

The Republic of India

**Collaboration Program with the Private Sector
for Disseminating Japanese Technology
for urban waste disposal system
in Bangalore, India
Final Report
Summary**

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Abbreviations

Abbreviation	Full name
3R	Reduce, Reuse, Recycle
BBMP	Bruhat Bengaluru Mahanagara Palike
BESCOM	Bangalore Electricity Supply Company
BWSSB	Bangalore Water Supply and Sewerage Board
CO ₂	Carbon Dioxide
DWCC	Dry Waste Collection Centre
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
FIT	Feed in Tariff
FS	Feasibility Study
GDP	Gross Domestic Products
GHG	Green House Gas
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
IGES	Institute of Global Environmental Strategies
INDC	Intended Nationally Determined Contributions
INR	Indian Rupee
JPY	Japanese Yen
KCDC	Karnataka Composting Development Centre
KREDL	Karnataka Renewable Energy Development Limited
KSPCB	Karnataka State Pollution Control Board
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation Ltd.
MRV	Measuring, Reporting and Verification
MSW	Municipal Solid Waste
O&M	Operation and Maintenance
PPP	Public Private Partnership
RDF	Refuse Derived Fuel
RPF	Refuse Paper & Plastic Fuel
SPC	Special Purpose Company
SWM	Solid Waste Management
WTE	Waste to Energy
Y-PORT	Yokohama Partnership of Resources and Technologies

1. Background and Objectives

1.1. Background

The City of Yokohama formulated the “Yokohama G30 Plan” and “Yokohama 3R Dream Plan” in January 2003 and January 2011, respectively, promoting initiatives to improve the overall environment by having its citizen, operators and administration jointly engage in reducing, separating and recycling waste. As a result, the amount of waste in 2010 reduced by over 30% compared to 10 years ago. Based on the knowledge and technology accumulated through these initiatives, Yokohama is pursuing the Y-Port Project for expanding its urban knowhow overseas. As a part of this project, it has entered into a comprehensive alliance with the Japan International Cooperation Agency (JICA) to strengthen partnership with overseas cities and to further provide other cities with its knowhow.

Meanwhile, the stoker type WTE facility by JFE Engineering Corporation (JFE), located in Yokohama, has succeeded in realizing high power generation efficiency and low environmental burden through high temperature air combustion and exhaust gas recirculation that provide stable low air ratio combustion. The company has a long track record of building this facility in and outside Japan. The City of Yokohama and JFE aims to engage in solving urban issues at emerging countries through the Y-Port Project by leveraging their technology and experience, and have entered into a “comprehensive collaboration agreement” on international technological cooperation based on public-private partnership, proposing joint solutions for the various infrastructure at overseas countries and cities.

Bengaluru City in India is located in the upper part of Mysore Plateau, Karnataka State, with a population of 959 million (2011). Population is increasing at an outstanding speed, marking a growth rate of 46.7% in 10 years. After the liberalization of the Indian economy, many IT companies have come to locate their headquarters in the city and it is now referred to as “India’s Silicon Valley”, accounting for 35% of India’s software export in 2004. The city is also known for universities with high educational standard and laboratories and is placed second among cities with the highest literacy rate. On the other hand, Bengaluru is faced with issues including air pollution, traffic congestion and increase in the amount of waste generated, resulting from fast urbanization and increased population which is hindering future growth. In particular, properly establishing its waste treatment system is an impending issue.

Currently, 4,500 tons of waste is generated in Bengaluru every day. The waste is not sufficiently separated and intermediate treatment facilities have not been introduced appropriately. Thus, 60% of waste is directly carried to the open dumping site from the city, the sites are almost full, but no site has been secured for constructing new waste disposal sites as a lawsuit is ongoing between residents and the administration. Furthermore, the

daily cost required to collect waste amounts to about 7 billion yen which is a large burden on the city's finance.

The State Government of Karnataka, responsible for handling Bengaluru's waste disposal issue, has started to consider measures to drastically improve the waste disposal process, which includes the introduction of a large-scaled incineration facility. Bruhat Bengaluru Mahanagara Palike (BBMP) has launched a pilot program to sort out and collect waste, but a more speedy approach is needed. Under such circumstances, Yokohama City received a letter from Bengaluru City in September 2013, requesting for assistance by way of providing knowhow and technical support on waste treatment. In response to the letter, Yokohama organized a site visit in March 2014, exchanged opinions with local government officials and a basic consensus was built on introducing an appropriate waste management system in Bengaluru City based on Yokohama's efforts on reducing waste in the form of power generation through WTE plant.

1.2. Objectives

The objective of this project is to have the State Government and stakeholders gain an understanding of the technical advantages of the WTE facilities which will be positioned as the core treatment facility, and to promote the widespread use of such technology in order to develop the optimum plan for Bengaluru's waste treatment by introducing Yokohama's recycling society system and JFE's waste treatment facilities (WTE plant).

As stated above, Bengaluru City currently produces 4500 tons of waste per day but is unable to treat the waste sufficiently. Establishing a structure to appropriately separate and collect Bengaluru's waste and to reduce the final disposal amount to be treated by the WTE plant should solve the social and economic issues on waste disposal and promote the further development of the region.

It is also considered that having the Japanese company's WTE technology as proposed through this project to be widely spread as the standard for India's domestic waste intermediate treatment should contribute to solving the country's environmental issues and improving the city's comprehensive strength.

There could be other future opportunities of partnership realized through this technological cooperation project which would include the dispatching of specialists on recycling society system to Karnataka State and other parts of India or acceptance of trainees from India.

We have conducted our study and local activities for the project based on the above and for achieving the objective.

2. Project Overview

2.1. Project implementation plan

This project was planned not only to provide the technical information, but also to make stakeholders understand the need to introduce the WTE technologies, which are used by Japanese municipalities like Yokohama City as an intermediate treatment facility and are essential to establish the appropriate SWM systems. Also, since the introduction of appropriate SWM systems is a significant factor to realize the sanitary living environment, several discussions will be made with not only BBMP and Government of Karnataka but also other stakeholders such as NGO and existing operators. The detail of the planned activities are as follow:

(1) Providing information through seminars: Yokohama City's recycling-oriented social system and JFE's WTE technologies will be introduced to government officials, NGOs, and waste management companies. We will not only focus on technologies but also demonstrate, using actual examples, how Japanese cities have dealt with waste problems in order to present an overall picture.

(2) A study of the "Bengaluru Model" using the existing pilot: Carry out the following tasks in collaboration with the administrative organizations of the districts currently conducting a waste separation/collection pilot with the BBMP (wards 168 and 174) to gain an understanding of the current situation:

- Understand the current state of waste treatment process.
- Propose an improvement plan based on the expertise of the City of Yokohama and JFE: Support the development of the "Bengaluru Model," an ideal waste treatment process for the City of Bengaluru.
- Provide support to conduct a pilot study based on the designed recycling-oriented social system model.
- The implementation of the pilot study will be delegated to local administrative organizations, and the City of Yokohama and others from the Japanese side will play an advisory role.

(3) Provide a concrete understanding of the project by organizing a program in Japan: Invite key members of the project to the City of Yokohama, and present a concrete image of how the project will be implemented by organizing a tour of the actual waste separation and collection sites, recycling treatment facilities, and waste incineration plants. In particular, we believe that the effectiveness of the incineration facilities can only be understood by seeing the facilities in operation since there are not any Japanese WTE system not only in Bengaluru but also in India. .

- The invited group will mainly consist of the government officials of the State of Karnataka and the Bengaluru city government.

All the members above participated in workshops with the City of Yokohama in Bengaluru this year and are now expressing a strong interest in this project.

- The JFE will be responsible for coordinating the visit on the Japanese side (Yokohama City and JFE), and PwC will play a supporting role. For the Indian side, JFE Engineering India Private Limited (JFE India) will play a central role and C40 Cities Climate Leadership Group, which has a close relationship with the local government, will serve as a liaison while PwC India will provide support.

(4) Make policy recommendations through workshops: Make improvements to the Bengaluru Model based on the results of studies, promote understanding of the model, and discuss future approaches and make concrete plans with all parties concerned.

- Clarify the need to incorporate incineration treatment in the Bengaluru Model.
- Assist in the preparation of: A “Pre-TOR” design for a feasibility study; a project implementation schedule for the bidding process (to be prepared by the Government of Karnataka); a plan for a regional separation and collection program; and technical standards required for a waste incineration plant and evaluation criteria for the bidding process (draft).
- Help design educational and awareness programs for other districts in Bengaluru.

Based on the key programs described above, we prepared a concrete project action plan as follows:

Table 2.1 : Action plan at the start of the project

Program type	Scheduled dates	Scheduled duration	Location	Main participants (organization, position, number of persons, etc.)	Program objectives and overview
First local program	Mid-April 2015	5 days	Bengaluru	Government officials (Karnataka government, Bengaluru city government, and administrative bodies of pilot districts (Wards 168 and 174)), local waste management companies, etc. 30 to 50 participants are planned for the seminar.	<p>Objectives:</p> <ol style="list-style-type: none"> 1. Introduce Yokohama City’s recycling-oriented social system and JFE’s WTE technologies to provide a basic understanding. 2. Conduct a local study tour to understand the current issues and provide support to prepare a preliminary design of a future model for the city. <p>Overview:</p> <ol style="list-style-type: none"> 1. Seminars <ul style="list-style-type: none"> • Hosted jointly by the City of Bengaluru, JFE, and City of Yokohama • A local hotel is considered for the venue. • Karnataka government, City of Bengaluru, JFE, City of Yokohama, PwC India, C40, and WRI will work together to attract seminar attendees. • From Japan, speakers from Yokohama City and JFE will join in. 2. Prepare a preliminary design of a model based on study tours and discussions. <ul style="list-style-type: none"> • Local tours by the Japanese team (Wards 168

Program type	Scheduled dates	Scheduled duration	Location	Main participants (organization, position, number of persons, etc.)	Program objectives and overview
					and 174, where a waste separation/collection pilot is underway; landfill sites, etc.) <ul style="list-style-type: none"> Hold discussions with Bengaluru City, the BBMP (which is conducting the pilot), local residents, etc., and provide support for the preliminary design of a recycling-oriented social system model.
First program in Japan	Late May 2015	3 days	City of Yokohama	A visit by a team of about 5 members is currently planned. <ul style="list-style-type: none"> Representatives from the Bengaluru city government and pilot districts Director of the Government of Karnataka Former advisor for the Government of Karnataka Director of the City of Bengaluru (Two) persons in charge of the pilot 	Objectives: <ol style="list-style-type: none"> Provide a better understanding of relevant technologies and expertise through study tours in Japan. Establish the “Bengaluru Model” and help develop a test plan using the existing pilot. Overview: <ol style="list-style-type: none"> Target areas: Yokohama City Hall, waste incineration facilities, waste separation and collection sites, JFE Yokohama, etc., are under consideration. Particulars: <ul style="list-style-type: none"> Provide a first-hand experience of the technologies and know-how of Yokohama City and JFE through seminars and study tours. Establish the “Bengaluru Model” through workshops and provide support for the design of a pilot test plan.
Model testing using the existing pilot	Mid- to late June 2015	1 to 2 weeks	Bengaluru	Representatives from pilot districts	Objective: <ul style="list-style-type: none"> To test the Bengaluru Model by using the existing pilot project. Overview: <ul style="list-style-type: none"> Target areas: Wards 168 and 174, where the BBMP is conducting a waste separation/collection pilot project, are under consideration. Local administrative organizations will conduct the pilot as an addition to the existing pilot and the City of Yokohama and others from the Japan side will provide advice. The BBMP and other existing waste management companies will play the central role in the operation of the pilot.
Second program in India	Early July 2015	Five days	Bengaluru	Representatives from the Government of Bengaluru and pilot districts (10 to 15 members)	Objectives: <ul style="list-style-type: none"> To promote support for the Bengaluru Model based on lessons learned from and recommendations made based on the pilot project in the two model districts. Clarify the need for the inclusion of incineration treatment in the Bengaluru Model. Provide support for the preparation of specification criteria for a feasibility study; a project implementation schedule for a bidding process (to be prepared by the Government of Karnataka); a proposal for a regional waste separation and collection program; and technical standards required for incineration facilities and evaluation criteria for the bidding process (draft). Help raise awareness in other districts in Bengaluru.

Program type	Scheduled dates	Scheduled duration	Location	Main participants (organization, position, number of persons, etc.)	Program objectives and overview
					Overview: <ul style="list-style-type: none"> • to be presented through (one or two) workshops • Also conduct a study tour of the pilot districts.

2.2. Project framework

As described above, the objective of this project has been to raise awareness of the advantage and effectiveness of the combined outcome of Yokohama's recycling-oriented social system and JFE's advanced WTE technology. We believed, therefore, that the project required not only negotiations between the government and corporations but also discussions involving NGOs active in local areas and in reference to experiences in other countries. As such, we have developed a framework comprising experts in respective areas for the effective implementation of the project.

JFE India, JFE Engineering's subsidiary in India, also conducted studies on a local basis and provided support for organizing the visit. The Indian office of PwC also facilitated the project by helping to coordinate meetings in India. In addition, by involving C40, which has a strong connection with BBMP, we were able to gain access to key government personnel working in waste management. Such access would otherwise have been impossible to secure through a normal route.

Table 2.2 : Project framework

Name	Role	Parties and departments expected to participate in the project	Main roles
JFE	Main proposing company	Management Department, Overseas Project Division; Engineering Department, Overseas Project Division; JFE Engineering India	As the main project coordinator, JFE will be responsible for overseeing the execution of all operations, providing technical expertise, and organizing workshops and presentations in India.
PwC	Contractor	Public-private Partnership /Infrastructure Department; Cities Solution Centre, PwC India	Overall project planning and operation including proposal development; promotion of widespread adoption of Japanese technologies in India; transfer of technologies to the Indian counterpart and residential organizations; finding precedents in other countries related to urban solutions made possible by Japanese technologies; supporting the pilot program
City of Yokohama	Joint project manager	Co-Governance and Creation Task Force	Providing expertise relevant to the local government and residents with respect to public participation, awareness programs, capacity building and coordination and sharing the experience of Yokohama in waste separation

			and collection; and providing support for the pilot program.
C40	Project collaborator	Former Advisor to Karnataka Government Bureau Director	Approaching local organizations in project areas; providing expertise relevant to the local government and residents; presenting the experiences of countries around the world.
Mr. Vijay (WRI)	Project collaborator	Former expert on waste management at the World Bank, former Karnataka government employee	Discussing and negotiating with Indian counterparts, including high government officials of the state of Karnataka; providing technical advice pertaining to waste treatment in Bengaluru.

3. Technologies to be disseminated

3.1. WTE technology

3.1.1. Superiority of Japanese technology

In this project, High efficient WTE technology owned by JFE is put forward for proposal.

The WTE plant owned by Japanese companies, including JFE, was built for the first time in 1965. Since then, more than 300 plants over its' 50-year history has reached a total power generation amount of 7.21 billion kWh / year; this has made incineration a very established technology. China, South Korea and India have made remarkable progress, but in regards to advanced combustion and exhaust gas treatment technology to deal with low-calorie to high calorie garbage, and to suppress the occurrence of dioxin contamination, Japan is better evaluated better. In addition, Japan has a track record of providing WTE for wet, low-calorie waste, which is very common in Asian countries, including India.

Incineration plants made by Japan can also operate long term as verified by the operation track record in Japan, and have also been designed to continue proper and convenient operation management through well-designed operation manual. When compared to incineration power plants made by other countries, in general, the initial cost of Japanese facilities tend to be high; however, when viewed from the perspective of facility life cycle cost by stable operation, Japanese WTE technology has sufficient advantage in economic value.

Although the Incineration plant technology was historically introduced from European manufacturers, it has been developed in order to adapt to strict environmental standards and construction conditions in Japan; even compared with European manufacturers, Japanese-made technology is the most advantageous. In addition, statistics shows that the proportion of incineration power generation taken in Japan is bigger compared with the US and Europe, and the amount of track record and the length of operation term support the superiority of Japanese technology.

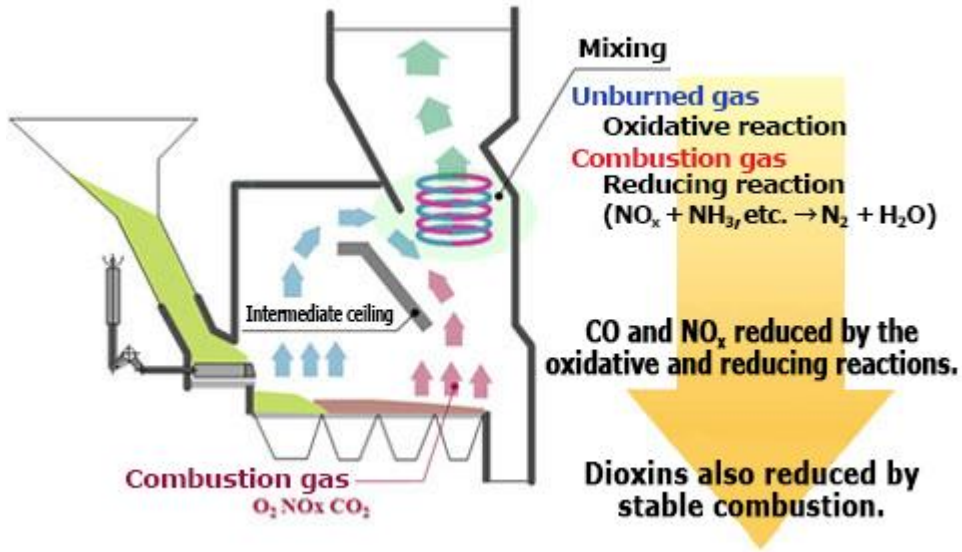
3.1.2. Features of JFE incineration plant technology

JFE's stoker incinerator (product name: Hyper 21 Stoke furnace) employs proprietary technology of Two-way gas flow, Hyper grate and High-temperature air combustion technology. These technologies can balance low air ratio combustion with stable waste combustion and enables for the higher energy recovery ratio; also it reduces the generation of environmentally hazardous substance, such as dioxins and NOx during combustion.

1. Two-way gas flow

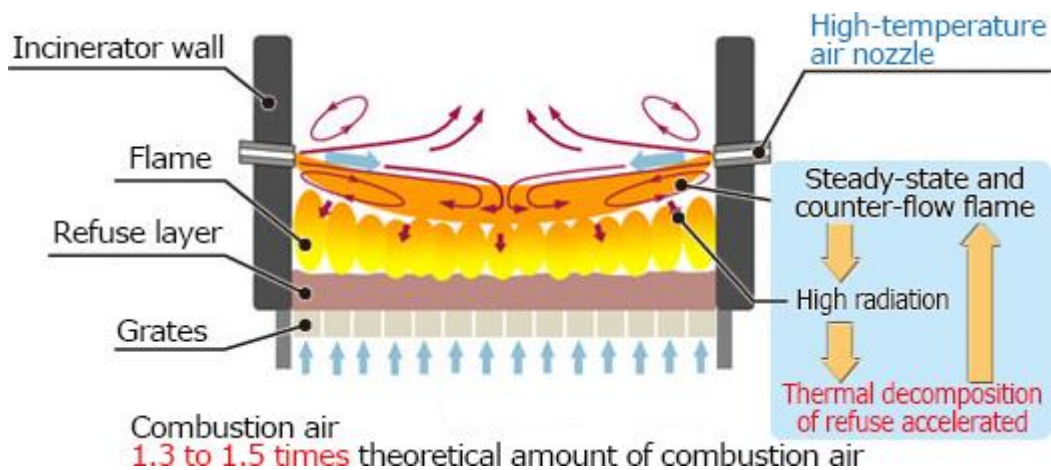
The JFE's "Two-way gas flow" system which has intermediate ceiling is proposed. The intermediate ceiling divides flue gas into 2 streams which flow through the flue gas main

path and sub-path and then turbulently mixes up in the secondary combustion chamber. Therefore, it is able to promote complete combustion by this raged confluence and is, able to reduce the generation of dioxins and NO_x during combustion.



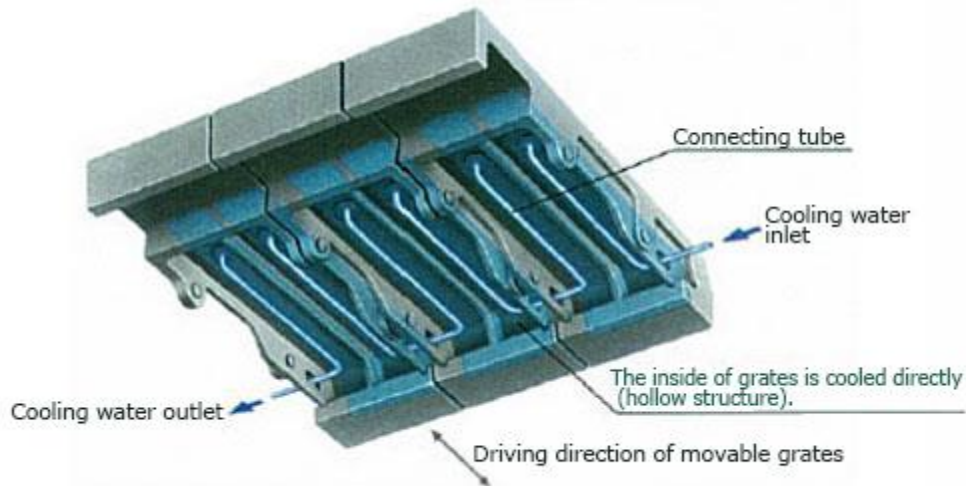
2. High-temperature air combustion technology

The technology forms a stable and uniform high temperature combustion field by blowing hot air from the incinerator side. It can suppress the low concentrations of CO and NO_x even at low air ratio to maintain a stable combustion.



3. Water cooling hyper grate

This technology consists of JFE's developed hyper grate and SBE Inc. (Germany) developed water cooling grate technology. It enables for high efficient/low pollution operation and longer product life cycle through a high cooling effect.



3.1.3. Track record of the company proposing the technology

JFE Engineering has supplied WTE plants in Japan since 1968. Currently, it has 171 plants (354 Furnaces) and is the top vendor with 24% of the national market share (2011-2015). The company is also responsible for the operation of 79 plants and the maintenance of 15,110 plants and is, well experienced in construction as well as O&M areas.

Particularly, JFE has experience in building the facilities in urban areas. In Meguro (Ordered by Clean authority of TOKYO), for example, JFE has successfully constructed a safe incineration plant in a residential area. Since the construction of March 1991 to the reconstruction of 2016, over the 25 years, it has maintained the operation in collaboration with the residents through the comprehensive environmental approach with appropriate exhaust gas treatment facility and effective usage of exhaust heat based power and heat supply. The fact that it was built in proximity to the residential area where the waste is actually produced also contributes to an agile waste collection process and the reduction of transportation costs.

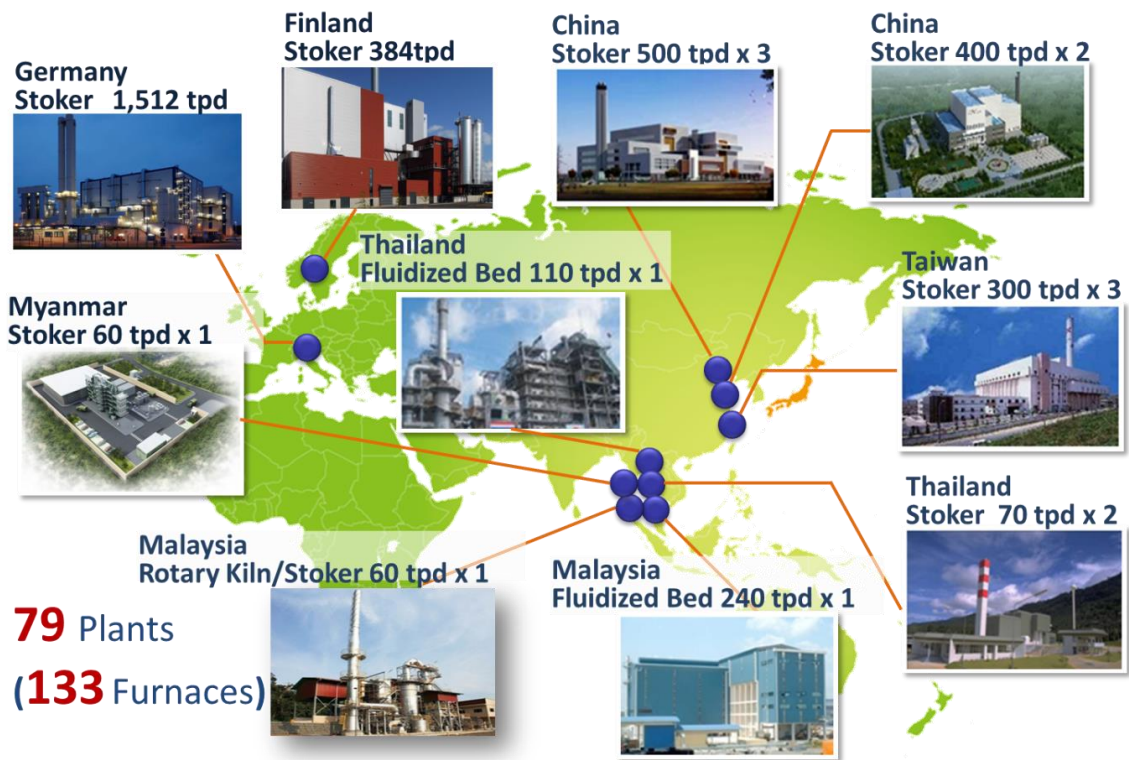
Additionally, in Yokohama, the collaborative partner for this project, JFE has constructed a large WTE facility (Kanazawa plant) to cover waste management in the southern part of the city.



Source: JFE

Figure 3.1 : Kanazawa Plant, Yokohama

In recent years, JFE has been aggressively expanding into overseas markets. In recent years, it has started constructing a 60t/day WTE plant in Yangon, Myanmar, as a JCM (Joint Crediting Mechanism) Model project of the Ministry of Environment of Japan. The facility is the first WTE plant in Myanmar under the JCM scheme, catching the attention of not just stakeholders in Myanmar, but also in the surrounding Asian countries.



Source : JFE

Figure 3.2 : Overseas track record of JFE

3.1.4. Comparison with other technologies

There are roughly three types of intermediate waste treatment methods: composting, biogas production, and incineration. Composting and biogas production are the two main methods used in India, a newly emerging country. The pros and cons of each method can be summarized below:

Table 3.1: Comparison of technologies

	Waste incineration	Mechanical composting	Biogas production
Treated waste	General waste (household waste), industrial waste Advanced segregation and screening are unnecessary during or before the collection phase.	Advanced segregation and screening are necessary during or before the collection of certain types of waste, mainly organic waste from kitchen waste and residue from wastewater treatment.	
Value generated	Electricity	Compost	Biogas
Final effluent	Furnace bottom ash, fly ash	Screened residue	Screened residue
Pros	Can accommodate many types of waste. • Flexible to changes in	Can be processed at small-scale facilities. • Can accommodate waste with	Can be processed at small-scale facilities. • Can accommodate waste

	<p>quality of waste.</p> <ul style="list-style-type: none"> • Allows intensive treatment at large-scale facilities. • A long track record in construction and operation with many completed technologies. • Electricity required for operation can be supplemented by self-generation. • Depending on the quality of waste, a simple pretreatment process can increase the amount of electricity generated per treated volume. 	<p>a high moisture content unfit for incineration.</p> <ul style="list-style-type: none"> • Does not produce flue gas. • The capital expenses of a single-facility operation are lower than those of an incineration facility. 	<p>with a high moisture content unsuitable for incineration.</p> <ul style="list-style-type: none"> • Does not produce flue gas. • The capital expenses of a single-facility operation are lower than those of an incineration facility.
Cons	<p>Cost effectiveness is lower in small-scale facilities.</p>	<p>Requires a treatment facility for screened residue.</p> <ul style="list-style-type: none"> • Business viability depends on the marketability of compost. • Advanced pretreatment is needed to ensure high quality. • In the case of a single-facility operation, energy needs to be purchased as the facility is not equipped with a power generation capability. • A single-facility operation requires the use of anti-odor equipment. 	<p>Requires a treatment facility for post-screening residues.</p> <ul style="list-style-type: none"> • Advanced pretreatment is needed to ensure safety. • In general, sale of gas is said to be more viable as a business than sale of electricity. If this is the case, energy may need to be purchased. • A single-facility operation requires the use of anti-odor equipment.

Source: JICA Study Team

As shown in the table above, composting involves significant investment risks since the viability of the business largely depends on the marketability of compost, and advanced pretreatment is necessary to ensure high quality. In the case of biogas production, it is important to set the appropriate gas and power price. Advanced pretreatment is also necessary to ensure safe operation by removing the unsuitable materials. Furthermore, in both methods, if an appropriate facility cannot be established for screened residue and post treatment residue, those residues are normally taken to the final landfill site, which shorten the lives of the site.

Also, Operating and administrative expenses of compost and biogas facilities (OPEX) are assumed to be lower than that of the incineration power generation facilities; however, by taking into account that the facility power demand can be covered by the incineration power generation and power sales revenue is expected, the facility power can be covered by the power generated by the incineration. Although it depends on the situation, the incineration power plant has an advantage in OPEX on the conditions that the scale of the facility is of a considerable size and that longer stable operation based on Japanese technology is assured.

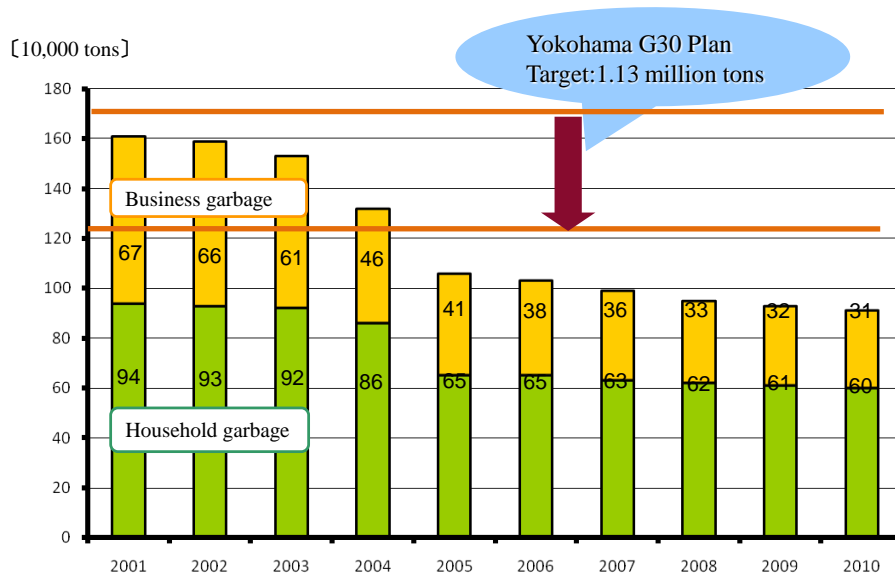
3.2. The Know-how of a recycling-oriented social system

The City of Yokohama launched the Yokohama G30 Plan in January 2003 with the goal of achieving a 30% waste reduction by 2010. The city accomplished the goal in 2005. Building on this accomplishment, Yokohama developed the Yokohama 3R Dream Plan in January 2011. With the goal of reducing, segregating, and recycling waste through collaboration between citizens, businesses, and the government, Yokohama is committed to developing stronger mechanisms and systems to reduce CO₂ and achieve safe, secure, and stable waste treatment.

3.2.1. Yokohama's accomplishments in G30 Plan

In the G30 Plan, Yokohama implemented programs aimed at a 30% waste reduction between 2001 and 2010. The target was accomplished in 2005, and by 2009 Yokohama reduced its waste by 40%. In addition, the city was successful in achieving the following:

- Reducing the cost of replacing two aging incinerators in 2011: reduced by 110 billion JPY
- Reducing the operation cost of waste management: reduced by 3 billion JPY
- Anticipated CO₂ reduction: 47%



Source: Yokohama City

Figure3.3: Changes in waste generation in Yokohama

3.2.2. Specific G30 programs

The goal of the G30 plan has been to reduce waste through the collaboration of the government, businesses, and citizens. In particular, the program has focused on raising public awareness of the importance of reducing waste and has achieved major success. Specific actions taken through the program are described below:

- Public seminars: Seminars and educational programs developed and held extensively for the general public on the importance of separating and reducing waste.
- Sessions on waste separation: 11,000 times (FY 2004 and 2005)
- Educational sessions near train stations: 600 times (FY 2004 and 2005)
- Early morning sessions at collection sites: 3,300 (FY 2004 and 2005)
- Sessions on non-segregated waste: 10,900 (FY 2009)



Seminar



Session in station



Session in collection point

Source: Yokohama City

Figure3.4: G30 activities

- Inspection of collected waste: Strengthened inspections on collected waste conducted at incineration facilities since 2003. New rules were introduced to ensure that if any inappropriate waste was found, the garbage collection vehicle returned the waste to the collection site.
 - Number of collection vehicles inspected in 2001: 2,263 → Number of collection vehicles inspected in 2012: 188,243
- Environmental outreach programs: Staff visited elementary and junior high schools to hold sessions on waste and the environment. School tours of incineration facilities were organized frequently.



Plant tour

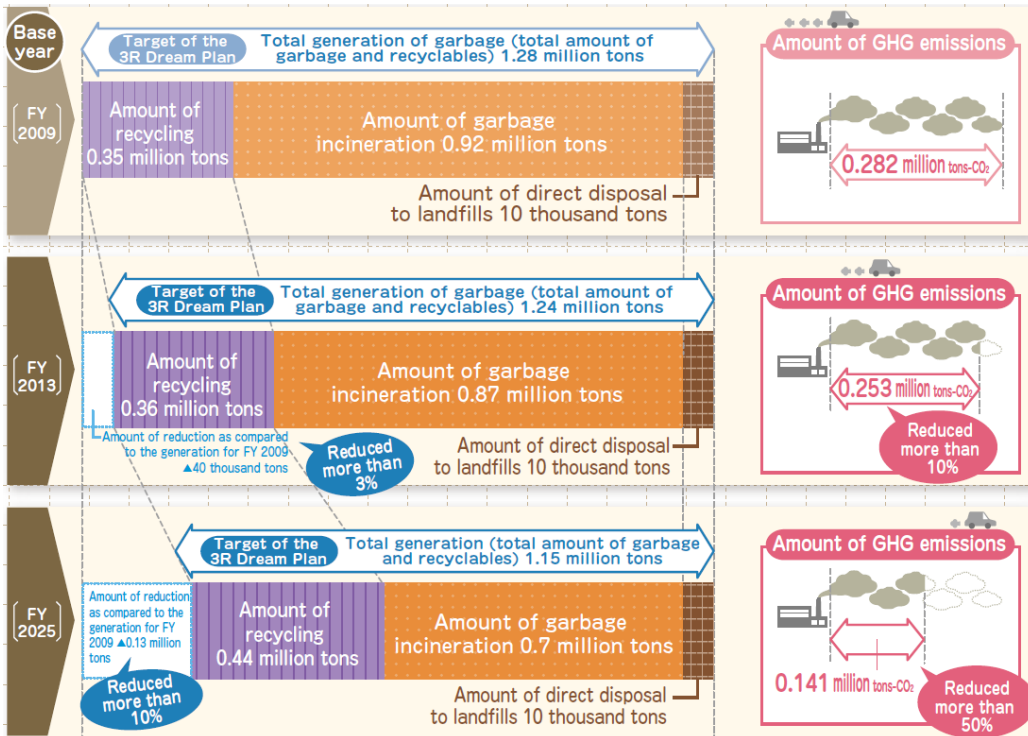
G30 tour

G30 session

Source: Yokohama City

Figure3.5: G30 activities

- Improvements in public services: voluntary community collection services for seniors and persons with a disability who had difficulty carrying waste were provided, as well as collection services using small trucks for locations where regular garbage collection vehicles could not access due to narrow roads.



Source: Yokohama City

Figure3.6: G30 activities

3.2.3. 3R Dream Plan

The 3R Dream Plan was developed in January 2011 based on the success of the G30 program. The objective of this plan has been to further reduce environmental impacts resulting from waste treatment not only by separating and recycling garbage but also by making aggressive efforts to reduce the amount of garbage.

Specifically, the plan aims to reduce the total amount of garbage by 10% from the current level of 1.28 million tons and to reduce greenhouse gas emissions by 50%, both by 2025. The following initiatives were undertaken between 2010 and 2014. The plan was to build the foundation for achieving the 2025 targets by advancing these programs.

Table3.2: Overview of 3R Dream Plan

Program	Details	Actions
Environmental education and awareness programs	<ul style="list-style-type: none"> • Actively provide information on garbage and the environment • Encourage eco-friendly actions by providing information relevant to the community, etc. 	<ul style="list-style-type: none"> • Provide information to new residents, foreigners, and seniors • Expand outreach seminar programs to offices and factories • Establish a new system centered on local human resources.
Promotion of garbage reduction	<ul style="list-style-type: none"> • Promote garbage reduction through the collaboration of citizens, businesses, and the government. 	<ul style="list-style-type: none"> • Set up and operate the Yokohama R (Reduce) Forum
Measures for household garbage	<ul style="list-style-type: none"> • Finely tuned services catered to residents' needs • Support for local communities • New recycling programs • Reducing and recycling household garbage • Proper treatment of household garbage • Development and operation of intermediate treatment facilities for resources • Approaches to the central government, etc. 	<ul style="list-style-type: none"> • Advancement of "community" collection services, etc. • Expand and strengthen administrative functions to set up a point of contact and provide citizens with consultation and information services • Strengthen programs for improving garbage collection sites • New kitchen waste recycling programs • A more thorough enforcement of waste separation
Measures for commercial waste	<ul style="list-style-type: none"> • Reducing and recycling commercial waste • Appropriate treatment of commercial waste • Partnerships with businesses taking eco-friendly actions 	<ul style="list-style-type: none"> • Promote reduction and recycling of food waste • Recognition of outstanding businesses through awards • Provide effective instructions on waste separation by inspecting waste delivered to incineration facilities or conducting on-site

Program	Details	Actions
	<ul style="list-style-type: none"> • Developing recycling businesses, etc. 	<ul style="list-style-type: none"> inspections at business offices.
Waste treatment and disposal	<ul style="list-style-type: none"> • Safe and stable treatment and disposal • Reduction of environmental impacts from waste treatment and achieving efficient operation • Various studies and research programs pertaining to the promotion of 3R and appropriate waste treatment 	<ul style="list-style-type: none"> • Earthquake retrofit construction work for the Tsuzuki factory • Construction of a final landfill site at Minami Honmoku Pier (Block 5) • Effective use of ash from incineration plants • Promotion of energy conservation
Creating clean communities	<ul style="list-style-type: none"> • Efforts to create a clean town in collaboration with the community 	<ul style="list-style-type: none"> • Support voluntary cleaning programs appropriate for the circumstances of the community • Implement a stronger monitoring program in areas with multiple incidents of illegal dumping

Source: JICA Study Team

4. Project Details

During the initial stage of the project, political change occurred within the local government, which caused a member of the counterpart that had originally participated in the discussion to be dismissed from the BBMP. One of the significant changes was the growing importance of the Karnataka government as a stakeholder.

Specifically, the Bharatiya Janata Party (BJP) occupied 100 out of 198 seats in the 2015 second half of the BBMP parliamentary election and became the ruling party. The Congress Party cooperated with Janata Dal (secular) against the BJP in the mayoral election and got a narrow margin of victory. This created a situation in which the ruling party of the Congress and the mayor's party were different. The Mayor election resulted in a narrow margin and was conducted several times due to the backlash from BJP. Because the ruling party of Karnataka is the Congress Party, the relationship between local government and the BBMP became complicated. The sudden dismissal or transfer of officials has become a frequent occurrence.

In order to achieve maximum effect in the unstable political situation, instead of sticking to the original schedule, we dedicated our effort into creating a better understanding of the waste treatment system which Yokohama City and JFE planned. As a result, in place of the originally planned activities, on-site visits were conducted and an understanding of the concept Yokohama City and JFE were advocated was deepened.

Details of the programs are described below based on the reports prepared for each program.

4.1. February visit for the project kickoff meeting

(1) Program objectives

From February 4, 2015, JFE, along with the City of Yokohama and PwC Japan, members of this project, visited Bengaluru to hold a kick-off meeting with the BBMP and to conduct study tours to understand the current state of waste treatment in the city. Members of the JICA India office, JFE India, and PwC India also joined in. Discussions were held in an all-inclusive framework representing the perspectives and expertise of businesses, municipalities, and central government.

- The main objectives of this program were set as follows:
 - Both sides will agree that the project is the first step taken to improve waste management in Bengaluru, and that its objectives are to share our expertise and build an organizational framework for developing concrete plans in the future and to determine the details of the next steps.

- Build an organizational framework within the BBMP that has the authority to make decisions and move forward with concrete studies and discussions, and use the framework as a foundation for developing specific plans for future programs.
- Instead of focusing only on discussions with the BBMP, visit the actual waste management sites in order to collect the information necessary to identify the root of the problems and the actions required to mitigate the problems.

(2) Main program components

Kick-off meeting with the BBMP

A kick-off seminar was held with about 20 participants, including the key members of the BBMP and their aides. The main participants and agenda items were as follows:

- **Main participants:**

- BBPM, Mayor, Shantha Kumari
- BBMP, Deputy Mayor, K Ranganna
- BBMP, Special Commissioner, Darpan Jain, IAS
- BBMP, Corporator, HSR Ward, K Latha Narasimhamurthy
- BBMP, Joint Commissioner, Health & SWM, Yatheesh Kumar
- BBMP, High Court Appointed Expert Committee on SWM, Kalpana Kar
- BBMP, Chief Engineer Solid Waste Management, M.R Venkatesh

- **Agenda:**

- Opening greetings (Gen Takahashi, JFE Engineering)
- Introduction of participants (Self introduction)
- Introduction of Yokohama City (Toru Hashimoto, Yokohama City)
- Services offered by JFE Engineering (Pravin Chavan, JFE Engineering India)
- Project overview (Atsuo Mori, PwC)

- **Main topics:**

- The JICA Study Team must apply a broad range of perspectives to study and design a model suited to the current situation in Bengaluru.
- The Team will examine the details of the project including the future roadmap, and reach a consensus with the BBMP side.

- The JICA Study Team emphasized its intention to act as a partner and propose solutions to address specific issues based on its discussion with Bengaluru, and not as a provider of ready-made solutions.

Detailed Discussions

We held discussions with Ms. Latha, the representative of 174th district where waste separation pilot had been held, and a participant of the Asia Smart City Conference held in Yokohama last year, and an NGO that works with Ms. Latha to improve waste treatment.

- **Main topics :**

- An organizational framework with a decision-making power must be set up within the BBMP. Since the Joint Commissioner has the final decision-making power, it is very important that we hold ongoing discussions with and gain approval from the Joint Commissioner to proceed with the project. However, we still need a separate organizational framework responsible for the day-to-day operation.
- A fund was set aside in Bengaluru about two years ago and serious efforts have been made to tackle waste management problems. Of the 198 wards, 44 wards have been chosen as pilot districts, and a progress report will be submitted to provide an update of the current situation and to propose solutions.
- Since the Municipal Solid Waste Rules (2000) were developed, Bengaluru has carried out its waste management initiatives in compliance with the rules. However, reviews are currently underway to determine whether it is necessary to revise the rules.
- The BBMP intends to review its operational regulations from a global perspective based on the regulations and guidelines adopted by Yokohama.

- **Agreements:**

- (1) the current project is the initial phase of a long-term study, and the details of the future steps must be determined based on the further examination of this project; and (2) the BBMP side will quickly form a local team in charge of studying and developing the project in collaboration with the JICA Study Team, with Ms. Latha playing a central role.
- In light of the above, the parties agreed on the following as the most immediate goals: Ms. Latha will form a study team and provide relevant information (e.g., waste collection and waste operation data); and the JICA Study Team will follow up with the latter and provide an initial analysis of the project.

Site Visit on waste management status of Bengaluru

With the support of Ms. Latha and NGO, the site visit was conducted to see the process from waste collection, separation, compost and land fill.

- **Schedule:**

- 5:00-: Site visit on Waste collection, separation in Bengaluru
- 9:00-: Discussion with NGO
- 10:00-: Site visit on Recycle shop
- 15:00-: Site visit on process on Compost and Landfill

(3) Achievements

- A consensus was obtained with respect to the objective of this project and the need to develop an organizational framework (BBMP has begun working on this).
- Based on the local tours, we identified and organized initiatives already underway in Bengaluru and some of the future issues that need to be addressed.

(4) Areas that need improvement

- It is essential that we have an opportunity to meet and discuss with the Chief Secretary, who has influence over Bengaluru's waste management, as we were not able to do so this time.
 - Even though the visit had been scheduled, there was no time for a meeting because the legislature was in session during our visit.
 - The JICA India office already communicated our view described above, including our request for a future visit. We plan to set a meeting to discuss the project in the future.
- Detailed and frequent discussions with persons with a decision-making power over waste treatment and management in Bengaluru are essential.
 - In addition to the BBMP, the Karnataka government is also involved in Bengaluru's waste management. Sharing information with a broad range of decision-makers is essential.

- In particular, frequent and close communications with decision-makers as well as those in charge of actual operation are essential in order to introduce new operations and technologies.
- It is necessary to discuss and provide information on the significance and effectiveness of introducing the operations adopted by Yokohama and JFE's advanced technologies—in particular their impacts on the daily lives of residents.
 - While the BBMP is aware of the need to address the current problems, Bengaluru lacks a clear vision of the ideal city it is trying to become. For this reason it appears that measures currently examined by the BBMP are based on short-term considerations and lack consistency.
 - In particular, we believe that it is necessary to present a long-term and broad-based vision to stakeholders such as decision-makers within the BBMP and local waste-related businesses who are satisfied with the current waste collection system (e.g., through discussions of the gap between Bengaluru's vision of an ideal city and the current situation, and how to fill the gap).

4.2. April Workshops

(1) Program objective

From April 23, 2015, a team consisting of JFE, the City of Yokohama, PwC Japan, JFE Engineering India, and PwC India visited members of the BBMP and other leading officials. Discussions were held to provide the Bengaluru side with a technical understanding of the optimal solution we have developed for Bengaluru's waste management problems centered on waste-to-energy (WTE) facilities. Also participating in this visit were members of the Institute for Global Environmental Strategies (IGES), which has a partnership agreement with Yokohama City to tackle urban problems in emerging countries.

- The main objectives of this local program were set as follows:
 - Visit the main participants of this project, including members of the BBMP and Mrs. Kalpana Kar, a member of the Expert Committee on Solid Waste Management (SWM) appointed by the High Court of Karnataka, to discuss the direction and objectives of this project and agree on the concrete plans for the future.
 - Collect information on whether or not elections or organizational changes within the BBMP will impact Bengaluru's waste management policies.

- Study waste treatment facilities in operation or under construction and the current state of waste segregation, and analyze issues with the goal of developing an optimal waste treatment system for the future.

(2) Main program components

Discussion with the High Court Committee on SWM

The study team had an opportunity to meet with Mrs. Kalpana Kar, the key person of the High Court Committee on SWM. The meeting was conducted in India Bengaluru City.

- **Main participants:**

- BBMP, High Court Committee on SWM, Mrs. Kalpana Kar

- **Main topics:**

- According to Mrs. Kalpana, the promotion of separating and recycling, the installation of methane fermentation and the installation of power generation plant resulted in consideration being given toward the organic waste in the rest of the Bengaluru City.
- Discussion about the optimal processing technology of hazardous waste and dry waste (mixing trash such as non-recyclable plastic trash which is collected separately at the recycling station) required.
- In contrast, the study Team (Yokohama City Hashimoto Director) explained that, although the methane fermentation and biogas power plant was conceptualized as organic-based waste disposal, appropriate pretreatment was necessary. Also because it was understood that it was not realistic to handle the large amount of solid waste in large cities such as Bengaluru City, discussions about other processing techniques, such as waste incineration was necessary.

- **Agreements:**

- Proposal for different study needs to be considered for optimal separation, recycle system, and dry waste treatment.
- After confirming the intention of the BBMP in the meeting with Mr. Darpan which was implemented the same day in the afternoon, the study team will discuss with Mrs Kalpana about future policy.

Discussion with the Special Commissioner, BBMP

The study team visited the Special Commissioner of the BBMP. In addition to the project presentation, the study team also confirmed the policy too.

- **Main participants:**
 - BBMP, Special Commissioner, Mr. Darpan Jain, IAS
- **Main topics and agreements:**
 - First, the study team explained the aim of the visit. Then, based on current data and the facility survey results related to waste disposal provided by Mrs. Kalpana, we made an agreement to re-propose in the future.
 - The study team made an agreement about the research schedule of the existing waste treatment facilities.

Detailed discussions with Special Commissioner, BBMP and a key official

Following a team discussion on topics including the results of the studies of the existing facilities, a final meeting was held among Mr. Darpan, the Special Commissioner, Mrs. Kalpana, JFE, Yokohama City, and PwC. During the meeting we confirmed the BBMP's priority issues and requests with respect to waste management.

- **Main participants:**
 - BBMP, Special Commissioner, Mr. Darpan Jain
 - BBMP, High Court Committee on SWM, Kalpana Kar
- **Main topics:**
 - Mr. Darpan Jain commented that, in order to ensure that an effective waste segregation and collection process is implemented, IT monitoring is also necessary. The study team responded that the City of Yokohama has gained the public's understanding and cooperation by hosting public seminars on waste segregation/collection, recycling, and treatment several times, and has been implementing an effective segregation and collection system.
 - Mr. Darpan Jain believes that Bengaluru's waste treatment is an urgent issue that must be resolved as soon as possible, and that he has high hopes for the BBMP's collaboration with the JICA Study Team.
 - In addition, the BBMP side made an inquiry regarding the feasibility of introducing a process for converting dry waste (in particular plastic waste) into RDF (fluff), and receiving and treating it at cement factories. The study team responded that it is technically feasible by all means, but that we will take the inquiry back home for a detailed examination and have a proposal ready for the next visit.

- In addition, the BBMP side commented that they would find a land lot for the construction of a waste treatment facility and implied that they would also guarantee the quality of waste collected.
- Mr. Darpan Jain was requesting a business model for financing, etc., and facility specifications required for solving waste treatment problems.
- **Agreements:**
 - In addition to this study project, which is aimed at providing the BBMP with technical knowledge related to WTE facilities for the early resolution of waste problems in Bengaluru, we will study the feasibility of a separate program for developing a waste segregation and collection system and a dry waste treatment facility.
 - The goal is to achieve an optimal waste treatment system for the future of Bengaluru by combining the above technologies and facilities.
 - Investigate the feasibility of developing a program for the construction of a waste segregation and collection system and a dry waste treatment facility.

Site Visit on waste management status of Bengaluru

With the support of Mr. Jain and Mrs. Kalpana, the site visit was conducted to see the process of waste separation, Biogas power plant, and compost facility.

- **Schedule:**
 - 9:00-: Site visit on waste separation facility in Sri Krishna Rajendra Market and Biogas power plant
 - 10:20-: Site visit on waste collection and separation facility in Freedom Park, Biogas power plant and RDF facility
 - 11:50-: Visit on Compost facility (200t/day)
 - 12:30-: Visit on Compost facility (500t/day)
 - 12:45-: Visit on Compost facility (300t/day)

(3) Achievements

- We now have a good understanding of the BBMP's future goals and intentions, as well as a clearer idea of the future direction of this project. In addition, the discussions allowed us to strengthen our relationships with various stakeholders on the BBMP side.
- With the cooperation of Mr. Jain and Mrs. Kalpana, we gained a better understanding of the current state of waste treatment facilities (e.g., biomass gas plants and composting plants) in operation or under construction, waste segregation and collection processes, and overall waste management in Bengaluru, and were able to determine the future direction of this project.

(4) Areas that need improvement

- During this visit we found out that the BBMP is not only focused on WTE technology, which is proposed through this project, but is also strongly interested in gaining expertise in various areas, including waste segregation/collection, recycling, and complex treatment facilities capable of accommodating different qualities of waste.
- However, since it appears that the BBMP is considering multiple technologies on a separate basis, we need to fully communicate to them the idea of a complex and integrated waste treatment system that is made possible by a detailed examination of different types of treatment technologies, with WTE plants playing a central role, as it is done in Yokohama.
- While we expect to encounter difficulties in arranging the Indian team's visit to Japan, we believe that organizing a workshop program in Japan will be the most effective way for providing them with the expertise described above. We therefore need to prepare and make necessary arrangements accordingly.

4.3. September Visit to India

(1) Program objectives

From September 27, 2015, a study team consisting of JFE, the City of Yokohama, PwC Japan, JFE Engineering India, and PwC India visited and held discussions with members of the BBMP and other authorities, primarily with the goal of preparing for the Indian team's visit to Japan.

This visit was organized in conjunction with meetings for other projects. The "Project for the Development of a Low-Carbon City Based on Resource Recycling Systems in Bengaluru (hereinafter the "JCM Project")" is an FY 2015 Ministry of Environment JCM feasibility study project. An application for the project has been submitted and approved based on the expertise and the relationship with the BBMP developed through this project. For this reason, some of the meetings were held with the attendance of corporations

implementing the JCM program (EX Research Institute Ltd. and Mansei Recycle Systems Co., Ltd.).

- The main objectives of the local program were as follows:
 - Meet with the new mayor and the Commissioner who assumed their posts following the election in September, explain the project as well as the JCM project, which will be the next phase of the current project, and ask for their continued cooperation.
 - Request the main participants of the project to be part of the training program to be held in Japan from October 18 to 23 (as well as the JCM City-to-City Collaboration Workshop to be held at the same time), and ask them to make necessary arrangements so that they can attend.
 - Conduct additional studies and discussions based on the results of the previous studies, and organize and examine the future direction with the aim of completing the project.

(2) Main program component

Following our arrival in India, the following unexpected incidents made it necessary to make some changes to our schedules.

- Ms. Kalpana Kar, a member of the Expert Committee on SWM who was the main channel of communication with the BBMP and was in charge of making arrangements for the workshop in Japan on the Indian side, and Mr. Sanjay Srinidhar, C40 Regional Director, were unable to attend the meetings due to health reasons.
- As a result, we contacted the BBMP ourselves and set up meetings with the support of Mr. Sanjay through emails.

The main program components were organized as follows in light of the above changes.

Discussion with the Mayor

We held a discussion with the mayor, SWM Joint commissioner and other 20 officials in Bengaluru, India in order to explain the training program in Japan and the JCM project, and gain the cooperation of the BBMP side.

- **Main participants:**
 - BBMP, Mayor, Mr. Bommanahalli Narayana Reddy Manjunatha Reddy
 - BBMP, Mr. S. Krishnappa

- BBMP, SWM Joint commissioner, Mr. Yatish Kumar
- **Main topics:**
 - Following the presentations by the JICA study team and the JCM study team, the mayor stated that he welcomes the initiatives made through the two projects to develop optimal waste treatment systems for Bengaluru, and in particular showed great interest in acquiring technologies and expertise through the training program in Japan.
 - At the same time, the mayor further commented that he would like individuals who are expected to play a key role in waste management to participate in the training program in Japan.
- **Agreements:**
 - The BMPP side agreed to proceed with the JICA project and the JCM project, which is the next phase of the JICA project. With respect to the training program in Japan, we have asked the BMPP to submit a list of participants approved by the mayor as soon as possible.



Figure4.1: Discussion at the mayor's conference room

Discussion with the Commissioner, BBMP

We held a discussion with a Commissioner in order to explain the training program in Japan and the JCM project, and gain the cooperation of the BBMP side.

- **Main participants:**
 - BBMP, Commissioner, Mr. Kumar. Naik, G
 - BBMP, SWM Joint commissioner, Mr. Yatish Kumar

- **Main topics:**
 - The Commissioner expressed his support for our efforts with respect to the introduction of WTE technologies through the JICA project and the JCM project, the next phase of the JICA project, and once again offered his full cooperation.
 - While the Commissioner also expressed a strong interest in the training program in Japan, he also suggested that various government arrangements might take time.
 - While the Commissioner expressed some support for the JCM scheme, he was of the view that there should be active discussions between the governments of Japan and India to reach an agreement.
- **Agreement:**
 - The Commissioner agreed to move forward with the JICA project and the JCM project, which is the next phase of the JICA project.
 - With regard to the training program in Japan, the Commissioner instructed us to proceed with the plan based on discussions with the Joint Commissioner on practical matters.

Discussion with the Joint Commissioner, BBMP

We held a discussion with Mr. Yathish Kumar, BBMP Joint Commissioner.

- **Main participants:**
 - BBMP, SWM Joint commissioner, Mr. Yatish Kumar
- **Main topics:**
 - The Joint Commissioner expressed his support for our efforts related to the introduction of WTE technologies through the JICA project and the JCM project, which will take over the JICA project, as well as the nature of the JCM project itself. He once again agreed to offer cooperation. We also provided him with a basic overview of WTE technology. The Joint Commissioner expressed great hopes that the two projects will succeed in developing an optimal waste treatment system for Bengaluru, which is one of the most urgent issues in the city, and that he would like to see the two projects move forward as soon as possible. The Joint Commissioner also said he intended to cooperate with us fully and provide all the data necessary for the projects.
 - The Joint Commissioner also stated that he would arrange the approval process within the BBMP for the Japanese training program under the instruction of the Commissioner.

Discussion with an Expert Committee Member

Since the meeting with Mrs. Kalpana, the main counterpart for this project, was cancelled due to her illness, we were introduced to Mrs. Almitra H. Patel, also a member of the Expert Committee for Solid Waste Management and an expert on waste management, and held a discussion with her.

- **Main participants:**

- BBMP, High Court Committee on SWM, Mrs. Almitra Patel

- **Main topics:**

- Mrs. Patel has been tackling the waste management problems of not only Bengaluru but also of India as a whole for the last few decades, and is one of the members of the team that developed MSW 2000, guidelines on waste management in India.
- Mrs. Patel provided us with a detailed explanation of various issues encountered in the efforts to optimize waste management in India, including the sequence of events leading up to now.
 - Various forces interfere with, and may even hinder, efforts to optimize waste management (e.g., corruption).
 - Since large portions of waste in India are organic components, soil, and sand, waste in many cases is not incinerated fully or properly.
 - Since waste is not segregated sufficiently, it is not fully utilized as a plastic fuel (RDF) either.
 - Since incineration plants have been constructed and operated in an inappropriate manner without pretreatment facilities, a negative image is associated with incineration plants. For this reason public acceptance of such facilities may be extremely difficult to achieve in India at this time.
- Mrs. Patel commented that India, Bangladesh, and other SAARC nations that share similar issues and waste types have signed the 2004 Dhaka Declaration on Waste Management and agreed that “incineration as well as unproven technologies such as Plasma, should not be considered as an option for the treatment of their municipal solid wastes for low calorific value and environmental pollution potential.” In selecting and studying waste management technologies for the JICA and JCM projects, it should be noted that the MSW 2000, which Ms. Patel helped prepare, also complies with the Declaration.

- At the same time, Mrs. Patel stated that she has high hopes that Japan would assist with the development of soft infrastructure (e.g., general framework, community awareness programs).
- **Agreements:**
 - Both parties agreed that, given the current situation in India, it was important for the Japanese side to use actual evidence in future discussions to demonstrate the advantages and superiority of Japanese WTE plants equipped with appropriate pretreatment facilities.
 - Because of the lack of expertise on waste segregation in India, it was agreed that the City of Yokohama would concurrently provide advice on collection and segregation.

Discussion with the Commissioner

After Mr. Miyajima of Yokohama City arrived in India, we had another meeting with the Commissioner.

- **Main participants:**
 - BBMP, Commissioner, Mr. Kumar. Naik, G
 - BBMP, SWM Joint commissioner, Mr. Yatish Kumar
- **Main topics:**
 - The City of Yokohama explained that, as part of its city-to-city partnership program with Bengaluru, Yokohama would continue to provide full cooperation to optimize the waste management of Bengaluru through the JICA and JCM projects. The Commissioner agreed to fully cooperate with the implementation of the two projects.
 - The City of Yokohama further explained that the training program in Japan on the JICA project would not only be coordinated with the JCM project but also include a participation to the Smart City Conference. The Commissioner showed great interest and stated that he would move forward with all necessary arrangements.
- **Agreements:**
 - Obtained cooperation for promoting both businesses from the Commissioner.
 - Strong interest was shown in regards to participation in the "Smart City Conference" and the necessary procedures should be advanced.

Discussion with the mayor

After the arrival of Mr. Miyajima of Yokohama City in India, we had another meeting with the mayor to explain the details of the BBMP's continuing collaboration with the City of Yokohama, and gain their understanding and cooperation.

- **Main participants:**

- BBMP, Mayor, Mr. Bommanahalli Narayana Reddy Manjunatha Reddy

- **Main topics:**

- As done for the Commissioner, the City of Yokohama explained that, as part of its city-to-city partnership program with Bengaluru, Yokohama would continue to provide full cooperation to optimize the waste management of Bengaluru through the JICA and JCM projects. The mayor agreed to fully cooperate with the implementation of the two projects.
- The City of Yokohama further explained that the training program in Japan on the JICA project would not only be coordinated with the JCM project but also include a participation to the Smart City Conference. The mayor showed great interest and stated that he would move forward with all necessary arrangements.
- The mayor once again emphasized his interest in the JCM program and the visit to Japan, and expressed his support in moving forward with the process for the visit.
- With respect to the visit to Japan, the mayor stated that there are some members he would like to include in the visit and would recommend the names as soon as possible. The study team strongly requested the mayor to make the selection as soon as possible since there was not much time until the training program, considering the time required for visa application.

- **Agreements:**

- The study team obtained cooperation from the Mayor for the promotion of the business.
- In regards to visiting Japan, the Mayor agreed to carry the discussion out as soon as possible.



Figure4.2: Discussion with the mayor and Mr. Miyajima from Yokohama City

(3) Achievements

- Meet with the new mayor and the Commissioner who assumed their posts following the election in September, explain the project as well as the JCM project, the next phase of this project, and ask for their continued cooperation. Through the two meetings with the new mayor and the Commissioner, we were able to gain the support of the leading members of the BBMP for this project as well as the JCM project, which is the next phase of the current project.
- In addition, by having face-to-face meetings with the new mayor and the Commissioner, we were able to drive home the idea that the two projects are based on the collaborative relationship between Yokohama and Bengaluru and reinforce the foundation for proceeding with the projects following the organizational shakeup in the Bengaluru government.
- We had to change our plans immediately before the meetings due to the unexpected illnesses of Mr. Sanjay and Ms. Kalpana, who supported us as the main channels of communication for the project. We will minimize similar risks by establishing multiple channels of communication in the future.
- We discovered that there might be some delays in paperwork and other arrangements for the training program since the mayor intends to request changes to the members. We suspect this may be due to the political shakeup following the election. Nevertheless, we hope to be able to implement the project by communicating frequently (and well in advance, if needed) with the BBMP side through several channels of communication, in addition to working on the areas described above.

4.4. June Visit to India

(1) Program Objective

On June 19, 2016, JFE, Yokohama City, JFE India and PwC India visited the Bengaluru City BBMP and Karnataka government officials. The details for the procedure of WTE introduction were discussed.

The objective of the visit was to make draft proposal on the specific project financing plan and the implementation aimed to obtain a consensus of how to proceed. To that end, the visit took advantage of the network of the government and the knowledge that has been accumulated through the “Project for the Development a Low-Carbon City Based on Resource Recycling Systems in Bengaluru”, funded by MOEJ. Thus, Mansei recycle systems, the company who conducted the study on RDF in the same area under JCM project joined the visit. The proposal was made, to response to the needs of Bengaluru, in the form of combined proposal on integrated waste processing facility.

The main objectives of the local program were as follows:

- To get the specific information on issues related to waste from the key local stakeholders.
- Conducted an introductory proposal of WTE to the BBMP and the state government and agree on a concrete procedure towards its actual introduction.

(2) Main program components

Discussion with Commissioner, BBMP

We had an opportunity to discuss with the Commissioner, BBMP the way forward for the project. Having incorporated Mr Karanth's views, the team prepared a presentation for the Commissioner in order to find out a way forward for the project

• **Main participants:**

- BBMP, Commissioner, Mr. N. Manjunatha Prasad IAS
- BBMP, Special Commissioner SWM, Mr. Subodh Yadav IAS
- BBMP, Joint commissioner (Health/SWM), Mr. Sarfarazkhan Sardar,
- Indo-Japanese Chamber of Commerce & Industry (Karnataka), Hon. Secretary, Mr. P N Karanth

• **Main topics:**

- JICA Study Team started the discussion by presenting the note to the audience. He briefed in detail various aspects including timelines for the project.
- The Commissioner stressed on the point that BBMP cannot wait for another 3 years to complete the project and that it has to start immediately.
- The Commissioner also elaborated another pre-requisite that the construction of the proposed RDF and WTE facilities in the Kannahalli plant should not affect the current operation of the plant. JFE / Mansei has to take responsibility for carrying out the current operation of the plant.

• **Agreements:**

- As a result of the discussion, the Commissioner agreed to examine the proposal and share the feedback later.



Figure 4.3: Discussion with Commissioner

Discussion with Joint Commissioner

We had a discussion with the Joint Commissioner to take inputs in preparing the proposal and the way forward for the project.

- **Main participants:**

- BBMP, Joint commissioner (Health/SWM), Mr. Sarfarazkhan Sardar,
- Indo-Japanese Chamber of Commerce & Industry (Karnataka), Hon. Secretary, Mr. P N Karanth

- **Main topics:**

- JICA Study Team explained the proposed solution in detail, including the proposed funding mechanism, along with the associated constraints.
- Mr Sardar expressed his concern that the project will take 3 years to complete, in spite of the fact that RDF and WTE facilities are being built on an existing plant. Mr Takahashi explained the reason for the same. He also explained that the team will look at the construction of the RDF and WTE facilities in parallel so as to save time.
- Mr Sardar pointed out that a major problem being faced in Bengalure with respect to SWM is the problem of odor control and enquired how the proposed system is going to address the same. Mansei explained that odor control will be achieved through dehydration, in order to reduce the moisture content in the waste and explained the whole process behind the same. Further, he clarified that this system (for dehydration of waste) can be installed in as soon as 6 months.

- After listening to the conversation, Mr Sardar suggested JFE / Mansei to submit a comprehensive proposal including technical and commercial details. BBMP would evaluate the same and try to take it up through Swiss challenge route. He said that it would be important to mention in the proposal that the project team would take up the operation of the plant immediately.
- **Agreements:**
 - As a result, a comprehensive proposal along with technical and commercial details will be submitted to BBMP within 1 month.



Figure 4.4: Discussion with Joint Commissioner

Discussion with KUIDFC General Manager

We had an opportunity to discuss Integrated Waste Processing Facility proposal and way forward.

- **Main participants:**
 - Karnataka Urban Infrastructure Development & Finance Corporation, General Manager, Mr. Ashok Jain
 - Indo-Japanese Chamber of Commerce & Industry (Karnataka), Hon. Secretary, Mr. P N Karanth
- **Main topics:**
 - JICA Study Team explained the Integrated Waste Processing Facility proposal for Kannahalli site in detail to Mr Ashok Jain including the proposed JICA program loan.

- Mr Ashok Jain highlighted that the land which JFE is planning to set WTE plant is the low lying land and it is currently used for Land fill. However getting 5000 sqft of land near the site will not be a major issue. If BBMP agrees we can identify another piece of land in the Kanahali site. Since earlier BBMP has plan to give 5000 sqft of land to another company for a pilot project.
- Mr Ashok also suggested that JFE should try to phase out there penetration in the India SWM space. Considering the fact that, BBMP urgently require a solution for Solid Waste Management.
- Mr Ashok suggested that, in the First phase, set up a dehydrating plant, which will help in controlling the odour problem and thereafter. In the second phase WTE plant can be installed.
- Mr Ashok also highlighted that currently they are getting lot of proposals for WTE plants from various countries i.e. US, Korea, UK, Netherland and others.
- **Agreements:**
 - As a result, a proposal for installing dehydrating plant to control the odor and improve RDF calorific value will be submitted.



Figure 4.5: Discussion with KUIDFC

Discussion with Minister, Government of Karnataka

We had an opportunity to discuss Integrated Waste Processing Facility proposal and way forward.

- **Main participants:**

- Government of Karnataka, Minister for Bengaluru Development and Town Planning, Mr. K J George.
- Government of Karnataka, Additional Chief Secretary, Mr. Mahinder Jain
- Indo-Japanese Chamber of Commerce & Industry (Karnataka), Hon. Secretary, Mr. P N Karanth

- **Main topics:**

- JICA Study Team explained the Integrated Waste Processing Facility proposal for to Mr George including the proposed JICA program loan.
- Mr George suggested JFE team to submit a proposal to convert 200t plant to Waste to Energy plant for Seagahalli Site instead of Kannahalli site where JICA Study team provided the proposal.
- Mr George also highlighted that project will be done under PPP scheme; 1) Government will provide land. 2) Government will provide the unseparated waste for free. 3) Power purchasing prices are determined by the Central Regulatory Commission at INR7.90 per unit, not in FIT scheme. 4) The private client has to bring technology and funds for setting up the facility. The private client has to build, operate, finance and operate the facility with no tipping fee.

- **Agreements:**

- Submit a proposal for installing Integrated Waste Management Plant by Monday 27th June 2016



Figure 4.6: Discussion with Mr., K.J George

Bengaluru Development Minister of Government of Karnataka

(3) Achievements

- The original objective of the visit was to obtain detailed information on waste management from the local key persons and make the proposal more detailed. It was also to make a proposal to the BBMP and the State Government on WTE and agree on the steps towards the actual installation.
- Through the discussion with the commissioner of the BBMP, we could grasp the issue in the BBMP and recognize the strong need for the RDF, dehydration and water treatment plan. Also, through discussions with the Karnataka government minister, we grasped the immediate introduction needs of WTE and was able to proceed to the phase of performing specific proposals.
- Based on the above, one month after this site visit, another visit is to be conducted in order to carry out a concrete investigation. Also it turned out that the priorities of WTE, RDF and a dehydration and water treatment plant differ between the BBMP and the state government. Additionally, topics such as budget and the public private partnership approach for WTE needed further discussion. It became clear that we need to discuss more about the business model, ordering method and technical evaluation in detail, then establish the path towards the actual order and installation.

5. Achievements and Future Direction

5.1. Achievements

The achievements of our project activities are outlined as follows:

Through the visits and discussions held with stakeholders, we were able to get Bengaluru City and the Karnataka State Government to understand that the wide spread use and introduction of advanced WTE technology by JFE, a company located in Yokohama City, which plays a critical role in the waste treatment in Yokohama, was indispensable to optimizing Bengaluru's appropriate waste management for the future.

Initially, in discussions at the start of the study, some local stakeholders expressed a negative feelings towards WTE, and time was spent on having the parties understand the advantages of WTE by explaining the safety of JFE's plant, as experienced in Japan.

As a result of continuing to proactively promote the technology at local workshops arranged for the Ministry of the Environment's JCM project that was being implemented simultaneously, we were able to deepen Bengaluru's understanding on the advantages of this technology within the overall flow from waste separation, collection, recycling to intermediate treatment, waste reduction up to appropriate final disposal.

Based on such understanding, the Karnataka State Government clearly specified its policy of appropriately building an intermediate waste disposal facility in future in several locations within Bengaluru City, assuming the application of the WTE technology. This was clearly stated in direct comments received from K.G.George, the Minister in charge of infrastructure at Bengaluru, Karnataka.

5.2. Issues

As stated above, we were able to gain the stakeholders' understanding towards widely spreading the WTE plant technology, however, at the same time, we received a clear message from the Minister himself that "the basic policy in building such types of facilities will be through the PPP scheme, involving private investments." The study team explained that conditions for the PPP assumed by the State Government were not sufficient to secure the project's feasibility, also pointing out that there were no successful PPP schemes on WTE in other countries. The team proposed the injection of appropriate public funds (including financial aid from foreign countries) for constructing the facility, the same as was in the case of Yokohama and other Japanese governments, but the Minister did not show much intention of changing their policy. The conditions announced make it difficult for JFE and other Japanese companies to participate in the tender process as these parties focus on introducing advanced technology for stable project implementation.

The Minister also indicated that there was a large number of agencies and companies other than those from Japan showing an interest in the construction of facilities through the PPP scheme. Based solely on hearings, it is said that companies are engaging in proposal

activities financially supported by their governments (e.g., loans for private companies) and as Japan's technology tends to lead to an expensive construction cost, despite its advantage, some form of financial assistance would be strongly required to specifically expand Japanese technology overseas.

5.3. Future direction

Although the above issues occurred, we were able to gain the parties' overall understanding of the facility construction plan that was developed and proposed through this project and the Ministry of the Environment's JCM Project that had been pursued simultaneously. In future, we will continue to appeal the use of WTE plant technology, based on the policy as described below.

- **Consensus building in line with the local decision making process**

Although Bengaluru's waste disposal urgently needs to be improved, efforts tend to be delayed due to the political confusion within BBMP. Under such circumstances, initiatives are being promoted by the State Government, led by its minister in charge of infrastructure.

The decision making process for constructing the facility is that after building consensus within BBMP, an application will be submitted to the State Government which will make the decision on whether to implement the project. Agreement and application are needed with the KUIDFC in case the State budget is to be applied, and with other organizations placed above, in the case of applying for other funds.

In future, a diversified approach is needed, involving parties such as the State Government and BBMP, while respecting the existing decision making process as described above, for introducing JFE's WTE technology. The reason is that if the existing process were to be fully complied with, Japanese technology requiring a relatively large investment, will be forced to compete with companies in other countries or in India with not sufficient technical skills, and may not be able to secure sufficient profit. As described above, a process is required to appropriately evaluate Japanese companies' technology and its' advantage from the point of view of life cycle cost despite the large initial investment, which allows for long-term stable operation and minimizes the release of substances that could cause pollution to the extent possible. We will maintain close communication with stakeholders at BBMP and the Karnataka State Government even after the completion of this project.

- **Early start of specific processes for constructing the facility in stages**

At the discussions with local stakeholders, we were able to gain basic approval on building an "Integrated Waste Processing Facility" based on JFE's WTE technology and Mansei Recycle Systems' RDF reforming plant by leveraging the existing facility. First, we will submit a "proposal" as requested by BBMP, adjusted from the presentation at the time of the proposal. Then we will begin the internal discussion process and promote moves within BBMP and KUIDFC to secure a budget and organize an order placement for

building the RDF reforming plant that will be a smaller financial burden on the State and City Governments.

- **Clear understanding of the advantages of Japanese technology gained through an early start**

As the first step, we will specifically provide the effect that can be produced by having Japanese companies and technology involved, which will be improvement measures including: 1) controlling odor emission within the existing facility; 2) appropriate treatment of seepage water; and, 3) reduction of the final disposal amount by increasing the amount used at cement plants as a result of improving the quality of RDF. These measures will be realized through the retrofit installment of moisture control equipment, etc. at the existing RDF production facility, applying Mansei Recycle Systems's technology. It should be noted that the RDF reforming facility is expected to play a role in eliminating inappropriate waste for combustion and to improve the quality of waste to be used in the next step which will be the introduction of the WTE technology plant (MRF= Material Recovery Facility). We will continue to introduce to local government stakeholders throughout the construction and operation period of the RDF reforming facility the fact that building an appropriate facility also covering pretreatment ultimately proves to be an advantage, compared to building a single, one-time disposal facility.

- **Other constructions for building a WTE plant**

As stated above, the policy on constructing a WTE plant is currently specified based on not sufficiently matured PPP conditions and it may be difficult to have an appropriate facility being completed. Even if one were to be constructed, it may be difficult that the private operator awarded the project at low price will be able to continue to secure profit on the long-term, as income from the operation of such facility is limited. On the other hand, Bengaluru City is in need of WTE plant at multiple locations and we will continue to propose to local stakeholders the need to build such facilities by investing public funds. As it would be difficult for the City to secure a budget alone, our proposal will broadly cover the possibility of a subsidy being granted by the central government or of financial aid being provided by the Japanese Government.

Yokohama City, the joint executor of the present business, operates the "Y-PORT Center", a platform for overseas infrastructure business promoted by public-private partnership. The Y-PORT center has a variety of functions, among them the provision of "appropriate regulatory development support in partner cities" through "teaching the experience of Yokohama urban development to partner cities", the matching of "the technology of companies properly and actively" by "understating the needs of emerging cities" and the establishment of an infrastructure solution showcase through cooperation with companies, have been considered important". JFE, which carried out this project, is also a member company of the Y-PORT Center. In the future, JFE will take advantage of the mechanisms

of the center and carry out proposal activities on the need for facility maintenance by public funds.

WTE plant is currently placed in “Category A” under the “JICA Guidelines for Environmental and Social Considerations”, as having a large impact on the environment. The WTE technology is considered to be a technology requiring time and effort for assessing during investment and loan projects, although it has been proved that applying this technology will minimize the impact on environment through the construction and operation of the WTE facilities in Japan.

While introducing the technology to local stakeholders, we will continue discussions with the Japanese Government and institutions for considering the possibility of providing appropriate financial support. Currently, there is no JCM memorandum in place between the Japanese and Indian governments and JCM is unable to implement subsidized or demonstration projects. Nevertheless, it is clear that JCM can be an effective option from the point of reducing greenhouse gas, and facility support projects will also be taken into consideration.

- **Improving waste separation and collection at the emission source**

Aside from the construction of intermediate treatment facilities such as the WTE technology and volume reduction installations, efforts to reduce the amount of waste produced itself through the promotion of separation and recycling at the emission source are important in order to reduce the volume of the final disposal of waste. Sample cases of combining these efforts to reduce the final disposal volume of waste are already being implemented by Yokohama City and other Japanese local governments, and should also be proactively pursued by Bengaluru which is similarly a large city. As Yokohama’s initiatives have already been understood through this project, we will consider how specifically Yokohama’s know-how can be transferred, such as through the use of technical cooperation projects, in future. Specific examples include joint sessions or educational programs for the citizens on waste separation as in the G30, or through visits to and training on the WTE facilities which was accepted by Japan but which did not come to be realized through this project.

- **Use of schemes provided by JICA and government agencies**

As stated above, Bengaluru City has currently clarified its policy of constructing an incinerating power generation plant through the PPP scheme, but due to the lack of appropriate order placement conditions and assessment standards, time could be required to select the operator and enter into an agreement. There are also concerns over the operator, being faced with difficulties in financing after an agreement has been executed, as seen in the past. As the State Government currently intends to build the facility under the PPP scheme, time may be required in order to have it change its policy and to place the order under a different scheme. Under such circumstances, we will widely consider and propose diversified financing assistance that can be provided by institutions, while repeatedly

referring to the specific advantages that can be enjoyed by introducing Japanese technology. We will continue discussions on the specific application of schemes, by sharing the knowledge and issues on the schemes' feasibility gained through this project with related organizations and agencies. Such schemes will include the scheme to support "high-quality infrastructure export" as specifically stated by the Japanese Government, the Ministry of the Environment's JCM facility subsidiary business, specific grant and loan assistance to support the comprehensive project cycle from facility construction to business operation, and ADB/JICA's Leading Asia's Private Infrastructure Fund (LEAP).

5.4. Schedule

As stated above, starting from the RDF reforming plant, we will develop our activities to link the complex facility for appropriately treating waste, applying a combination of Japanese technologies, to the construction of a WTE facility in future. Specifically, based on the results of our meeting for the project in June 2016, we will materialize Mansei Recycle Systems' RDF reforming plant as the "first step" to the complex facility. Already, Mansei has revisited BBMP and the Karnataka State Government officials in July, provided a briefing on their specific proposal, gained understanding, and had its' proposal submitted to KUDIFC's budget process at the time of creation of this report.

Realizing the introduction of the RDF reforming plant by Mansei located in Yokohama and who is a partner of JFE, will help to have the advantages of Japanese technology recognized. Together with the RDF facility, we will continue our proposal on the specific introduction of the incinerating power generation plant that will form a part of the "Integrated Waste Processing Facility" and which should greatly reduce the final waste treatment amount.

Table 5.1: Schedule (assumed)

	RDF reforming plant	Incinerating power generation plant
2016 3Q	<ul style="list-style-type: none"> - BBMP, KUIDFC, Karnataka State Government to consider budgetary steps - Detailed review of technology to be introduced 	<ul style="list-style-type: none"> - Review financing scheme
2016 4Q	<ul style="list-style-type: none"> - Budgetary steps completed, order placement procedure 	<ul style="list-style-type: none"> - Continued approach to the counterparty government
2017 1Q	<ul style="list-style-type: none"> - Facility construction 	<ul style="list-style-type: none"> - Detailed design of plant specification (earliest)
2017 2Q		
2017 3Q	<ul style="list-style-type: none"> - Start of operation 	<ul style="list-style-type: none"> - Model plant construction to start (earliest)
2017 4Q		