in Japan (in more detail)" and "History of waste management in Japan."

(2) Dioxin Analysis Session

The session management and lecture content were well received by the participants. Due to the high level of technicality of the content of the lecture, some participants reported to having a hard time in understanding the lecture. They also reported to be particularly interested in the topic "Preparation of stack gas and ambient air sample capturing/adsorbent material".

(3) WTE Session (Clean Authority of Tokyo)

The session management and lecture content were well received by the participants. Participants further noted that they would have wanted more time to be allotted for the Q&A portion to accommodate more inquiries. They also reported to have deep understanding and appreciation of the topics covered, and were particularly interested on topics on “Environmental measures surrounding Suginami Incineration Plant" and "Operation of WTE Plant"

(4) WTE Session (Eight-Japan Engineering Consultants Inc.)

The session management and lecture content were well received by the participants. In response to some specific questions about the PPP scheme, with 80% noting that the Philippines should develop financial support systems similar to Japan, sourced from the National Government, to support the development of waste management facilities. Participants also reported to have deep understanding and appreciation of the topics covered, and were particularly interested on topics on "Requirements for the construction of WTE facilities," and "The chemical that will be used"

4. Participant List

The participants for each training course are shown in Table 2 and Table 3. There were 47 participants in the SWM/WTE course and 29 participants in the dioxin analysis course from each of the concerned organizations.

Table 2 Participants list of SWM/WTE Courses

No.	Name	Office	Designation
1	Ms. Charisse Jane D. Pascual	Department of Energy - REMB	Senior Science Research Specialist
2	Ms. Sarah Sharmaine T. Gabriel	Department of Energy - REMB	Science Research Specialist II
3	Ms. Gemmalyn G. Galang	Department of Energy - REMB	Science Research Specialist I
4	Mr. Luis Sabater	QC Task Force Solid Waste Management	Planning Officer III
5	Mr. Christoper Ador	QC Task Force Solid Waste Management	Project Development Officer
6	Ms. Jodell Robiso	QC Task Force Solid Waste Management	Planning and Research Assistant
7	Ms. Elmie Ranchez	QC Task Force Solid Waste Management	Clerk

No.	Name	Office	Designation
8	Ms. Glory Rose C. Manatad	Cebu City Environment and Natural Resources Office	Environmental Management Specialist II
9	Ms. Marilou T. Calado	DENR - EMB - Project Preparation Division - FASPS	DMO III
10	Mr. Conrado A. Bravante, Jr.	DENR - EMB - Project Preparation Division - FASPS	Chief
11	Ms. Isabel D. Salas	DENR - EMB - Project Preparation Division - FASPS	DMO III
12	Ms. Alma P Ferareza	EMB NCR	Sr. Environmental Management Specialist
13	Ms. Myra Tansengco	DOST - ITDI - Environment & Biotechnology Division	Supervising Science Research Specialist
14	Ms. Gee Maurene G. Manguera	PPPC	Project Development Officer
15	Mr. Aaron Gabrielle M. Tanyag	PPPC	Project Development Officer
16	Mr. Erwin James G. Caluag	PPPC	Project Development Officer
17	Mr. Lakandiwa Orcullo	Davao City Environment and Natural Resources Office	Engineer
18	Ms. Elvira Pausing	EMB - SWMD - PMO	Supervising EMS
19	Ms. Roxanne Barcenas	EMB - SWMD - PMO	Technical Assistant
20	Mr. Alwin Jay D. Robel	DENR - EMB	Environmental Management Specialist I
21	Ms. Raquel Rosario A. Reyes	DENR - EMB	Sr. Environmental Management Specialist
22	Ms. Rodeth Antonio	DENR - EMB - SWMD	Monitoring Officer
23	Mr. Eric Nagum	DENR - EMB - SWMD	Site Engineer
24	Mr. Ronald Ewa	DENR - EMB R11	Environmental Management Specialist II
25	Ms. Patricia Rose Orante	QC Task Force Solid Waste Management	Sr. Environmental Management Specialist
26	Ms. Mary Ash Day O. Malimit	NEDA Infrastructure Staff	Chief Economic Development Specialist
27	Mr. Edgar Basilio	NEDA Infrastructure Staff	Chief Economic Development Specialist
28	Mr. Kevin Gilbert M. Manzano	NEDA Infrastructure Staff	Supervising EDS
29	Mr. Bernie C. Magtalas	NEDA Infrastructure Staff	Senior EDS
30	Ms. Roselyn Ann P. Obrique	NEDA Infrastructure Staff	EDS II
31	Mr. Ronelle S. Yuag	NEDA Infrastructure Staff	EDS II
32	Ms. Arianne Rose A. Santos	NEDA Infrastructure Staff	EDS I
33	Ms. Wyona Kay Rativo	EMB - AQMS	Engineer II
34	Mr. Edmundo Escubio	EMB - AQMS	Engineer II
35	Mr. Paul Nathan Vallar	EMB - AQMS	Environmental Management Specialist II
36	Ms. Mariam Salemizadeh	EMB - AQMS	Environmental Management Specialist II
37	Mr. Arnon Brix Faustino	EMB - AQMS	Monitoring Officer
38	Mr. Felix Brylle Domingo	EMB - AQMS	Site Engineer

No.	Name	Office	Designation
39	Ms. Mae Ann Gatchallan	EMB - AQMS	Site Engineer
40	Mr. Rey John Esquivel	DENR - EMB - SWMD	Environmental Management Specialist I
41	Mr. Jay Christoffer F. Bawi-in	DENR - EMB R11	Chief, Ecological Solid Waste Management Section
42	Ms. Rocelle Estoya	EMB - SWMD	Project Support Officer
43	Ms. Gee Maurene G. Manguera	PPPC - PDS	Project Development Officer
44	Mr. Aaron Gabrielle M. Tanyag	PPPC - PDS	Project Development Officer
45	Ms. Marla Clarisol Agas	DILG	Project Development Officer III
46	Ms. Elle Pancho	DILG	Project Development Officer III
47	Engr. Danilo Gonzales	DENR-EMB R11	

* Those who participate in even one session are considered participants.

Table 3 Participants list of DXN Analysis Courses

No.	Name	Office	Designation
1	Mr. Sammy L. Aytona	DENR - EMB - ERLSD	Sr. SRS
2	Mr. Roger C. Evangelista, Jr.	DENR - EMB - ERLSD	Sr. SRS
3	Mr. Lyle Shane G. Dichoso	DENR - EMB - ERLSD	Chemical Technician
4	Mr. Khennyie-Ar G. Peroja	DENR - EMB - ERLSD	Chemist
5	Mr. Alex Avel P. Romero	DENR - EMB - ERLSD	Chemist
6	Mr. Luis Sabater	QC Task Force Solid Waste Management	Planning Officer III
7	Mr. Christoper Ador	QC Task Force Solid Waste Management	Project Development Officer
8	Ms. Jodell Robiso	QC Task Force Solid Waste Management	Planning and Research Assistant
9	Ms. Elmie Ranchez	QC Task Force Solid Waste Management	Clerk
10	Ms. Menchie M Alanis, PhD	EMB NCR	Chief, Laboratory Services Section
11	Ms. Myra Tansengco	DOST - ITDI - Environment & Biotechnology Division	Supervising Science Research Specialist
12	Mr. Lakandiwa Orcullo	Davao City Environment and Natural Resources Office	Engineer
13	Ms. Elvira Pausing	EMB - SWMD - PMO	Supervising EMS
14	Ms. Roxanne Barcenas	EMB - SWMD - PMO	Technical Assistant
15	Mr. Alwin Jay D. Robel	DENR - EMB	Environmental Management Specialist I
16	Ms. Rodeth Antonio	DENR - EMB - SWMD	Monitoring Officer
17	Mr. Ronald Ewa	DENR - EMB R11	Environmental Management Specialist II
18	Mr. Ronelle S. Yuag	NEDA Infrastructure Staff	EDS II
19	Ms. Arianne Rose A. Santos	NEDA Infrastructure Staff	EDS I
20	Ms. Wyona Kay Rativo	EMB - AQMS	Engineer II
21	Mr. Angelo Villegas	EMB - AQMS	Site Engineer
22	Mr. Felix Brylle Domingo	EMB - AQMS	Site Engineer

No.	Name	Office	Designation
23	Ms. Mae Ann Gatchallan	EMB - AQMS	Site Engineer
24	Mr. RJ Esquivel	DENR - EMB - SWMD	Environmental Management Specialist I
25	Mr. Jay Christoffer F. Bawi-in	DENR - EMB R11	Chief, Ecological Solid Waste Management Section
26	Ms. Rocelle Estoya	EMB - SWMD	Project Support Officer
27	Ms. Gee Maurene G. Manguera	PPPC - PDS	Project Development Officer
28	Mr. Aaron Gabrielle M. Tanyag	PPPC - PDS	Project Development Officer
29	Mr. Erwin James G. Caluag	PPPC - PDS	Project Development Officer

＊Those who participate in even one session are considered participants.

＊There is a duplication in the names of those who participated in both the SWM/WTE course and the DXN Analysis course.

Project for Capacity Development on Improving Solid Waste Management through Advanced/Innovative Technologies

—Summary of Questionnaire for Online Training—

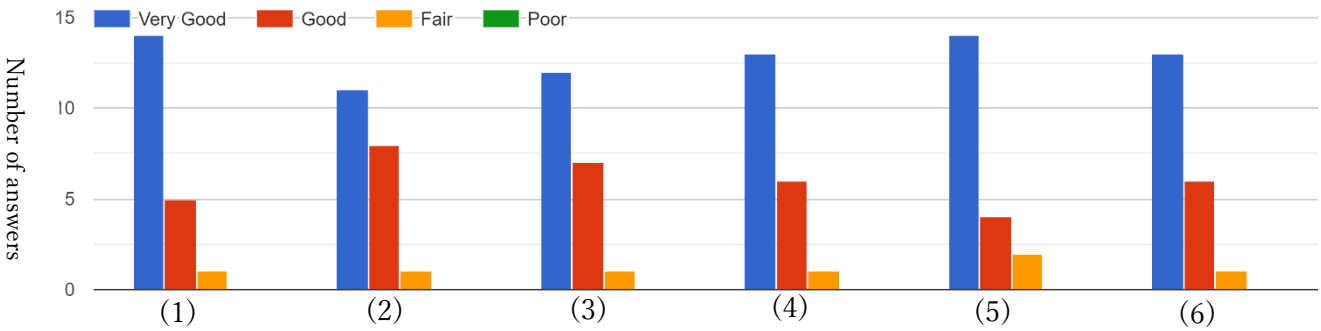
- **JICA Online Training Program : Sessions 1 (Solid Waste Management in Japan)**

➢ **Answerers of Questionnaires (17 participants)**

Name	Organization
Wyona Kay C. Rativo	Environmental Management Bureau
Luis Sabater	Quezon City Local Government
Rey John Esquivel	EMB
Glory Rose Manatad	LGU Cebu City
Myra L. Tansengco	ITDI-DOST
Jay Christoffer F. Bawi-in	EMB XI
Marla Agas	DILG
Raquel Rosario Acuña Reyes	DENR-Environmental Management Bureau
Roselyn Ann P. Obrique	NEDA
Mariam Salemizadeb	Environmental Management Bureau
Elvira Pausing	DENR-EMB-Solid Waste Management Divsiion
Aaron Tanyag	PPP Center
Sarah Sharmaine T. Gabriel	Department of Energy Philippines
Alwin Jay D Robel	DENR-EMB
Rodeth F. Antonio	DENR - EMB - SWMD
Roxanne R. Barcenas	DENR - EMB - SWMD
Mae Ann Gatchallan	Environmental Management Bureau of the Philippines

➢ **Response tothe Questionnaire**

1. General session management
   （1）Overall conduct of session
   （2）Duration of session (2hrs)
   （3）Afternoon session schedule
   （4）Internet stability of presenter
   （5）Usage of MS Teams
   （6）Management of lecture, questions, and participants



2. Presentation of Speakers

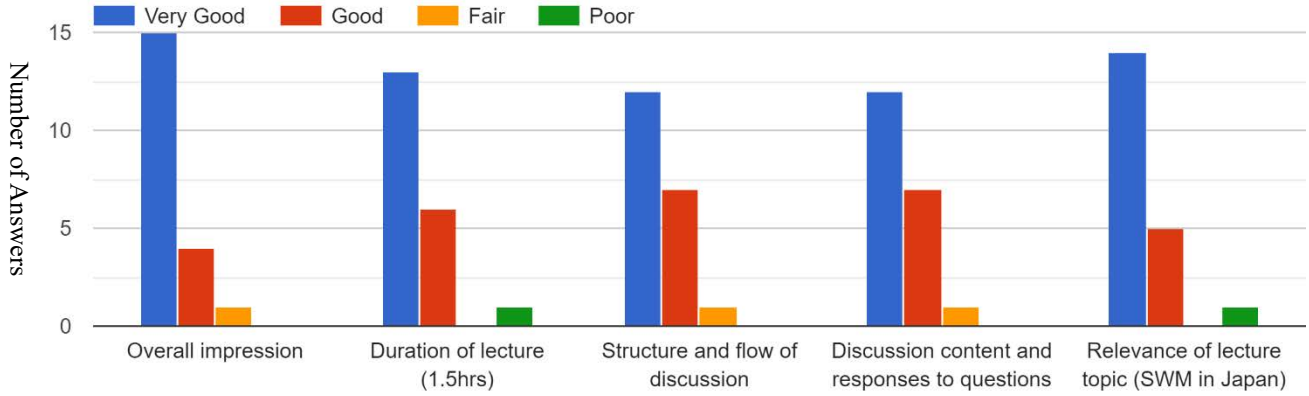
(1) Overall impression

(2) Overall duration of lecture (1.5hrs)

(3) Overall structure and flow of discussion

(4) Overall discussion content and responses to questions

(5) Relevance of lecture topic (SWM in Japan)



3. Understanding of topics discussed

(1) Municipal Waste Management Facts in Japan

(2) History of Municipal Waste Management in Japan

(3) Current Municipal Waste Management in Japan

(4) Technical explanations and others

(5) Overal legal framework in Japan

(6) The Basic Environmental Law

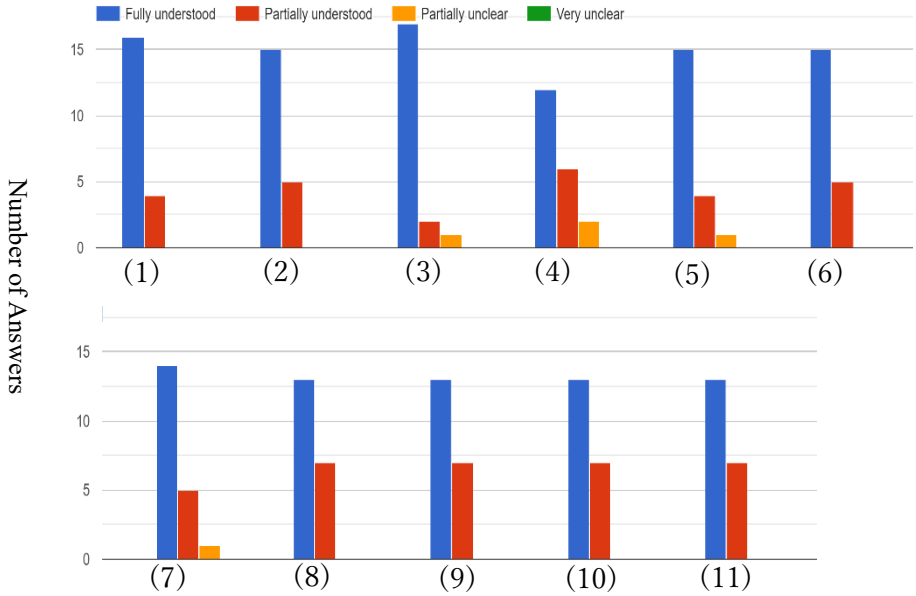
(7) The Basic Law for Establishing a Sound Material-cycle Society

(8) Law for the Promotion of Effective Utilization of Resources

(9) Waste Management and Public Cleansing Law

(10) Recycling related Laws (Container & Packaging, WEEE)

(11) Appendix: Waste Management and Recycling in Daily Life



4. Please provide any comments and/or suggestions
   - All were presented well
   - Nice webinar
   - Thank you for sharing your knowledge and practices
   - The speaker was effective in delivering all the topics. I have learned a lot. Thank you very much.
   - The speaker is commendable and is very knowledgeable on the topic.
   - Informative presentation

5. Which of the discussion points in the session was most relevant/ interesting for you?
   - The Basic Environmental Law
   - Extended producer responsibility
   - I am more interested on the topic: Waste Management and Public Cleansing Law. Japan is not so different from most countries in terms of challenges and issues encountered, but it has successfully applied proper waste management measures in its country. It is also impressive that their citizens diligently observes their environmental laws.
   - History and Current SWM in Japan
   - The different laws relative to waste management
   - Technical explanations
   - Process in the incineration plant
   - All topics are interesting
   - Law for the Promotion of Effective Utilization of Resources
   - The management of the waste and recycling

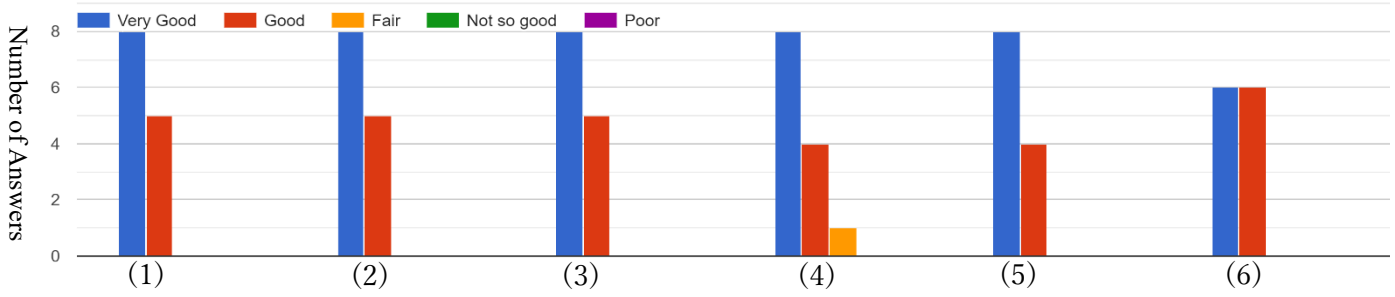
- **JICA Online Training Program : Sessions 2-4 (Dioxin Analysis in Japan)**

➢ **Answerers of Questionnaires(12participants)**

Name	Organization
Alwin Jay Robel	DENR-EMB
Rey John Esquivel	EMB
Jay Christoffer Bawi-in	DENR EMB XI
Myra L. Tansengco	DOST-ITDI
Wyona Kay Rativo	Environmental Management Bureau
Lyle Shanne Dichoso	DENR EMB
Elvira Pausing	DENR-EMB-Solid Waste Management Division
Rodeth F. Antonio	DENR - EMB -SWMD
Roger C. Evangelista, Jr.	DENR Environmental Management Bureau Central Office
Khennyie-Ar Gregorio Peroja	Environmental Management Bureau
Roxanne R. Barcenas	DENR - EMB - SWMD
Mae Ann So Gatchallan	Environmental Management Bureau of the Philippines

➢ **Response totheQuestionnaire**

1. General session management
   (1) Overall conduct of session
   (2) Duration of session (3 days, 2hrs)
   (3) Morning session schedule
   (4) Internet stability of presenter
   (5) Usage of MS Teams
   (6) Management of lecture, questions, and participants

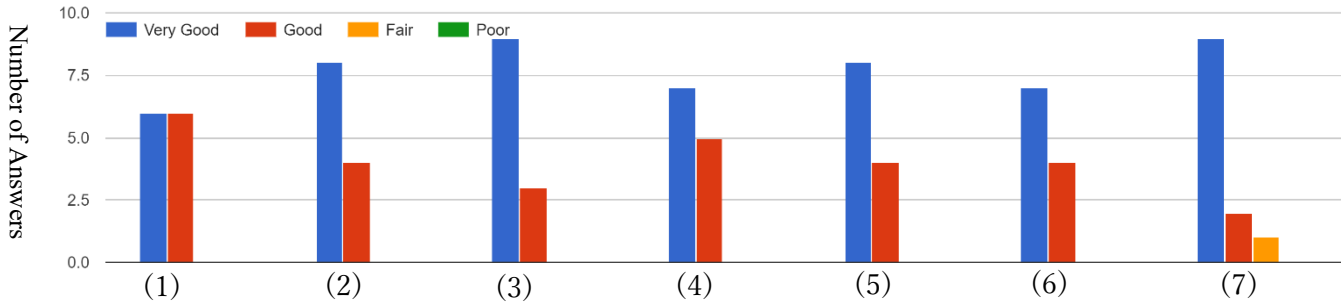


2. Presentation of Speakers
   (1) Overall impression
   (2) Overall duration of lecture (3 days, 1.5hrs)
   (3) Overall structure and flow of discussion
   (4) Overall discussion content and responses to questions

(5) Session 2 topic: Preparation of stack gas and ambient air sample capturing/adsorbent materials

(6) Session 3 topic: Sample recovery from sampling train

(7) Session 4 topic: GC/HRMS measurement and Data processing by Diok operation

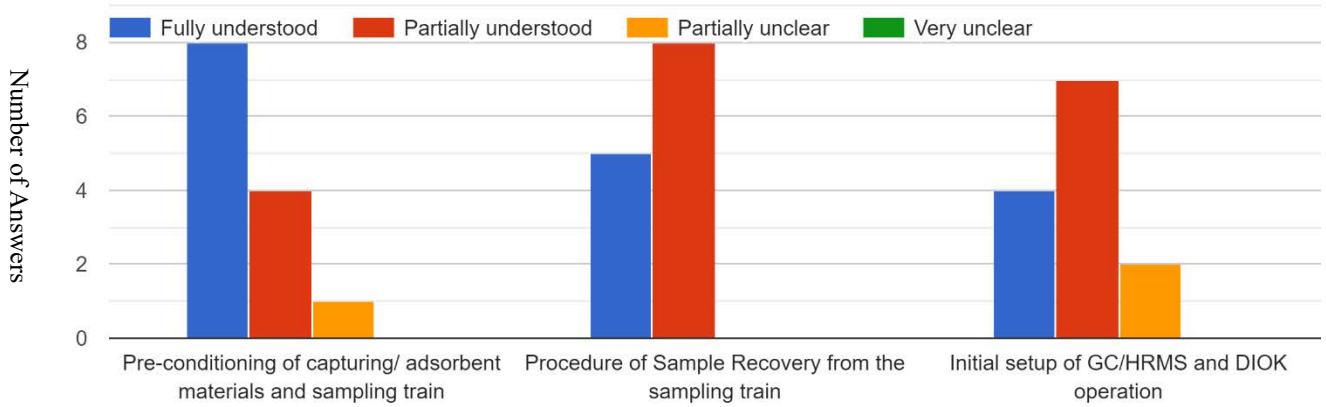


3. Understanding of topics discussed

(1) Pre-conditioning of capturing/ adsorbent materials and sampling train

(2) Procedure of Sample Recovery from the sampling train

(3) Initial setup of GC/HRMS and DIOK operation



4. Please provide any comments and/or suggestions.

- Thank you for sharing your valuable time and knowledge
- Informative information

5. Which of the discussion points in the session was most relevant/ interesting for you?

- Dioxin analysis
- Preparation of stack gas and ambient air sample capturing/adsorbent material
- I'm not actually involve in the above topics discussed. my interest is more on SWM management and technologies
- All topics are interesting

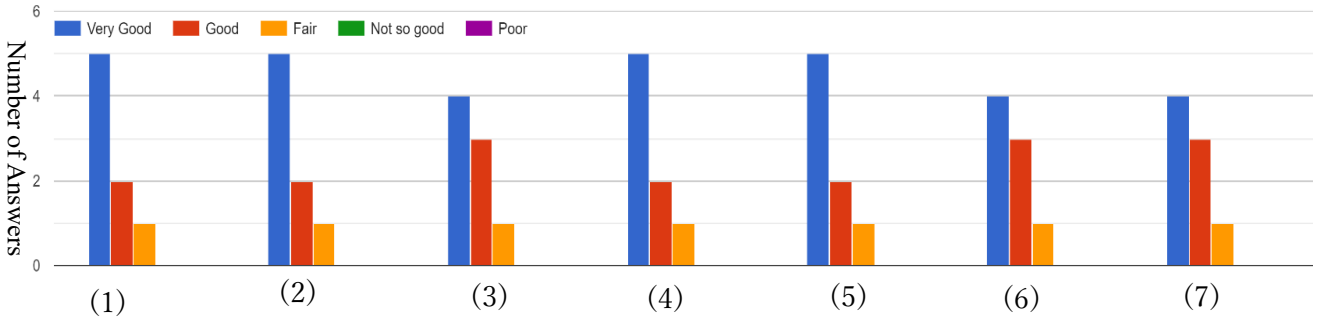
- **JICA Online Training Program : Sessions 6-7 (Waste to Energey in Japan by Clean Authority of Tokyo)**

➢ **Answerers of Questionnaires(8participants)**

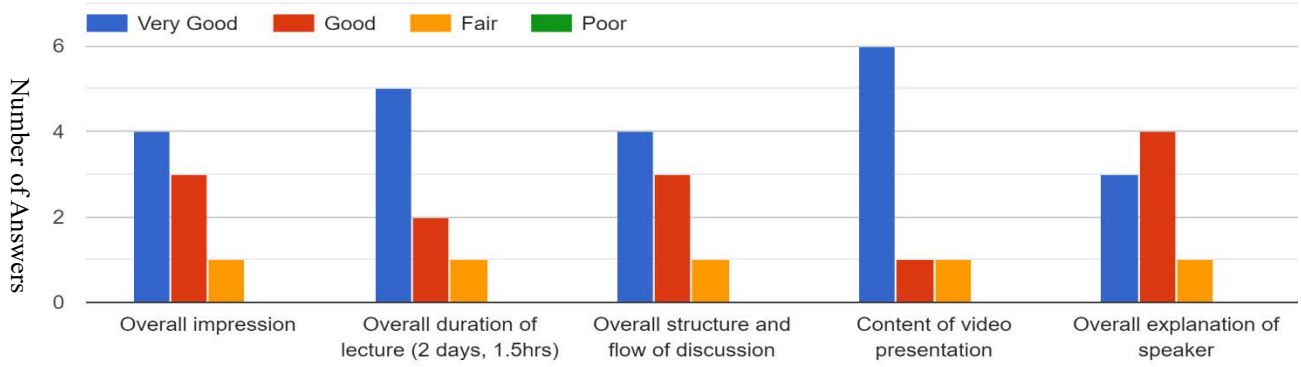
Name	Organization
Luis S. Sabater	QC LGU
Wyona Kay Rativo	Environmental Management Bureau
Myra Tansengco	ITDI-DOST
Conrado Bravante, Jr.	DENR Foreign Assisted and Special Projects Service
Isabel D. Salas	DENR
Rodeth F. Antonio	DENR - EMB - SWMD
Roxanne R. Barcenas	DENR - EMB - SWMD
Mae Ann Gatchallan	Environmental Management Bureau of the Philippines

➢ **Response totheQuestionnaire**

1. General session management
   (1) Overall conduct of session 6 (December 3)
   (2) Overall conduct of session 7 (December 6)
   (3) Duration of session (2days, 2hrs)
   (4) Morning session schedule
   (5) Internet stability of presenter
   (6) Usage of MS Teams
   (7) Management of lecture, questions, and participants



2. Presentation of Speakers
   (1) Overall impression
   (2) Overall duration of lecture (2days, 1.5hrs)
   (3) Overall structure and flow of discussion
   (4) Content of video presentation
   (5) Overall explanation of speaker



3. Understanding of topics discussed

(1) Introduction of Suginami Incineration Plant (Video)

(2) Online inspection of Suginami Incineration Plant

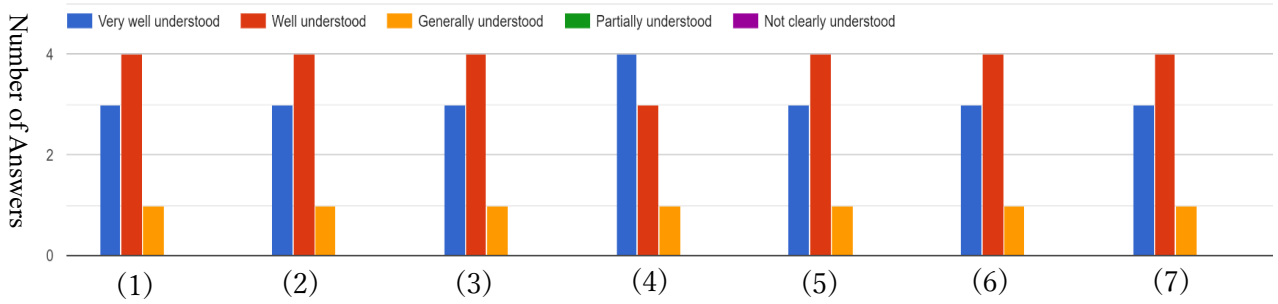
(3) Environmental measures surrounding Suginami Incineration Plant

(4) Introduction of waste management of Tokyo 23 cities

(5) Consensus building with local residents

(6) Separation (Promotion of Waste Reduction and 3R Promotion

(7) Operation of Incineration Plant



4. Please provide any comments and/or suggestions.

- More time for question and answer should be allocated.
- Very good
- Thank you for sharing your knowledge and practices
- The presentations were clear and useful, and were made easily understandable by the participants.
- Informative presentation

5. Which of the discussion points in the session was most relevant/ interesting for you?

- Environmental measures surrounding Sugigami Incineration Plant
- The requirements for WtE and the social considerations.
- Plant operation
- The management of the operation of incineration plant and show the creation of the power source

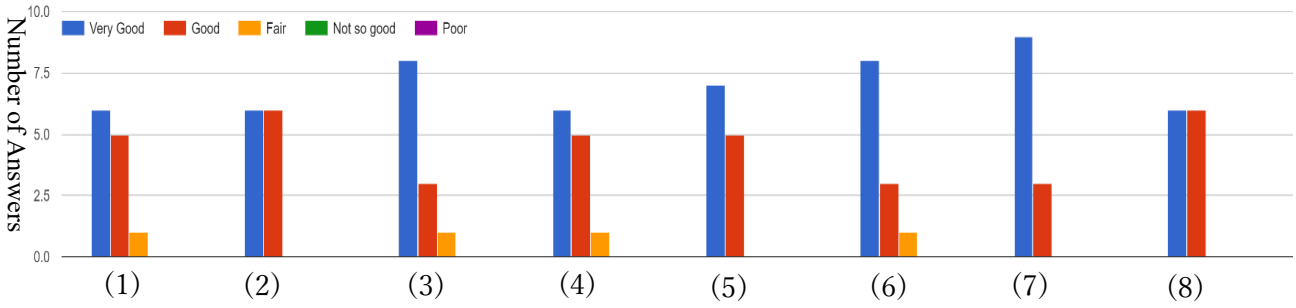
- **JICA Online Training Program : Sessions 5,8 (Waste to Energey in Japan by Eight-Japan Engineering Consultants)**

➢ **Answerers of Questionnaires (11 participants)**

Name	Organization
Myra L. Tansengco	DOST-ITDI
Wyona Kay Rativo	Environmental Management Bureau
Christoper Ador	Quezon City Task Force Solid Waste Management
Marilou T. Calado	DENR
Gemmalyn Galang	DOE
Rey John Esquivel	EMB SWMD
Sarah Sharmaine Gabriel	Department of Energy Philippines
Elvira Pausing	DENR-EMB-Solid Waste Management Division
Rodeth F. Antonio	DENR - EMB - SWMD
Roxanne R. Barcenas	DENR - EMB - SWMD
Mae Ann Gatchallan	Environmental Management Bureau of the Philippines

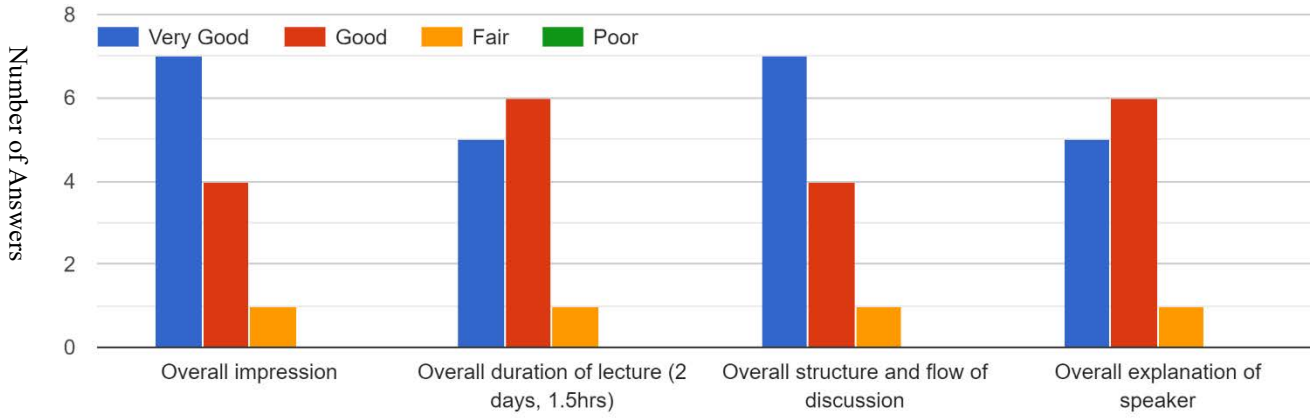
➢ **Response totheQuestionnaire**

1. General session management
   (1) Overall conduct of session 5 (November 26)
   (2) Overall conduct of session 8 (December 10)
   (3) Duration of session (2days)
   (4) Length of session (2 hrs)
   (5) Morning session schedule
   (6) Internet stability of presenter
   (7) Usage of MS Teams
   (8) Management of lecture, questions, and participants



2. Presentation of Speakers
   (1) Overall impression
   (2) Overall duration of lecture (2days, 1.5hrs)
   (3) Overall structure and flow of discussion

(4) Overall explanation of speaker



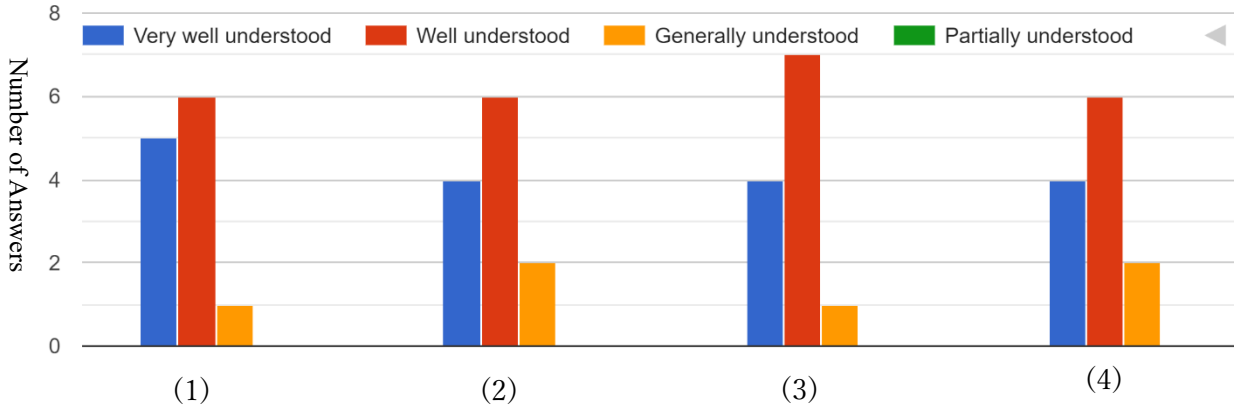
3. Understanding of topics discussed

(1) [26Nov] PPP for WTE Project: The Process of forming an MSW treatment project in Japan

(2) [10Dec] Outline of WtE Project

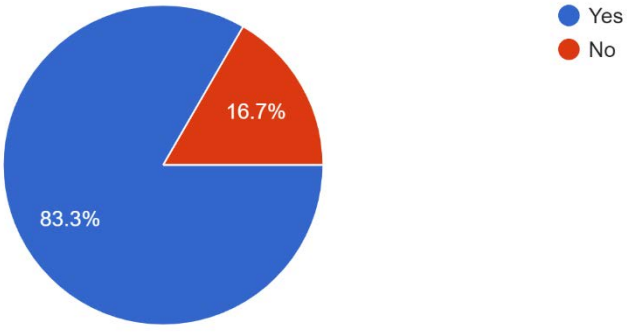
(3) [10Dec] What are the requirements in WtE Project

(4) [10Dec] How to succeed in WtE Project



4. Response to the Specific Questions

(1) Do you think that a financial support system like in Japan, initiated by Ministry of the Environment, is needed for the Philippines? (Yes/No)



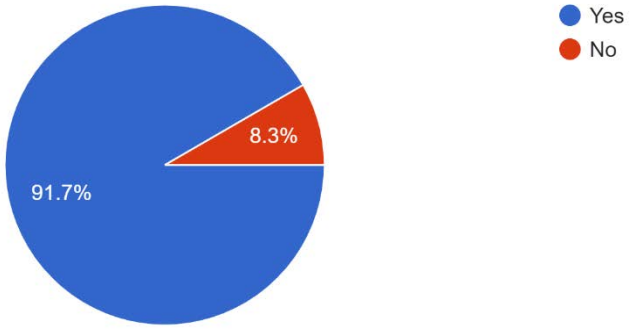
(2) If yes, from which agency do you think should the funds be sourced?

- May be from the national government
- Local Government Units (LGUs)
- DOE/DENR
- Government and/or international organizations
- Given the huge amount of investment, funds should be devolved from the Nat'l govt to the local govt
- From any of the concerned government agencies
- I am not sure due to funds will be a major factor of it

(3) What are the possible difficulties that could be encountered in developing such support system?

- Basis for such support system is needed, as it should be in accordance to the laws, rules and regulations of the country.
- Availability of funds
- Due to lack of funds of other LGUs
- Where to get the funds; location sites
- Lack of funds and political will. NGOs interventions
- Too long of procedural documentations needed with multiple conferences to justify utilization of funds

(4) Regarding the WTE development procedures by the local government in Japan as shown in the lecture, do you think it is important to create similar procedural guide in the Philippines?(Yes/No)



(5) If yes, which part of the procedures do you think are particularly important for the Philippines?

- MSW Treatment Master Plan, Facility Development Conceptual Plan, Facility Basic Plan
- On the materials that been collected
- Implementation of consensus building information disclosure
- The WTE laws policies etc
- Social Acceptance
- Emission issues, sustainability of project, political will of officials
- Facility Development Conceptual planning; whole-of-govt approach; Intensive financing scheme
- Not necessarily similar procedure. Any related system that can be adopted to the situation of a developing country like the Philippines that would include applicable financial mechanism that may be provided to the local government units for them to adopt, considering the huge investment for having a WtE facility.

5. Please provide any comments and/or suggestions.
    - It is very informative
    - It is better to have a face to face session specially on the virtual tour of the WtE facility
    - Thank you for sharing your knowledge and practices
    - The speakers have great mastery of their topics. Thank you for sharing your knowledge and experiences.
    - It's been clearly explained
    - Presentation was informative
    - Informative presentation
6. Which of the discussion points in the session was most relevant/ interesting for you?
    - The requirements in WtE Project
    - The chemical that will be used
    - all topics are relevant
    - WTE in general
    - All topics are interesting
    - The management of Wte
    - Most of it

Appendix 10-2:
SWM in Japan

Online Training
< Outline of Waste Management in Japan >

15 November 2021

Shungo SOEDA

Circular Economy Promotion Dept.
NIPPON KOEI CO., LTD.

The Technical Cooperation Project (TCP) for Capacity Development on
Improving Solid Waste Management (SWM) through
Advanced/Innovative Technologies

Contents of the Presentation

NIPPON KOEI

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1. Self Introduction
2. Municipal Waste Management Facts in Japan
3. History of Municipal Waste Management in Japan
4. Current Municipal Waste Management in Japan
5. Technical explanations and others

NIPPON KOEI

Self Introduction

Name: Shungo SOEDA

Occupation:

Senior Environmental Engineer for 3R and
Solid Waste Management at NIPPON KOEI Co., Ltd.

Education:

BSc Chemical Engineering, Doshisha University 1986
MSc Environmental Sciences, University of Tsukuba 1995

Work Experiences:

Daicel Chemical Industries co., Ltd., 1986 – 1993 (Plant engineer)
City of Cambridge, MA, USA, 1996 (Assistant recycling coordinator)
Nippon Koei Co., Ltd., 1997 – (Environmental Engineer)

Major Engaged Overseas Project

- Information Collection and Verification Survey for Municipal Solid Waste Management in Ukraine (JICA, 2018)
- Technical Cooperation Project for improvement of E-waste reverse logistics in Brazil (JICA, 2014 – 2017)
- Technical Cooperation Project for promotion of sustainable 3R activities in Maputo, Mozambique (JICA, 2013 – 2017)
- Feasibility Study on the introduction of Waste to Energy Plant in Yangon, Myanmar (Ministry of Environment, Japan, 2013)
- Feasibility Study on the construction of the new sanitary landfill, decommission of the existing dumping site and procurement of the solid waste management equipment in Nairobi, Kenya (JICA, 2012)
- Solid Waste Management Holistic Decision Modeling (The World Bank, 2007)
- The Study on the Solid Waste Management in the Kathmandu Valley for the Kingdome of Nepal (JICA, 2006)
- Japanese Grant Aid Project for Improvement of Solid Waste Management in Xi'an City in the People's Republic of China (Xi'an City, 2005)
- Preparatory Study on Solid Waste Management Plan for Dhaka City in People's Republic of Bangladesh (JICA, 2002)

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Municipal Solid Waste Generation Facts/1

	Unit	Japan (FY2018)	Philippines
Total Generation	Ton/Year	42,720,000	13,114,000*
Unit Rate of Generation	gram/ d-capita	918	320-630*
Population	Capita	127 million	100 million
Area	Km^2	377,930	299,404
Pop. Density	Cap./Km^2	337	334
Waste Gen. Density	Ton/Km^2	113	43
GDP per Capita (nominal)	USD	38,214	3,294(2019,IMF)

Source: Ministry of Environment, Japan
National SWM Strategy 2012-2016, DENR

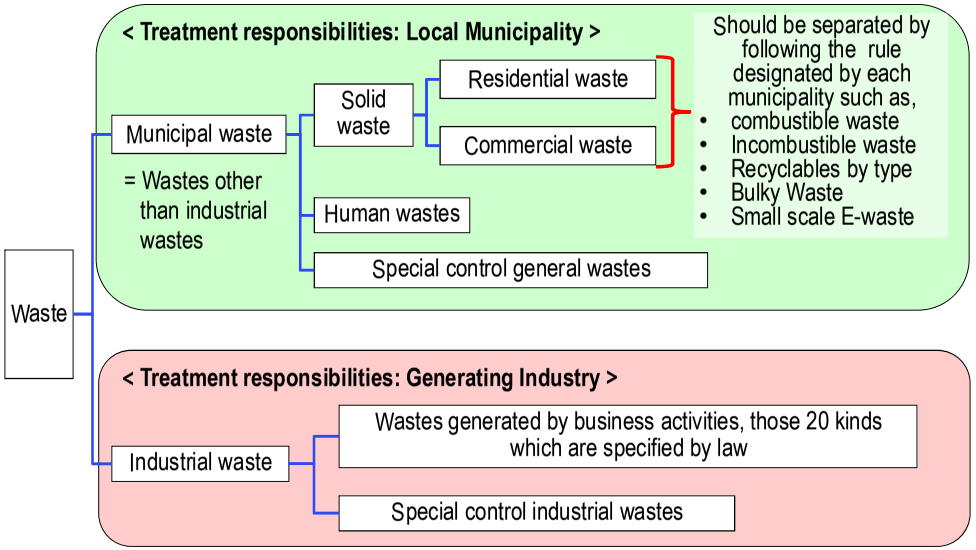
Municipal Solid Waste Treatment Facts/2

		Quantity (ton/year)	Ratio	Note
A	Total Generation	42,720,000		
B	Source Recycling at Community	2,040,000		
C	Total Quantity for Treatment	40,740,000	≒A-B	
D	Treatment for Volume Reduction	38,410,000	94.3%	= D/C
E	Direct Landfill Quantity	440,000	1.1%	= E/C
F	Overall Landfilled Quantity	3,840,000	9.4%	= F/C
G	Overall Recycled Quantity	8,530,000	19.9%	= G/A

Source: Ministry of Environment, Japan (JFY 2018 Survey Data)

Appendix 10

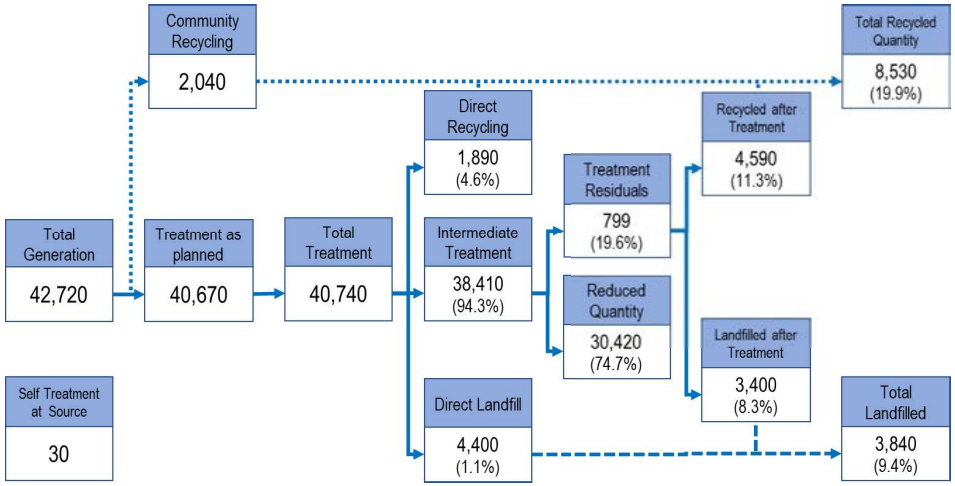
Definition of Waste



Source: Ministry of Environment, Japan

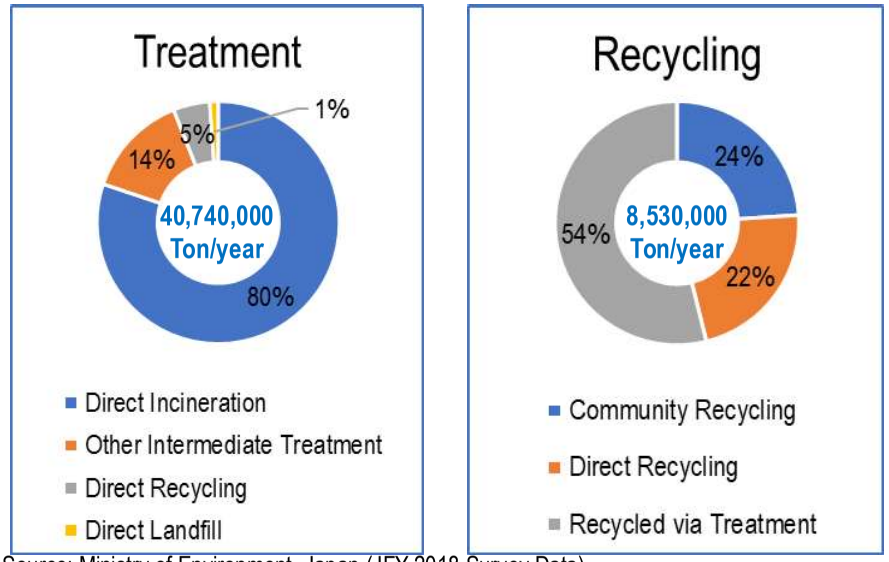
Municipal Solid Waste Flow (2018)

unit: 1,000 ton



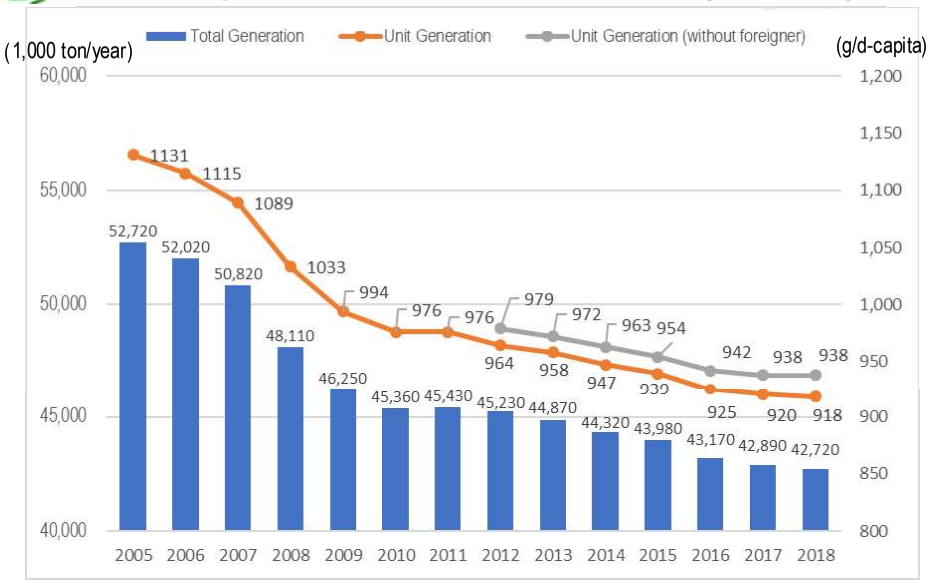
Source: Ministry of Environment, Japan (JFY 2018 Survey Data)

Treatment and Recycling (2018)



Source: Ministry of Environment, Japan (JFY 2018 Survey Data)

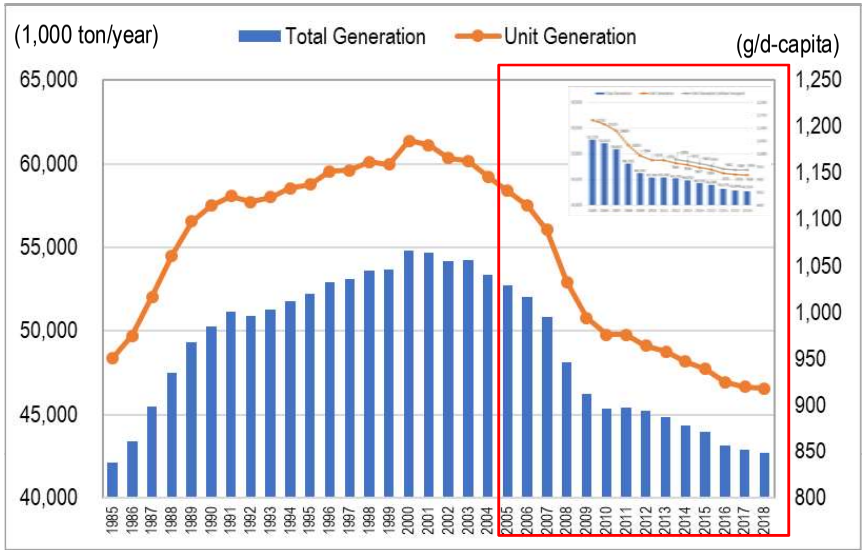
Municipal Solid Waste Generation (2005-18)



Source: Ministry of Environment, Japan

Appendix 10

Municipal Solid Waste Generation (1985 - 2018)



Source: Ministry of Environment, Japan

Municipal Solid Waste Generation (1905 - 2015)

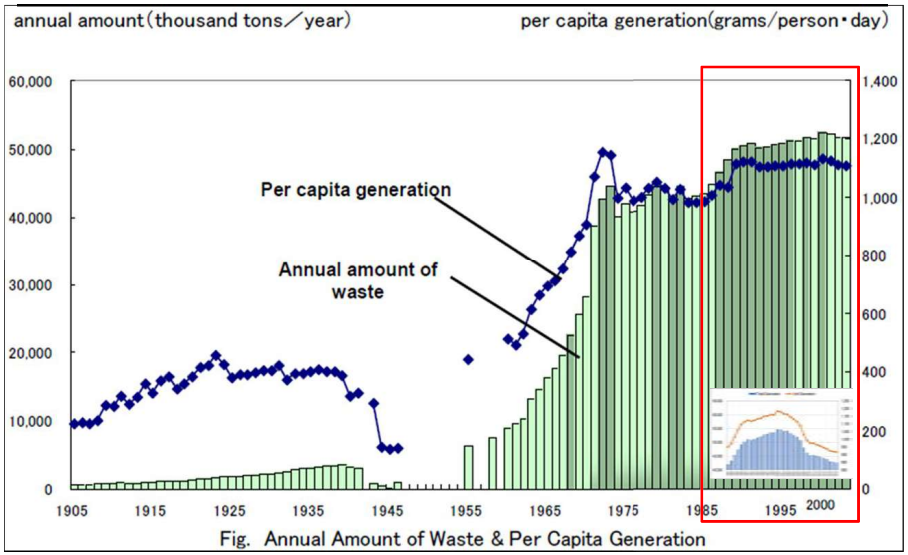


Fig. Annual Amount of Waste & Per Capita Generation

Source: Ministry of Environment, Japan

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Changes of Laws related to SWM

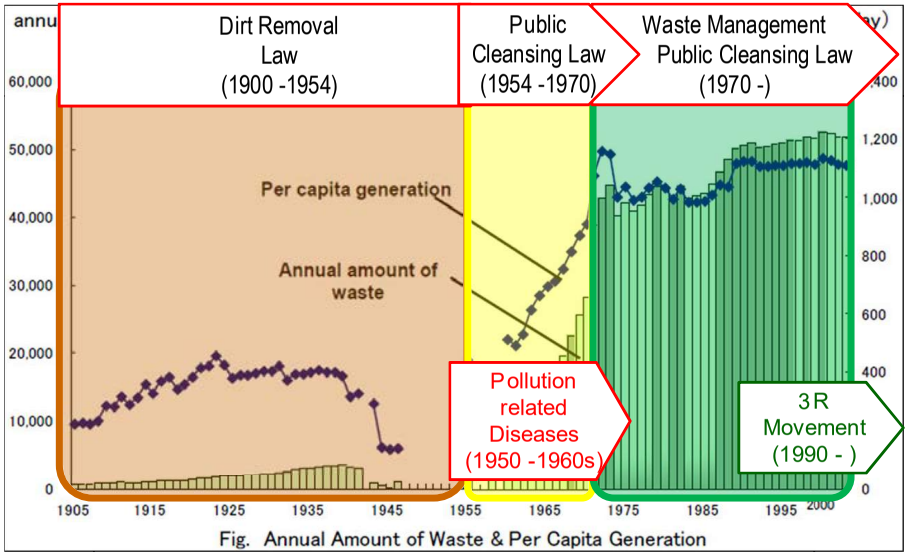


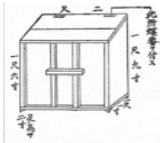
Fig. Annual Amount of Waste & Per Capita Generation

Source: Ministry of Environment, Japan

Appendix 10

Era of Dirt Removal Law (1900-1954)

- ✓ Experienced degradation in hygienic living environment and repeated outbreak of cholera and other infectious diseases in urban area, leading to the establishment of the **Dirt Removal Law**
- ✓ Municipalities were obliged to collect waste in public place
- ✓ Collected waste was carried to designated places – required to burn subject to the regulations
  - no incineration facilities in those days; open burning took place generally
- ✓ Waste was mostly composed of food waste in those days
  - metals, paper and textile were collected as valuables rather than garbage



Used as fertilizer or feed

Generation of new waste

Source: Ministry of Environment, Japan

Era of Public Cleansing Law (1954-1970)

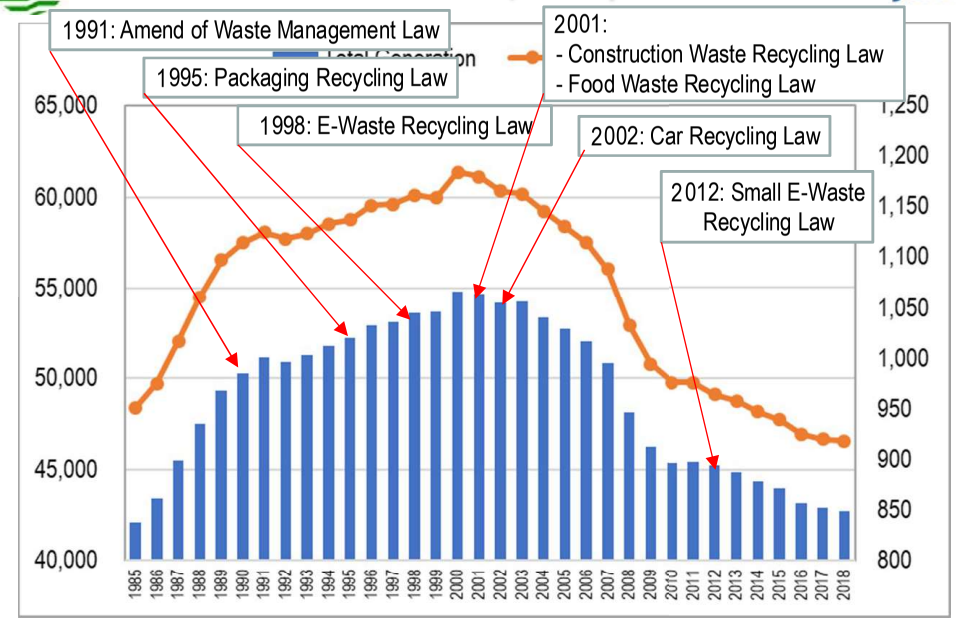
- ✓ Public Cleaning Law was enacted to address environmental degradation caused by rapid economic growth
  - Government was required to provide technological and financial support to municipalities while encouraging progress in science and technology
  - Municipalities were forced to take full responsibility for waste management - required to collect and dispose waste in a well-planned manner from the hygienic viewpoint in designating special cleaning area
  - People were required to keep both their house and premises clean, including the toilet, from the sanitary viewpoint
- ✓ Construction of incinerating facilities was promoted with subsidies by the government
  - high-speed composting was examined as another option, but incineration was adopted as more effective means, viewed from demand for compost and disposal efficiency
- ✓ Composition of waste changed – Plastics in waste increased substantially
- ✓ Active movements "Not in My Back Yard"(NIMBY) often took place

Source: Ministry of Environment, Japan

Era of Waste Management and Public Cleansing Law (1970-)

- ✓ This Law aims to secure living environment and improve public hygiene by disposing waste properly and keeping clean living environment
- ✓ Waste is largely divided into industrial waste and municipal waste to establish a disposal framework for each waste
- ✓ The principle of "responsibility of waste generator" was laid down with regard to industrial waste
- ✓ Collection, transport and disposal of waste must be implemented subject to the disposal criteria specified by Cabinet Order
- ✓ Each prefecture is asked to develop a plan for industrial waste disposal and promote the development of disposal framework in its jurisdiction
- ✓ The responsible area by municipalities was enlarged to the entire area of respective municipalities
- ✓ Cooperation by local residents was highly requested

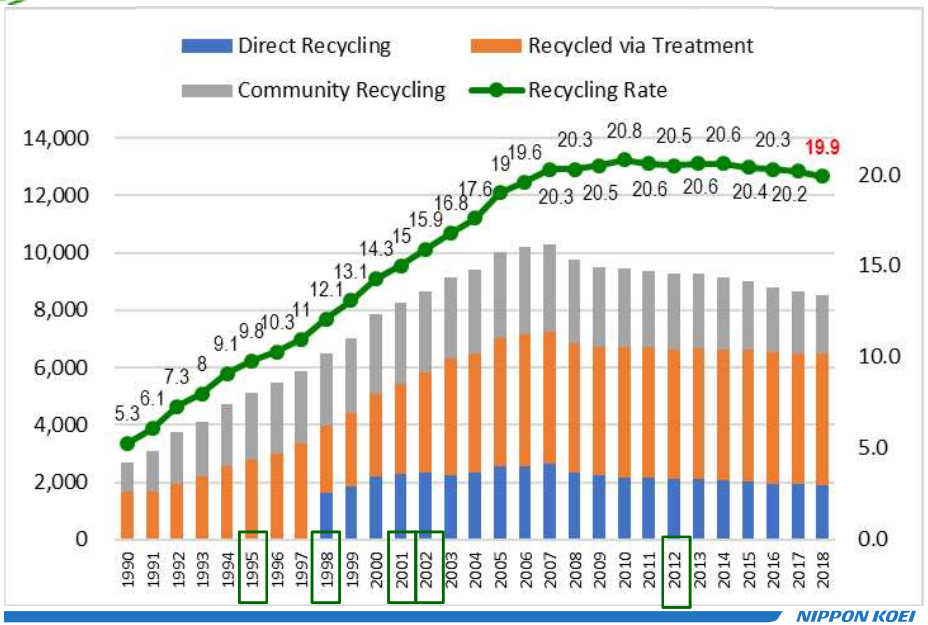
Era of 3R (1990-)



Source: Ministry of Environment, Japan

Appendix 10

Impact of 3R related Laws (1990-)

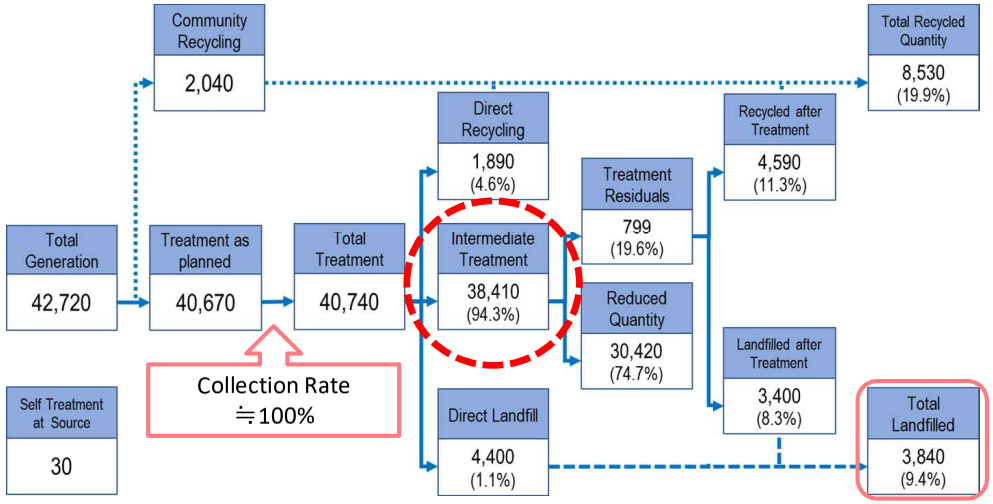


Source: Ministry of Environment, Japan

Contents of the Presentation

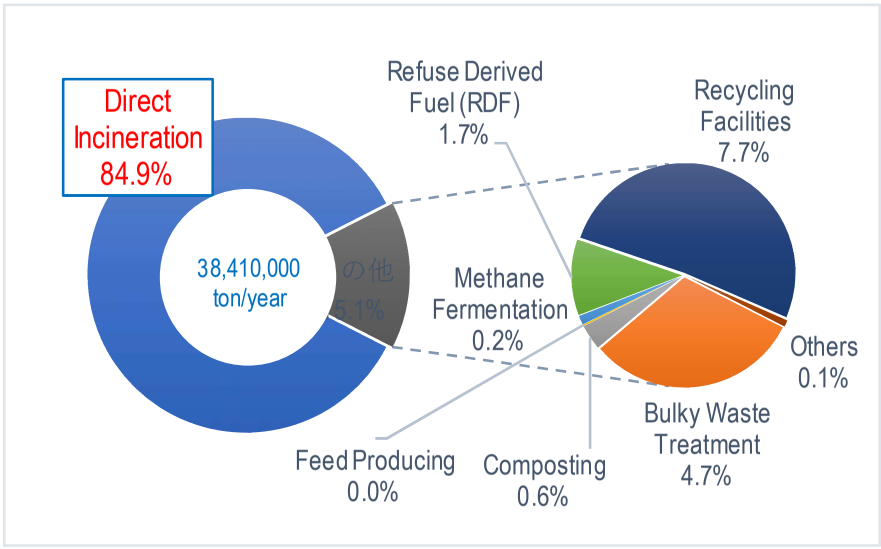
Municipal Solid Waste Flow (2018)

unit: 1,000 ton



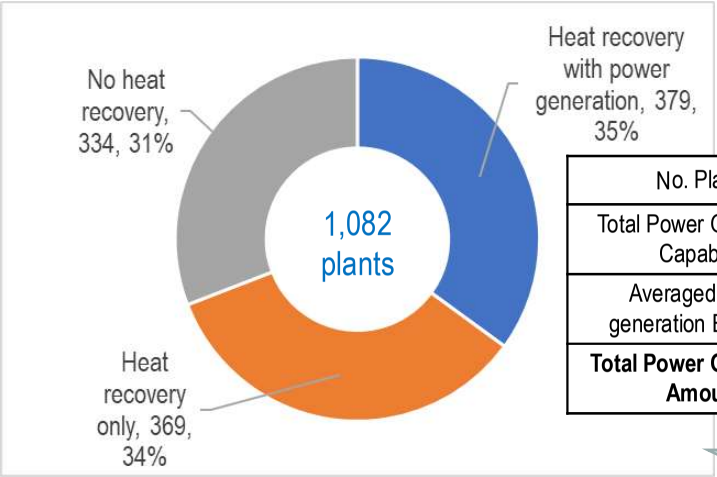
Source: Ministry of Environment, Japan

Intermediate Treatment Options (2018)



Source: Ministry of Environment, Japan

Incineration Plants in Japan (2018)



No. Plants	379
Total Power Generation Capability	2,069 (MW)
Averaged Power generation Efficiency	13.58 (%)
Total Power Generation Amount	**9,553 (GWh)**

Source: Ministry of Environment, Japan (JFY 2018 Survey Data)

For approx. 3.21 million households per year

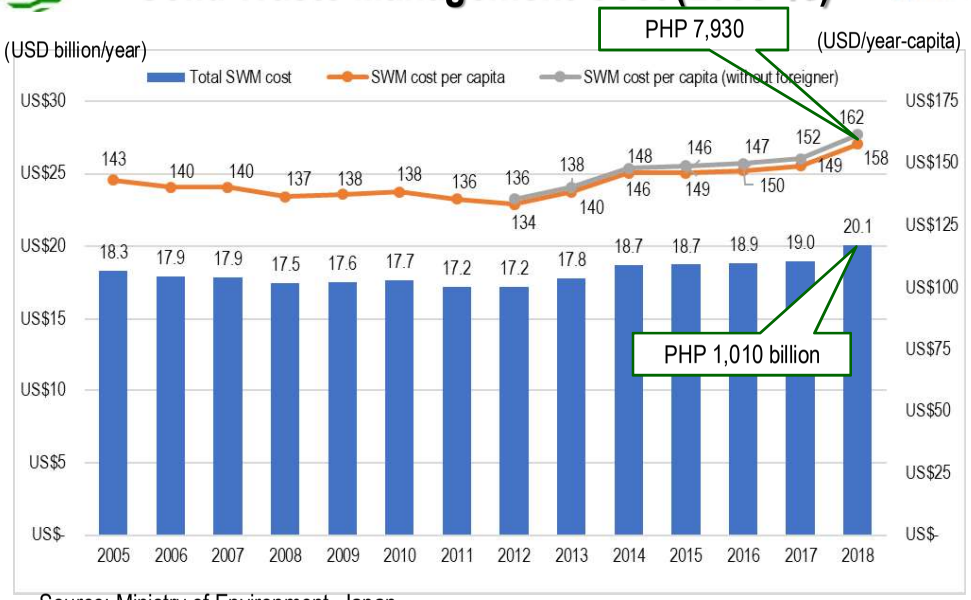
Solid Waste Management Policy (Hierarchy)

- Source Reduction and Reuse
- Material Recovery by Source Separation (分別 : Bunbetsu)
- Material Recycling via Treatment
- Thermal Recycling (Waste to Energy)
- Final Disposal (Landfill)

Cost Efficiency

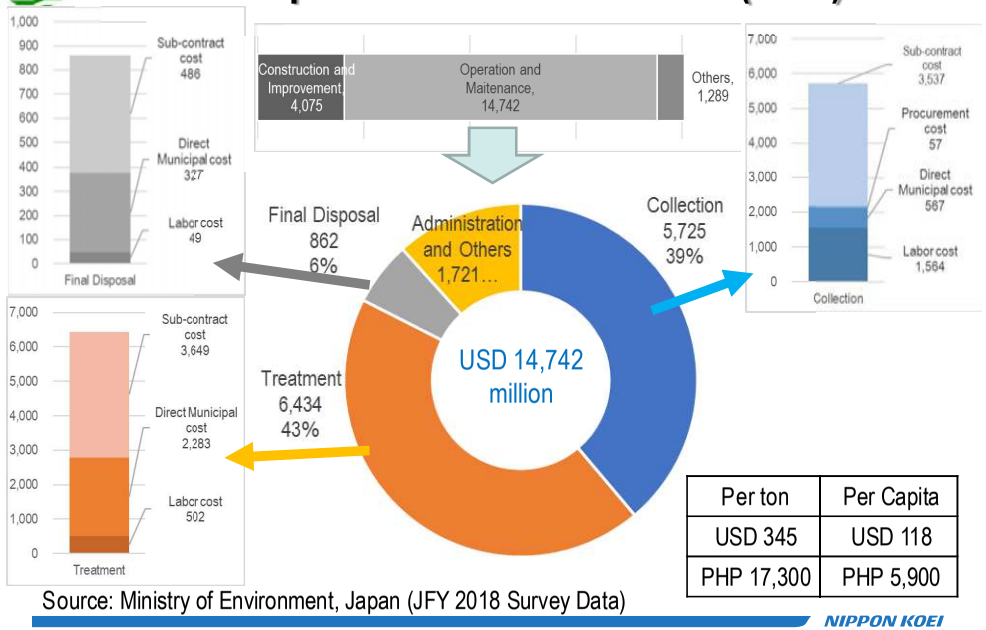
Appropriate Technology

Solid Waste Management Cost (2005-18)



Source: Ministry of Environment, Japan

Annual Operation Cost Breakdown (2018)



Per ton	Per Capita
USD 345	USD 118
PHP 17,300	PHP 5,900

Source: Ministry of Environment, Japan (JFY 2018 Survey Data)

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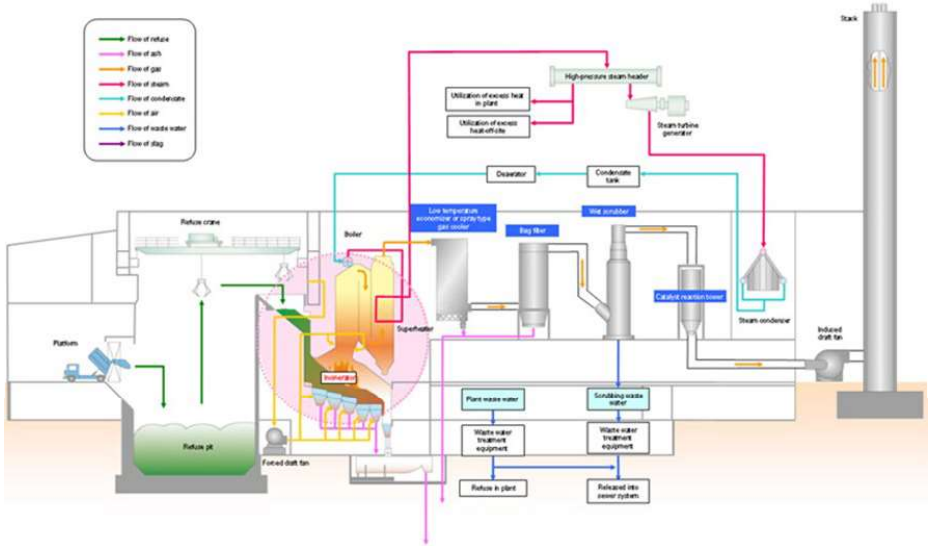
Thermal treatment technologies in Japan

	① Stoker /Grate	② Fluidized bed	③ Gasifying & direct melting	④ Pyrolysis Gasification	⑤ Plasma Gasification
Image					
Features	- The most conventional system in Japan - Large capacity of furnace (400 – 500t/d) is widespread	- No movable part inside furnace - Pretreatment is required for stable combustion - Generation of fly ash is larger	- High reduction rate - Slag can be utilized - Coke is necessary for ash melting 	- Waste is gasified in a primary combustion chamber - Synthesis gas can be introduced to gas engine	- This is for residual ash melting - Slag can be utilized - Large amount of self electric consumption

Typical Waste to Energy Facility



https://www.hitachizosen.co.jp/english/products/products001.html

Typical Waste to Energy Facility

Recreation Center

Environmental Education Center

Waste Treatment Facility

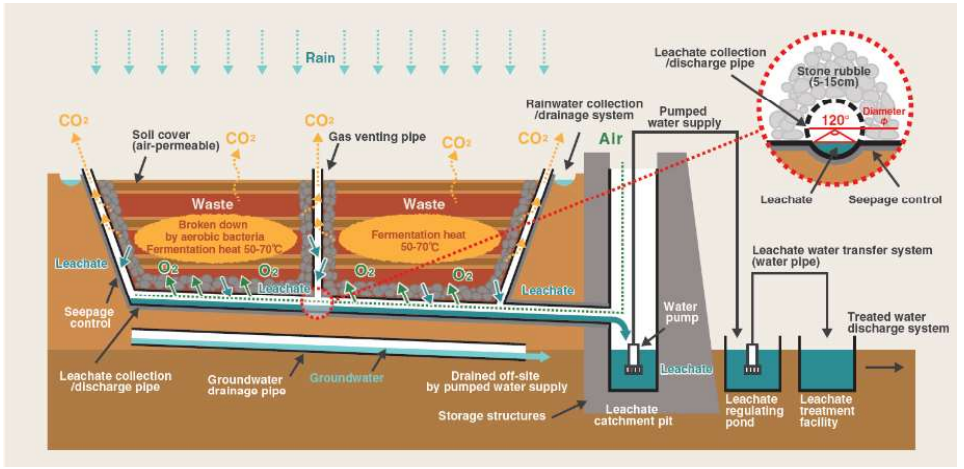
Source: http://sakura-kc.saitama.jp/

Waste to Energy Facility in urban area

https://www.obayashi.co.jp/works/detail/work_409.html

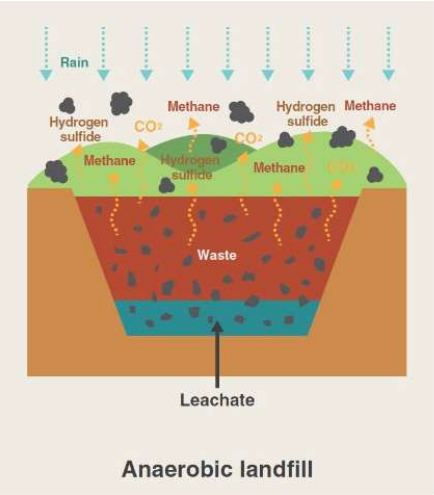
https://www.union.tokyo23-seisou.lg.jp/kensetsu/kensetsu4/hikarikakozenkei.html

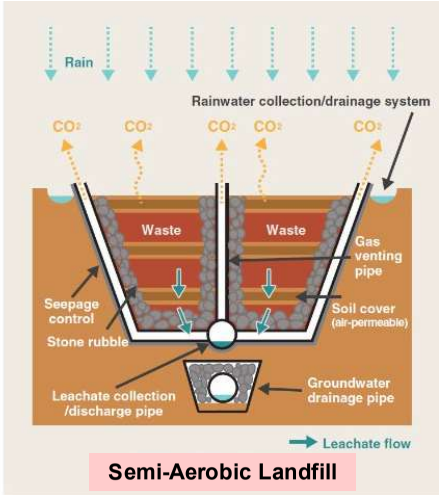
Typical Landfill Method in Japan



https://www.pref.fukuoka.lg.jp/uploaded/life/542225_60422573_misc.pdf

Typical Landfill Method in Japan





https://www.pref.fukuoka.lg.jp/uploaded/life/542225_60422573_misc.pdf

Public Participation and Cooperation

Combustible waste

Incombustible waste

Glass and bottles

Paper

PET bottles

Source: Norihisa Hirarta (SSDi)

Public Participation and Cooperation

Kawaguchi City

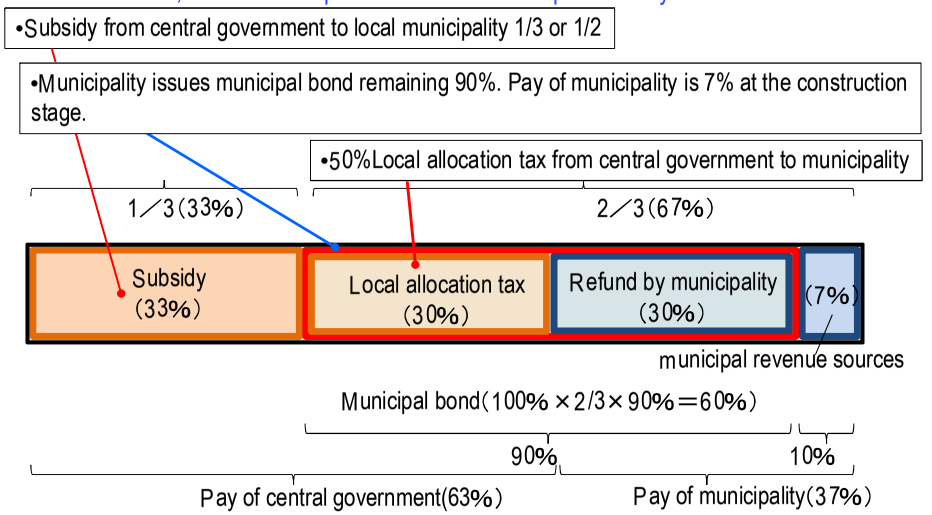
https://www.city.kawaguchi.lg.jp/material/files/group/94/wakekata_TAGALOG.pdf

Tachikawa City

https://www.city.tachikawa.lg.jp/gomitaisaku/gomicalender/documents/f-01.pdf

Financial Support by Central Government

✓ For the construction of municipal waste treatment facility, central government subsidies 1/3 to 1/2 of CAPEX, and also compensate 50% of municipal bond by local allocation tax.



Q & A

Discussions

END

Thank you for your participation!

Appendix 10

Online Training
< Legal Structure of Waste Management in Japan >

15 November 2021

Shungo SOEDA

Circular Economy Promotion Dept.
NIPPON KOEI CO., LTD.

The Technical Cooperation Project (TCP) for Capacity Development on Improving Solid Waste Management (SWM) through Advanced/Innovative Technologies

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4. Law for the Promotion of Effective Utilization of Resources
5. Waste Management and Public Cleansing Law
6. Recycling related Laws (Container & Packaging, WEEE)

Appendix: Waste Management and Recycling in Daily Life

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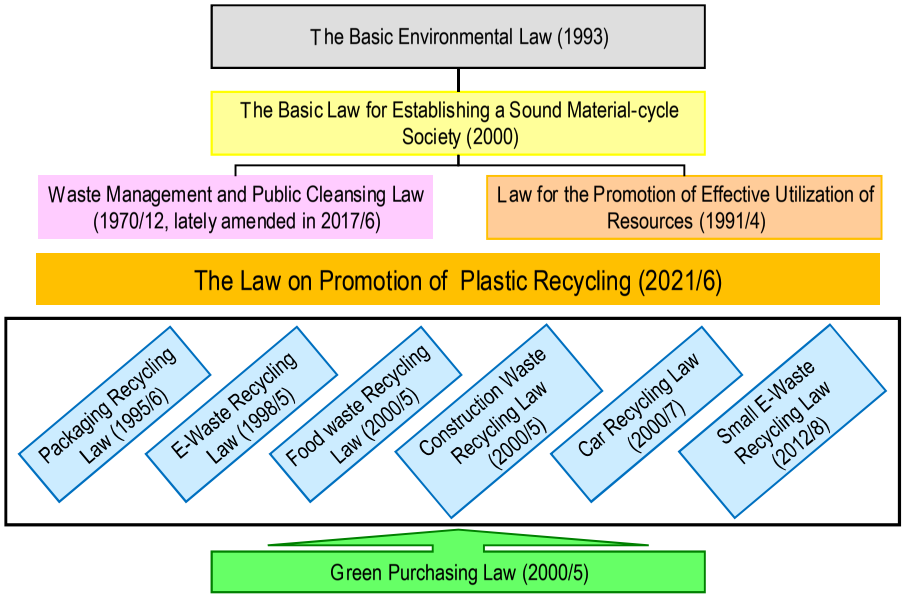
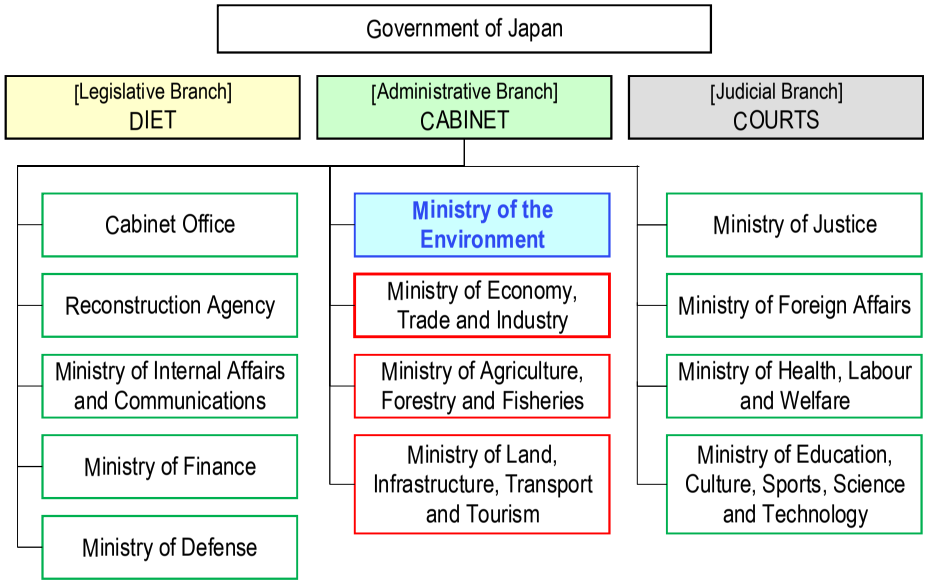
Overall Framework of WM Related Laws



NIPPON KOEI

[Reference] Governmental Structure of Japan



Contents of the Presentation

Basic Environmental Law

Law No.91 of 1993.
Effective on November 13, 1993.

Chapter 1 General Provisions (Articles 1-13).
Chapter 2 Basic Policies for Environmental Conservation
Section 1 Guidelines for Policy Formulation (Article 14)
Section 2 Basic Environment Plan (Article 15)
Section 3 Environmental Quality Standards (Article 16)
Section 4 Environmental Pollution Control in Specific Areas (Articles 17 and 18)
Section 5 Implementation of Policies for Environmental Conservation by the State (Articles 19-31)
Section 6 International Cooperation for Global Environmental Conservation etc. (Articles 32-35)
Section 7 Implementation of Policies by Local Governments (Article 36)
Section 8 Bearing of Costs and Financial Measures (Articles 37-40)
Chapter 3 Environment Council etc.
Section 1 Environment Council (Articles 41-44)
Section 2 Conference on Environmental Pollution Control (Articles 45 and 46)

Basic Environment Law

Highest-level Law on Environment

Background:
Globalization of environmental issues (UN Earth Summit in Rio de Janeiro, 1992)
→ Upgraded from “Pollution Control Basic Law”.

Objective (Article 1):
The purpose of this law is to comprehensively and systematically promote policies for environmental conservation to ensure healthy and cultured living for both the present and future generations of the nation as well as to contribute to the welfare of mankind, through articulating the basic principles, clarifying the responsibilities of the State, local governments, businesses and citizens, and prescribing the basic policy considerations for environmental conservation.

http://www.env.go.jp/en/laws/policy/basic/index.html

Basic Environment Law

Article 7 (Responsibility of Local Governments)

The local governments are responsible for formulating and implementing policies with regard to environmental conservation corresponding to national policies and other policies in accordance with the natural and social conditions of the local governments' jurisdiction, pursuant to the basic principles.

Article 8 (Responsibility of Businesses)

2. In manufacturing, processing or selling products, or engaging in other business activities, **businesses are responsible for taking necessary measures for ensuring proper management of the wastes generated from products and other goods related to their activities,** so as to prevent interference with environmental conservation, pursuant to the basic principles.

Article 9 (Responsibility of Citizens)

2. Besides the responsibility prescribed in the preceding Paragraph, **citizens are responsible for making efforts to conserve the environment and for cooperating with the policies implemented by the State or local governments** with regard to environmental conservation, pursuant to the basic principles..

Basic Environment Law

Article 23 (Promotion of Construction of Facilities and Other Projects for Environmental Conservation)

2. **The State shall take necessary measures to promote projects which contribute to prevent interference with environmental conservation**, i.e. the construction public facilities such as sewerage, **public waste treatment and disposal facilities**, traffic facilities (including transportation facilities) which contribute to reduce the environmental load, and other projects such as improvement of forests.

Article 36

Local governments shall comprehensively and systematically implement and promote policies corresponding to the national policies provided for in Section 5 and other policies necessary for environmental conservation in accordance with the natural and social conditions of the local governments' jurisdiction. **In this case, the prefecture shall mainly implement the policies for a large area and comprehensively coordinate the policies administered by the municipalities.**

Article 39 (Financial Measures for Local Governments)

The State shall make efforts to take necessary financial measures and other measures with regard to the expenses borne by the local governments to formulate and Implement policies for environmental conservation.

Contents of the Presentation

Basic Law on Establishing a Sound Material-Cycle Society

Law No.110 of June 2, 2000.

Chapter 1 General Provisions (Articles 1-14).
Chapter 2 The Basic Plan for Establishing a Sound Material-Cycle Society (Article 15-16)
Chapter 3 The Basic Policies for Establishing a Sound Material-Cycle Society
Section 1 Policies of the State (Articles 17-31)
Section 2 Policies of Local Governments (Articles 32)

循環型社会形成推進基本法

Basic Law on Establishing a Sound Material-Cycle Society

Article 2 (1) For the purpose of this Law, a **"Sound Material-Cycle Society" means a society in which the consumption of natural resources will be conserved and the environmental load will be reduced to the greatest extent possible**, by preventing or reducing the generation of wastes from products, by promoting proper cyclical use of materials from products when these products become circulative resources, and by ensuring proper treatment and disposal of resources which are potentially circulative but could not be put into cyclical use

Basic Law on Establishing a Sound Material-Cycle Society

Fundamental Policy on resource circulating and appropriate waste management

Background:

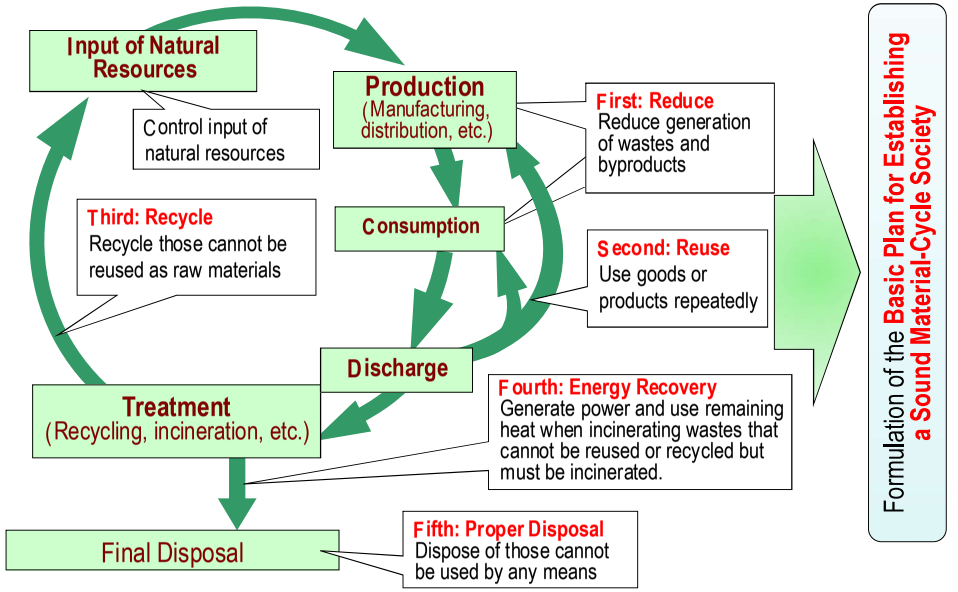
Aiming to achieve "Sustainable Society" from the aspect of effective material circulating, together with establishing "Low-carbon society" and "Nature harmonizing society".

Objective (Article 1):

The purpose of this Law is to promote comprehensively and systematically the policies for the establishment of a Sound Material-Cycle Society and thereby help ensure healthy and cultured living for both the present and future generations of the nation, through articulating the basic principles on the establishment of a Sound Material-Cycle Society, in conformity with the basic philosophy of the Environment Basic Law, **clarifying the responsibilities of the State, local governments, businesses and citizens**, and articulating fundamental matters for making policies for the formation of a Sound Material-Cycle society, including those for establishing the Basic plan for Establishing a Sound Material-Cycle Society.

https://www.env.go.jp/recycle/circul/kihonho/law.html (Japanese)

Basic Law on Establishing a Sound Material-Cycle Society



Basic Law on Establishing a Sound Material-Cycle Society

Article 4 (Proper Role Sharing, etc.)

The establishment of a Sound Material-Cycle Society must be undertaken by having necessary measures carried out **under the proper sharing of roles among the State, local governments, businesses and citizens, and with the costs of such measures shared appropriately and fairly among them.**

Article 7 (Basic Principles of the Cyclical use and Treatment of Circulative Resources)

The cyclical use and treatment / disposal of circulative resources **must be undertaken to the extent technologically and economically possible,** taking it into full consideration that, for the reduction of environmental load, it is necessary to proceed under the provisions of the following items.

(1. Reduce >) 2. Reuse > 3. Recycle > 4. Energy Recovery > 5. Proper Disposal

Article 19 (Promotion of Use of Recycled Products)

In order to contribute to the increase in demand for recycled products, **the State shall take the lead in making use of recycled products and take necessary measures so that the use of recycled products by local governments, businesses and citizens may be promoted.**

Basic Law on Establishing a Sound Material-Cycle Society

Article 15 (Formulation, etc. of the Basic Plan for Establishing a Sound Material-Cycle Society)

The Government shall establish **a Basic Plan for establishing a Sound Material-Cycle Society** for the purpose of comprehensive and systematic promotion of the policies and measures for establishing a Sound Material-Cycle Society.

→ The 4th Basic Plan was issued in 2018

http://www.env.go.jp/recycle/recycle/circul/keikaku/pam4_E.pdf

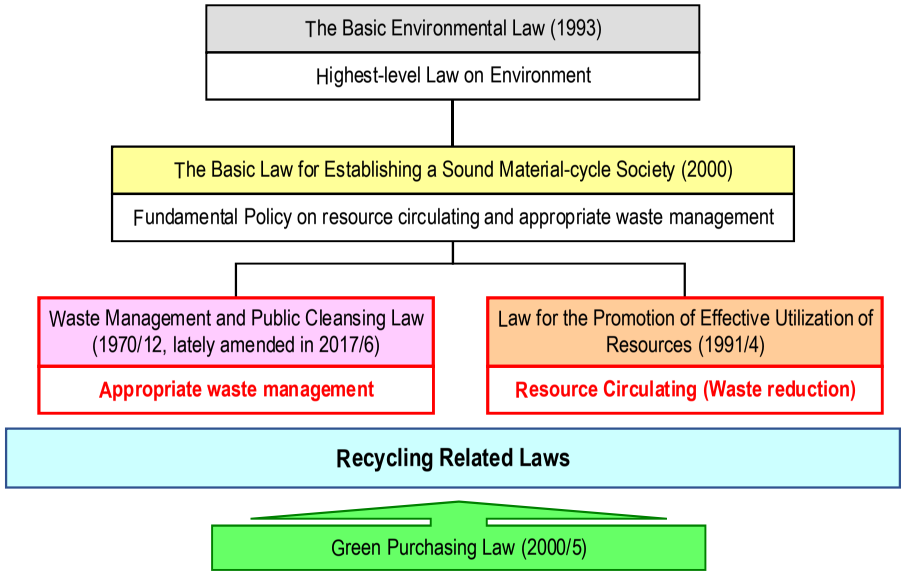
Article 26 (Financial Measures, etc. towards Local Governments)

The State shall make efforts to **take necessary financial and other measures regarding the costs for local governments** to make and implement policies for establishing a Sound Material-Cycle Society.

Article 27 (Promotion, etc. of Education and Learning on the Establishment of a Sound Material-Cycle Society)

The State shall take necessary measures for the improvement of publicity and **the promotion of education and learning on the establishment of a Sound Material-Cycle Society**, in view of the fact that it **is indispensable to gain the understanding and cooperation of businesses and citizens** in order to facilitate the transformation into a Sound Material-Cycle Society.

Overall Framework of WM Related Laws



Contents of the Presentation

Law for the Promotion of Effective Utilization of Resources

Law No.48 of April 26, 1991.

Chapter 1 General Provisions (Articles 1-2).
Chapter 2 Basic Policy, etc. (Articles 3 to 9)
Chapter 3 Designated Resources-Saving Industries (Articles 10 to 14)
Chapter 4 Designated Resources-Reutilizing Industries (Articles 15 to 17)
Chapter 5 Specified Resources-Saved Products (Articles 18 to 20)
Chapter 6 Specified Reuse-Promoted Products (Articles 21 to 23)
Chapter 7 Specified Labeled Products (Article 24 and Article 25)
Chapter 8 Specified Resources-Recycled Products (Articles 26 to 33)
Chapter 9 Specified By-products (Articles 34 to 36)
Chapter 10 Miscellaneous Provisions (Articles 37 to 41)
Chapter 11 Penal Provisions (Articles 42 to 44)

Outline of the law:
The law provides for measures to be taken by businesses, such as 3R-related measures in the production stage, 3R consideration in the product designing stage, labeling for separated collection, and development of a system for self-collection and -recycling by manufacturers.

Law for the Promotion of Effective Utilization of Resources

Fundamental Policy on 3Rs (Reduce, Reuse and recycling)

Background:
Aiming to change from "Mass-producing, Mass-consuming and Mass-discharging society", based on **"Circular Economy Vision"** proposed by "Industrial Structure Council" under Ministry of Economy, Trade and Industry in 1999.

Objective (Article 1):
The purpose of this Law, **in light of the circumstances in Japan**, a country largely dependent on imports for major resources and where, along with the recent development of the national economy, the heavy use of resources generates an enormous amount of Used Products, etc. and By-products, a considerable part of which are disposed of while a considerable part of the **Recyclable Resources and Reusable Parts are not utilized but also disposed of**, is to ensure the effective utilization of resources and to take necessary measures to reduce the generation of Used Products, etc. and By-Products and **promote the utilization of Recyclable Resources and Reusable Parts in order to contribute to waste reduction and environmental preservation,** thereby contributing to the sound development of the national economy.

Law for the Promotion of Effective Utilization of Resources

Designated Resources-Saving Industries

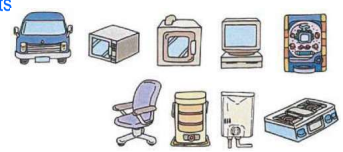
Required to reduce generation of by-products

Designated Resources-Reutilizing Industries

Required to use recyclable resources and reusable parts

Specified Resources-Saved Products

Required to ensure rational use of raw materials, prolong product life and reduce generation of used products



Specified Reuse-Promoted Products

Required to promote the use of recyclable resources or reusable parts (designing and manufacturing products that can be easily reused or recycled)

http://www.env.go.jp/en/laws/recycle/06.pdf (Outline)

https://www.meti.go.jp/policy/recycle/main/data/pamphlet/pdf/handbook2010-eng.pdf (Handbook)

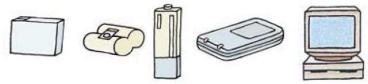
Law for the Promotion of Effective Utilization of Resources

Specified Labeled Products

Required to be labeled to facilitate separated collection

Specified Resources-Recycled Products

Required to promote self-collection and recycling



Specified By-products

Required to promote the use of by-products as recyclable resources

http://www.env.go.jp/en/laws/recycle/06.pdf (Outline)

https://www.meti.go.jp/policy/recycle/main/data/pamphlet/pdf/handbook2010-eng.pdf (Handbook)

Contents of the Presentation

Waste Management and Public Cleansing Law

Law No.137, 1970.

Chapter 1 General Provisions (Articles 1 to 5).
Chapter 2 Municipal Solid Waste
Section 1 Municipal solid waste Management (Article 6)
Section 2 Municipal Solid Waste Management Service (Article 7)
Section 3 Municipal Solid Waste Treatment / Disposal Facility (Article 8 to 9(7))
Section 4 Special Provision on Treatment of Municipal solid waste (Articles 9(8) to 9(10))
Section 5 Export of Municipal solid waste (Articles 10)
Chapter 3 Industrial Waste (Articles 11 to 15(4))
Chapter 3-2 Waste Management Center (Articles 15(4) to 15(16))
Chapter 3-2 Changes of shape and nature of the land where waste is underground (Articles 15(17) to 15(9))
Chapter 4 Miscellaneous Provisions (Articles 16 to 24)
Chapter 5 Penal Provisions (Articles 25 to 34)

Outline of the law:
The law provides the definition of waste, responsibility for treatment and disposal, and the standards for treatment methods, treatment facilities, and treatment industries.

Waste Management and Public Cleansing Law

Fundamental Policy on Appropriate Waste Management

Background:

- ✓ Increase in the amount of, and change in of the quality of the waste derived from economic activities, as a result of Japan's high economic growth
- ✓ Responding to environmental conservation measures related to waste management

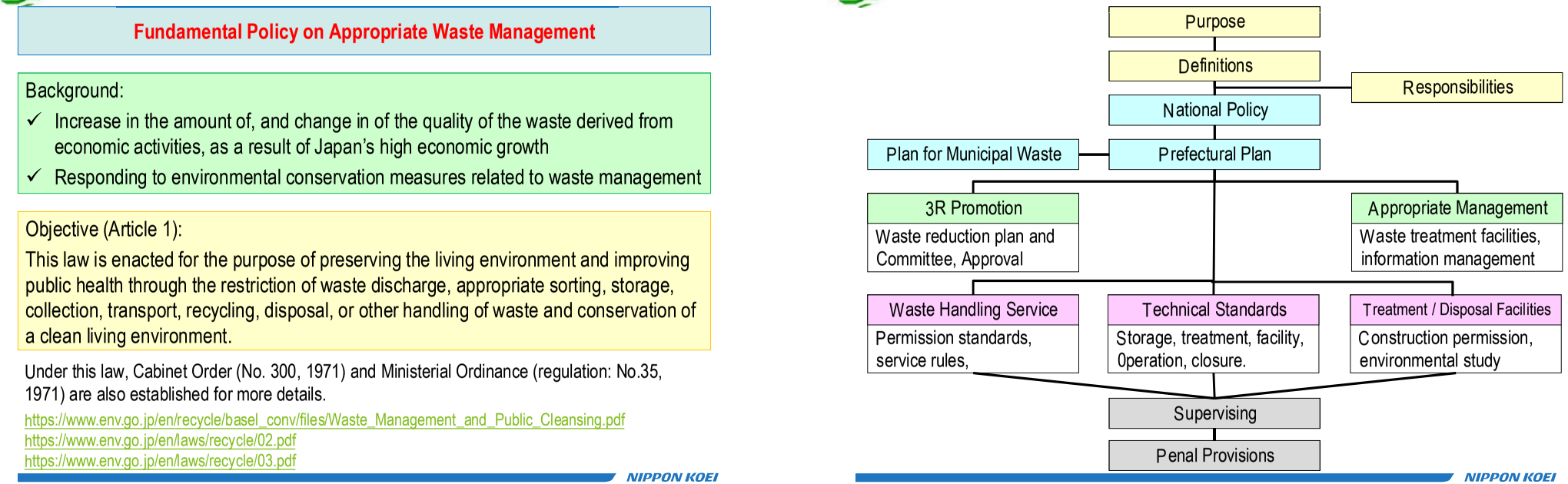
Objective (Article 1):

This law is enacted for the purpose of preserving the living environment and improving public health through the restriction of waste discharge, appropriate sorting, storage, collection, transport, recycling, disposal, or other handling of waste and conservation of a clean living environment.

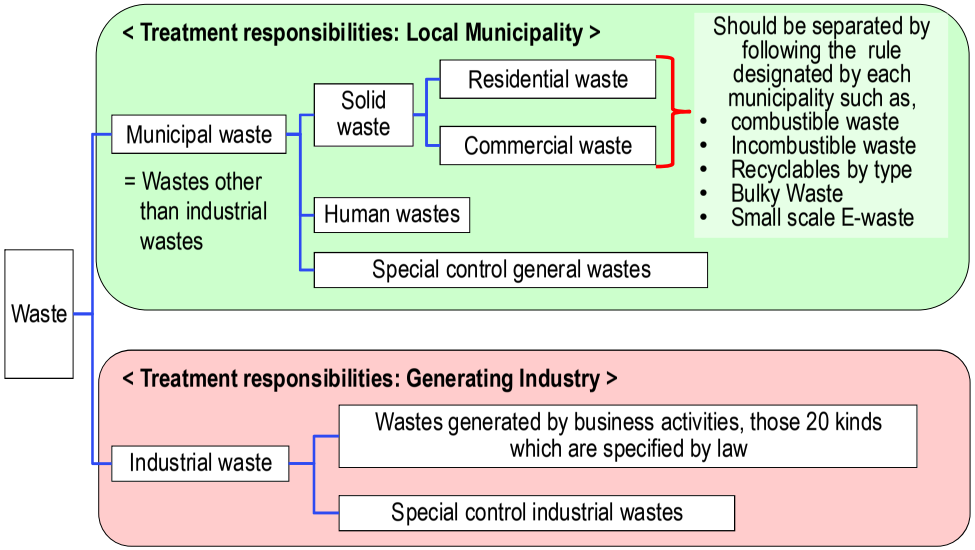
Under this law, Cabinet Order (No. 300, 1971) and Ministerial Ordinance (regulation: No.35, 1971) are also established for more details.

https://www.env.go.jp/en/recycle/basel_conv/files/Waste_Management_and_Public_Cleansing.pdf
https://www.env.go.jp/en/laws/recycle/02.pdf
https://www.env.go.jp/en/laws/recycle/03.pdf

Waste Management and Public Cleansing Law

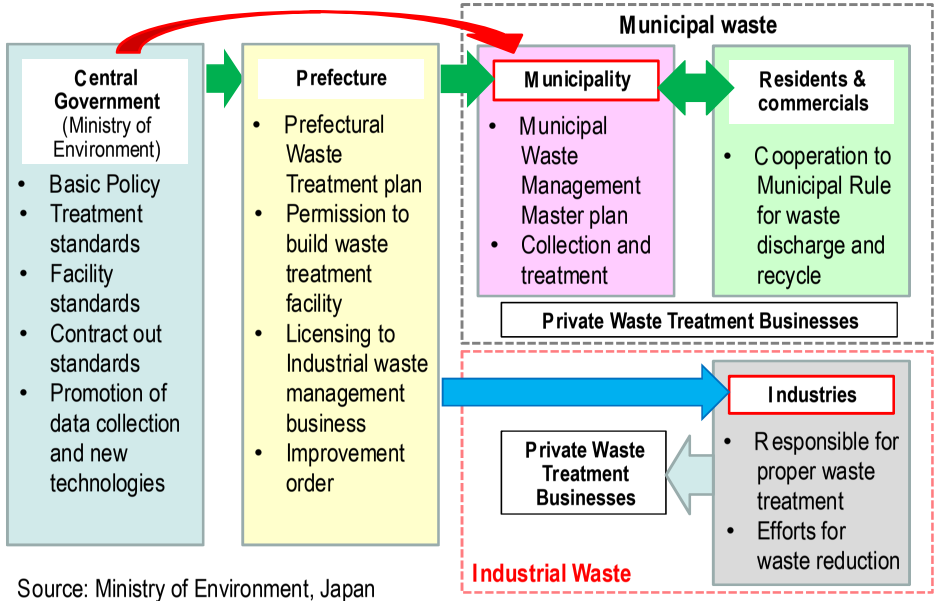


Waste Management and Public Cleansing Law



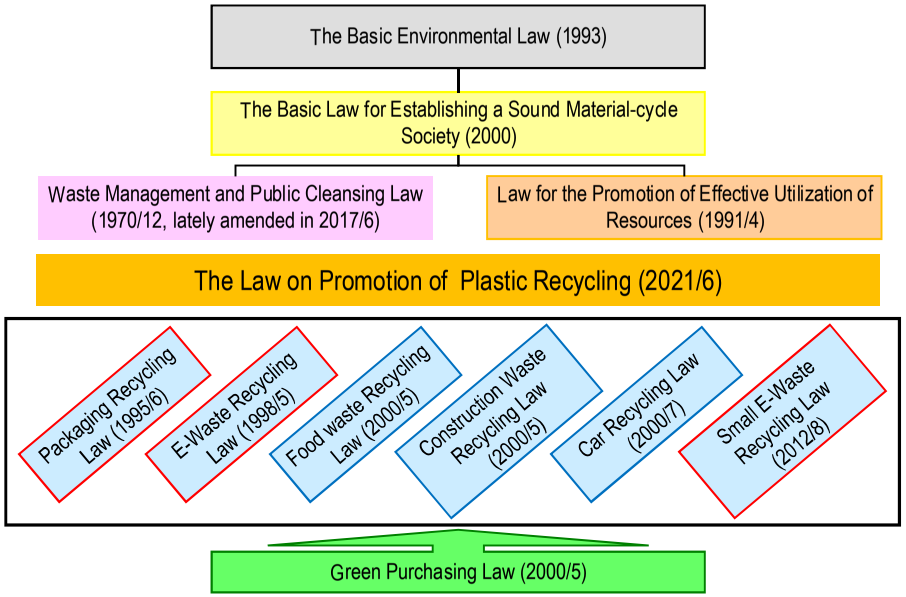
Source: Ministry of Environment, Japan

Waste Management and Public Cleansing Law



Source: Ministry of Environment, Japan

Overall Framework of WM Related Laws



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5. Waste Management and Public Cleansing Law
6. Recycling related Laws (Container & Packaging, WEEE)

Appendix: Waste Management and Recycling in Daily Life

Containers and Packaging Recycling Law

Law for the Promotion of Sorted Collection and Recycling of Containers and Packaging

Law No. 112 of June 16, 1995

Chapter 1 General Provisions (Articles 1 to 2).
Chapter 2 Basic Policy, etc. (Article 3 to 6)
Chapter 3 Recycling Plan (Articles 7)
Chapter 4 Reduction of Discharge (Articles 7(2) to 7(7))
Chapter 5 Sorted Collection (Articles 8 to 10)
Chapter 6 Implementation of Recycling (Articles 11 to 20)
Chapter 7 Designated Juridical Person/Organization(Articles 21 to 32)
Chapter 8 Miscellaneous Provisions (Articles 33 to 45)
Chapter 9 Penal Provisions (Articles 46 to 49)

Outline of the law:
The law provides for a collection and recycling system in which municipalities take charge of collecting sorted containers and packaging (sorted and discarded by consumers) and businesses take charge of recycling such collected containers and packaging

https://www.env.go.jp/en/laws/recycle/07.pdf
https://www.jcpra.or.jp/Portals/0/resource/association/pamph/pdf/law2003_eng.pdf

Containers and Packaging Recycling Law

Fundamental Policy on Recycling of Containers and Packaging

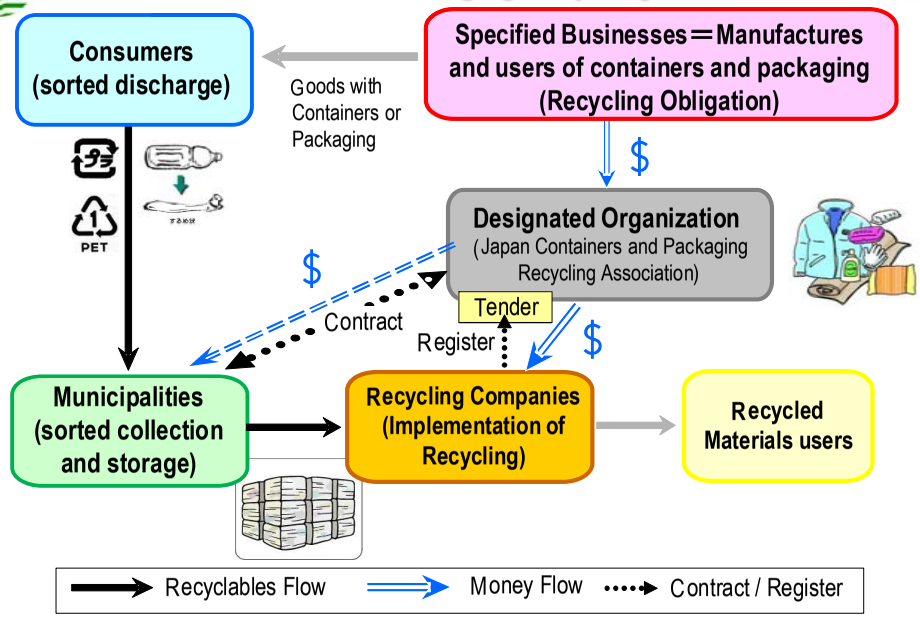
Background:
- ✓ Remaining capacity of the final disposal site for municipal waste is being filled up
- ✓ Containers and packaging accounted for approximately 60% of municipal waste by volume

Objective (Article 1):
The purpose of this Law is, by taking measures to promote reduction of **waste containers and packaging** discharged and the sorted collection thereof as well as the recycling of waste containers and packaging which are obtained through sorted collection, etc., that conform to the sorting standards, to ensure proper management of waste and effective use of resources through **reduction of municipal solid waste and adequate use of recyclable resources,** thereby contributing to the preservation of the living environment and the sound development of the national economy.

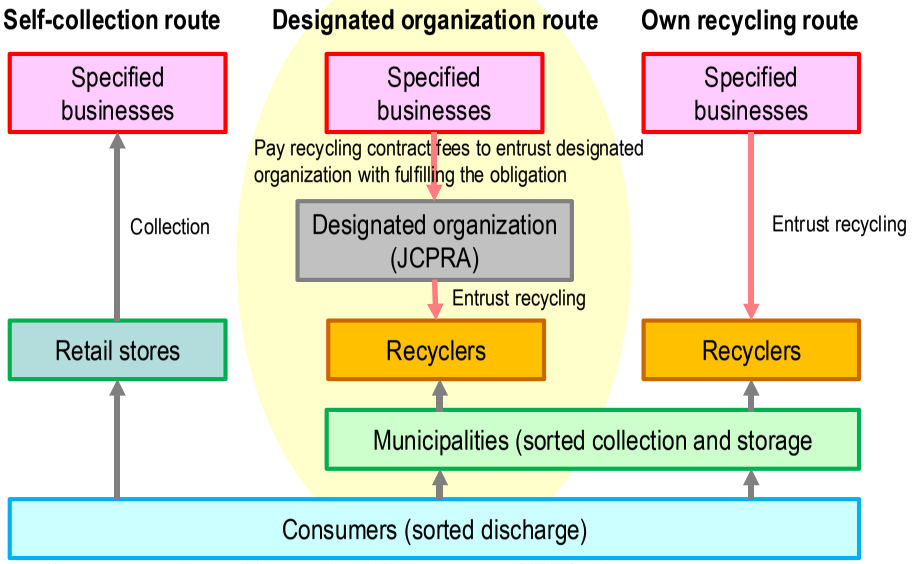
Containers and Packaging Recycling Law

https://www.jcpra.or.jp/Portals/0/resource/eng/JCPRAdocuments202012.pdf

Containers and Packaging Recycling Law

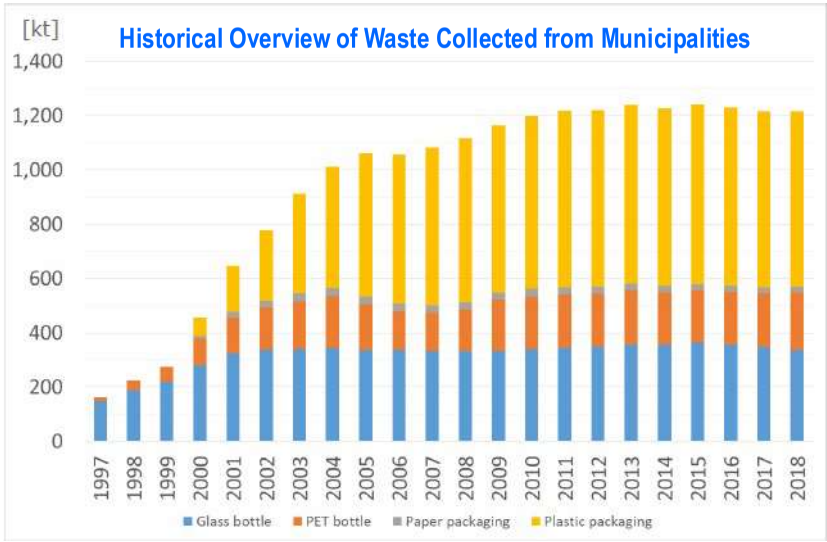


Containers and Packaging Recycling Law



https://www.jcpra.or.jp/Portals/0/resource/eng/JCPRAdocuments202012.pdf

Containers and Packaging Recycling Law



https://www.jcpra.or.jp/Portals/0/resource/eng/JCPRAdocuments202012.pdf

Appendix 10

E-Waste (home appliance) Recycling Law

Law for Recycling of Specified Kinds of Home Appliances

Law No. 97 of June 5, 1998

Chapter 1 General Provisions (Articles 1 to 2).
Chapter 2 Basic Policy, etc. (Article 3 to 8)
Chapter 3 Collection and Transportation by Retail Traders (Articles 9 to 16)
Chapter 4 Implementation of Recycling by Manufacturers (Articles 17 to 31)
Chapter 5 Designated Bodies (Articles 32 to 42)
Chapter 6 Miscellaneous Provisions (Articles 43 to 57)
Chapter 7 Penal Provisions (Articles 58 to 62)

Outline of the law:
The law provides for a collection and recycling system in which home appliance retailers take charge of collecting used home appliances and home appliance manufacturers take charge of recycling collected appliances
Home appliances: air conditioners, television sets, refrigerator/freezers, and washing machines

https://www.meti.go.jp/policy/it_policy/kaden_recycle/en_cha/pdf/english.pdf (outline)

http://www.env.go.jp/en/laws/recycle/08.pdf (outline)

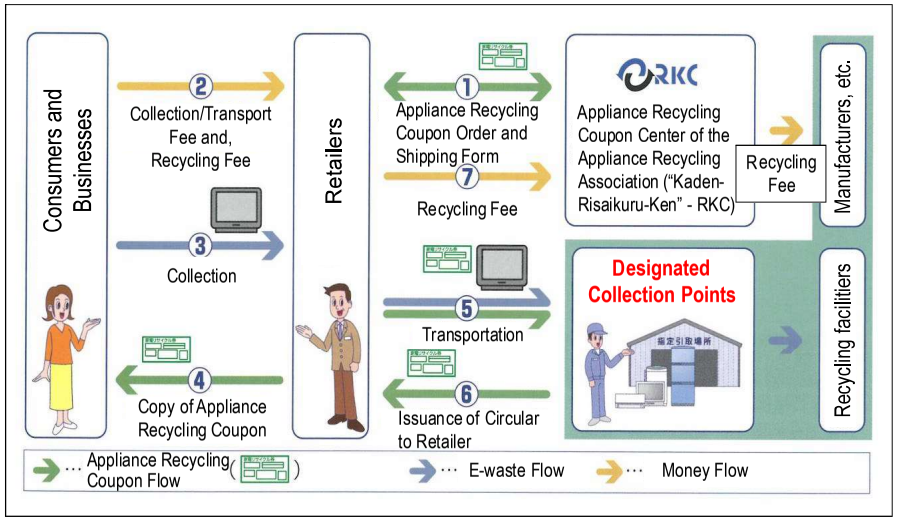
E-Waste (home appliance) Recycling Law

Fundamental Policy on Large Home Appliances Waste Recycling

Background:
- ✓ The remaining capacity of the final disposal site for domestic waste is being filled up
- ✓ Post-consumer home appliances contain useful resources such as iron, aluminum, plastics, or glasses which can be recycled

Objective (Article 1):
The purpose of this law is to take measures to appropriately and smoothly collect, transport, recycle, etc. **specified kinds of home appliances** by entities including retailers, manufacturers and importers, then **to secure the appropriate management of waste and utilization of natural resources**, and consequently to contribute to preservation of life environments and sound development of the national economy

E-Waste (home appliance) Recycling Law



E-Waste (home appliance) Recycling Law

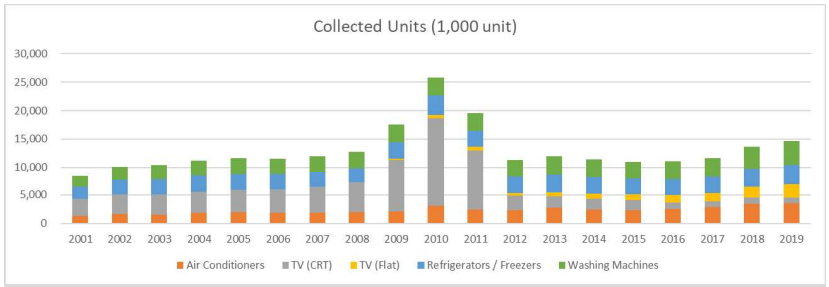
Recycling Fee (as of 2020)

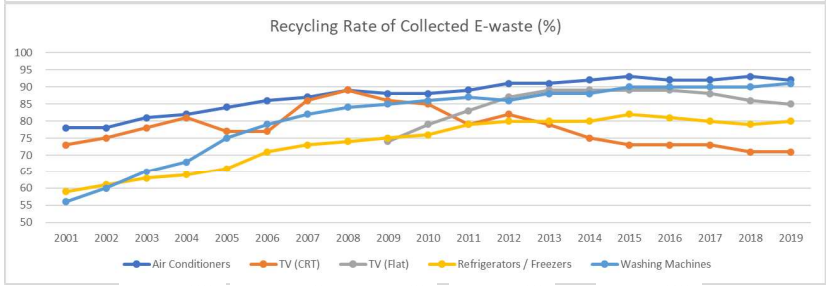
Types of Appliance		Recycling Fee	Types of Appliance		Recycling Fee
Air Conditioner		JPY 990 (PHP 433)	TV (CRT)	Large	JPY 2,420 – 2,970 (PHP 1,059 – 1,299)
washing machine		JPY 2,530 (PHP 1,108)		Small	JPY 1,320 – 1,870 (PHP 577 – 818)
Refrigerator Freezer	Large	JPY 4,730 (PHP 2,069)	TV (Flat type)	Large	JPY 1,870 (PHP 818)
	Small	JPY 3,740 (PHP 1,636)		Small	JPY 2,970 (PHP 1,299)

Source: Association for Electric Home Appliances

Appendix 10

E-Waste (home appliance) Recycling Law





Source: Association for Electric Home Appliances

Small E-Waste Recycling Law

Law on Promotion of Recycling of Small Waste Electrical and Electronic Equipment

Law No. 57 of August 10, 2012

Small E-Waste Recycling Law

Fundamental Policy on Small Home Appliances Waste (WEEE) Recycling

Background:

- ✓ There was no sufficient recovery of resources from small end-of-life electronic equipment, which contains many valuable metals and other recyclables that municipalities treat as the municipal waste.

Objective (Article 1):

In light of the circumstances where a considerable portion of metals or other useful materials used in small waste electrical and electronic equipment is disposed of without being recovered, this Law aims to take measures for **promoting the recycling of small waste electrical and electronic equipment**, thereby ensuring proper management of waste and effective use of resources and contributing to the preservation of the living environment and the sound development of the national economy.

Small E-Waste Recycling Law

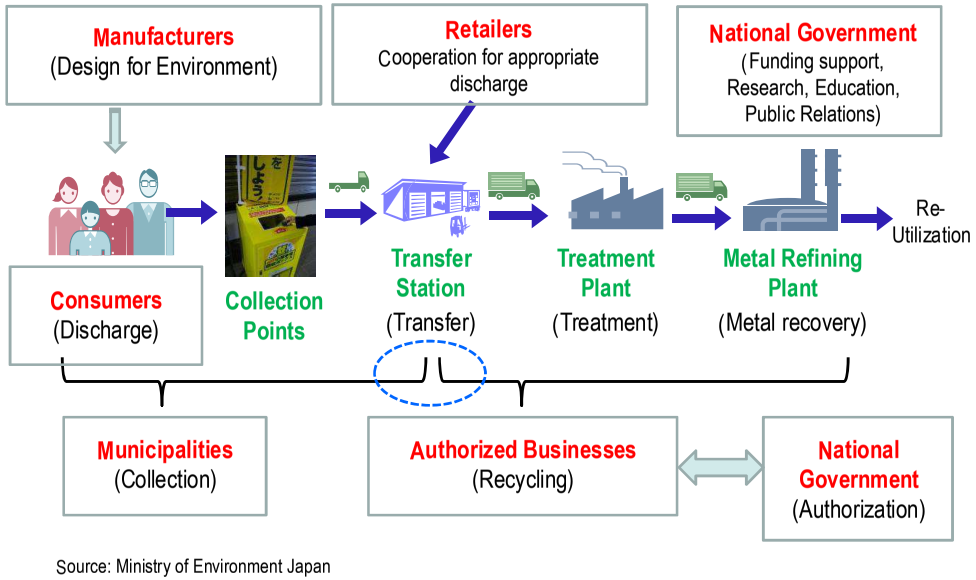
Outline

- ✓ Since recovering of small E-waste which contains rare and useful resources in wider area and through more efficient way will make the system profitable, this system was created as **a promotion-type system where the people involved cooperates voluntarily.**
- ✓ Regarding those who intend to start a small electronic equipment recycling business, they must prepare **the business plan for recycling** to obtain the certification from the competent Minister **that the license for waste treatment becomes unnecessary.**

Target E-Waste

- ✓ 28 items are designated as target E-waste, which exclude 4 large home appliances, by the Cabinet Order for this Law, by considering their recyclability and transportability
- ✓ telephone, mobile phone, radio, camera, video, DVD recorders, audio players, printers, displays, electric sewing machines, calculators, rice cookers, microwave ovens, room fans, irons, vacuum cleaners, clock, musical instrument, game machine, hair dryers, etc.

Small E-Waste Recycling Law



Source: Ministry of Environment Japan

Small E-Waste Recycling Law

http://nemototravel.com/blog/50242.html

GETTING A MEDAL FOR RECYCLING: HOW OLD DEVICES ARE TURNED INTO OLYMPIC MEDALS FOR TOKYO 2020

IOC/GREG MARTIN

DATE25 NOV 2018 TAGSOLYMPIC NEWS, IOC NEWS, TOKYO 2020, SUSTAINABILITY

https://www.olympic.org/news/finishing-line-in-sight-for-tokyo-2020-medal-project

https://www.tokyo-np.co.jp/article/120382

https://www.j-cast.com/2021/07/28417095.html

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Q & A
Discussions

Appendix 10