MOEJ/GEC JCM Project Planning Study (PS) 2014
Summary of the Final Report

"Introduction of Energy-from-Waste Project in Ho Chi Minh City"

(Implementing Entity: Hitachi Zosen Corporation, K.K. Satisfactory International)

1. Overview of the Proposed JCM Project

<table>
<tr><td>Study partners</td><td colspan="3">E.J. Business Partners
Center for Environment Technology Management (ETM)</td></tr>
<tr><td>Project site</td><td colspan="3">Ho Chi Minh City, Viet Nam</td></tr>
<tr><td>Category of project</td><td colspan="3">Waste/ Biomass, Energy industries (renewable - / non-renewable sources)</td></tr>
<tr><td>Description of project</td><td colspan="3">The project incinerates MSW currently disposed at the Phuoc Hiep Landfill to generate electricity to supply to the grid based on the support mechanism for Energy from Waste projects. The project contributes to reduce GHG emissions by avoiding methane emissions from the landfill and by replacing the grid electricity. It also contributes to utilize the waste generated in the city, reduce landfilled waste and introduce integrated waste management systems in Ho Chi Minh city.</td></tr>
<tr><td rowspan="2">Expected project implementer</td><td>Japan</td><td colspan="2">Hitachi Zosen Corporation, K.K. Satisfactory International and E.J Business Partners Co., Ltd.</td></tr>
<tr><td>Host country</td><td colspan="2">Special Purpose Company (SPC) established by implementers.</td></tr>
<tr><td>Initial investment</td><td>JPY6,250,000,000</td><td>Date of groundbreaking</td><td>February 2016</td></tr>
<tr><td>Annual maintenance cost</td><td>JPY365,000,000</td><td>Construction period</td><td>24 months</td></tr>
<tr><td>Willingness to investment</td><td>All of the project implementers is willing to invest</td><td>Date of project commencement</td><td>February 2018</td></tr>
<tr><td>Financial plan of project</td><td colspan="3">Initial investment amount is 62.5 Million USD (about 6.25 Billion JPY, 1 USD = 100 JPY); project development cost 5 Million USD, 50 Million USD for plant design, procurement, and construction cost (Assuming a cost until completion including the commissioning of waste power generation facility) with additional 7.5 Million USD for incidental equipment.
For funding plan, 40%(25 Million USD) from JCM equipment auxiliary, 42% (26.25 Million USD) from local bank loan, 18% (14.66 Million USD) from our own capital.</td></tr>
<tr><td>GHG emission reductions</td><td colspan="3">Green House Gas(GHG) Emissions Reduction: 2,052 to 46,92 1tCO_2/year</td></tr>
</table>

	Reference Emissions: ① Avoidance of CH4 emissions from a SWDS: 95,061 to 107,231tCO_2/year ② Grid connected electricity generation from waste: 27,256 to 35,044tCO_2/year Project Emissions: 85,911 to 128,053tCO_2/year The emissions reductions potential is 307,800 to 7,038,150tCO2/year based on the waste amount of 90,000t/day in the country by year 2025.

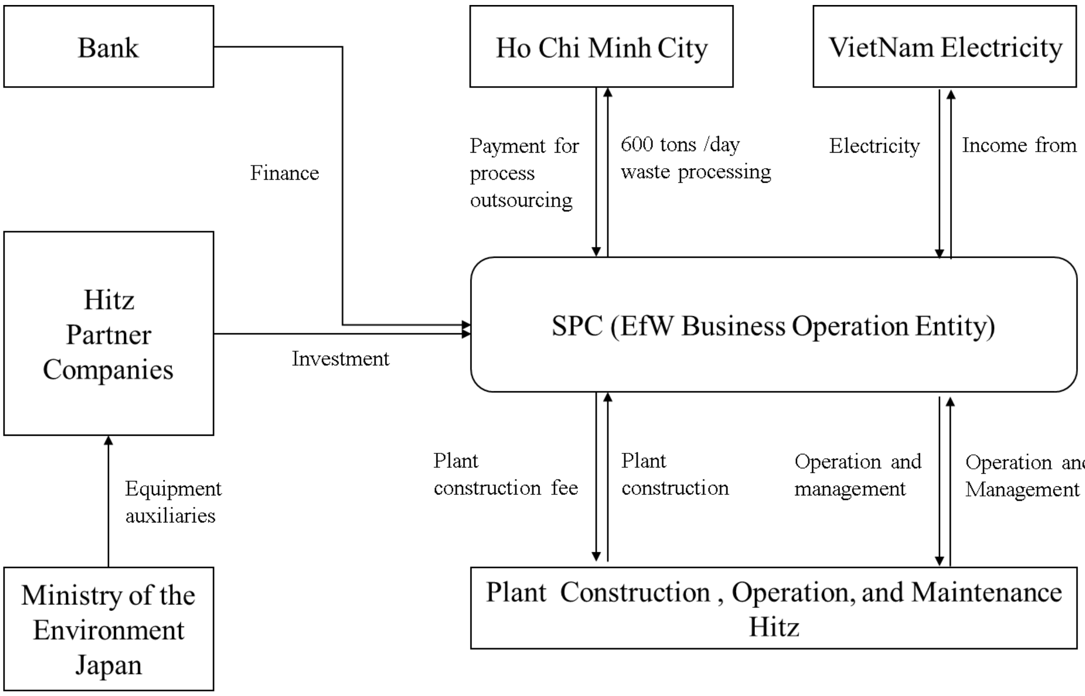
2. Study Contents

(1) Project development and implementation

1) Project planning

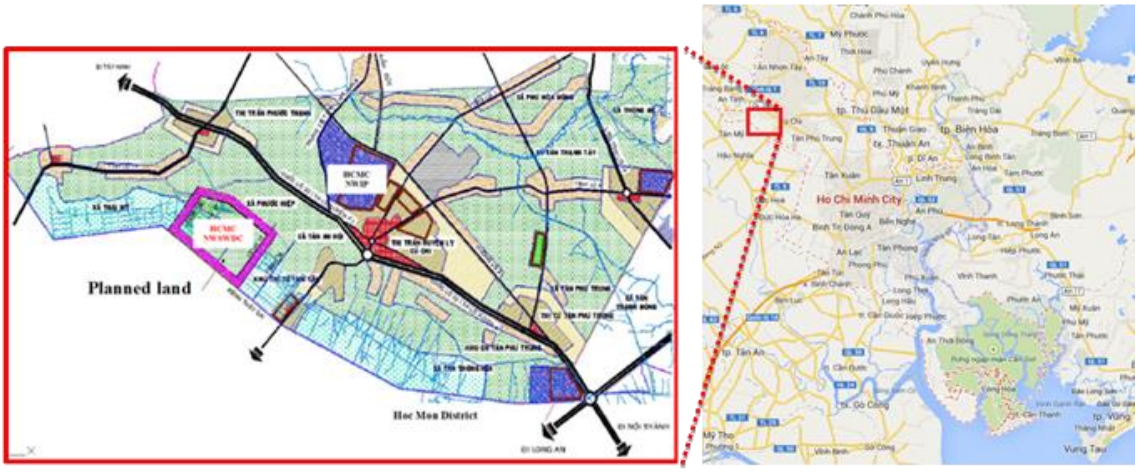
About project planning implementation system, following entity joined this project: Hitachi Zosen Corporation (Hitachi Zosen) and K.K. Satisfactory International (KKSI) from Japan and a special purpose company (SPC) established in Vietnam by the companies from Japan managed all project.

Participants from Japan collected and analyzed the data for application technologies and business enterprise to make Project Design Document (PDD), then completed.



① History of negotiation with Ho Chi Minh City for investment certificate.
In Aug. 2014, we send the principle approval letter to Ho Chi Minh City People's committee (HPC) and started negotiation to receive the investment certificate. For about 5 months of negotiation, after having meeting with HPC on 30th Jan, we finally received principle approval letter on 3rd February, 2015.

② Research the candidate place of construction.
Based on the report from DONRE to HPC on 3rd Dec., 2014, we made research Tay Bac waste management complex for the candidate of construction. In Ho Chi Minh City waste master plan, it is written that the complex is planned for the project of Energy from Waste(EfW).



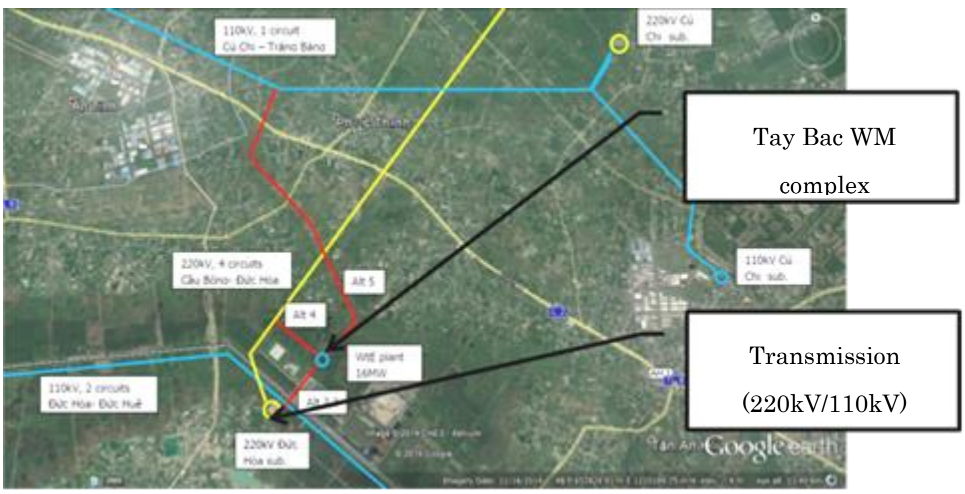
- Research about utility condition

We researched the utility conditions and the result is as follows: We list the utility condition as follows for plant construction. The infrastructure around the site will be maintained by HCMC. The gain over into the site will be done by vendor.

Electricity	To connect to the grid of EVN(22kV) and lower to 220V for use. The generated electricity will be supplied to a transmission station of 110kV.
Water	Well water and purchase water
Fuel	Diesel
Waste water	Recycle as much as possible within EfW facility. Effluent is treated and discharge to the canal
Rain water	Discharge to the canal
Telephone/Internet	To get connection from the border

- Grid electricity connection

Based on research to Department of Industry and Trade (DOIT), the load capacity of Tay Bac SWDS's (SWDS: Solid Waste Disposal Site) 22kV line is 5MW. In this project, we plan to sell about 10MW and researched to make it possible, we found that the grid system that is constructing Duc Hoa Transmission which is 800 meters away from Tay Bac SWDS is feasible.



-

③ Consideration of target waste

In the report from DONRE to HPC on 3rd Dec. 2014, compost residue, municipal solid waste after source separation, scarify waste from landfill are the candidate of target waste for EfW. To consider target waste, we estimated the amount of waste and arranged the situation of collecting, transporting, and processing of the waste and composition of the municipal waste. Referring these data, we set the target waste processing plan.

④ Initial investment/O&M cost

Investors and investment ratio of capital (1.466 billion yen) for the SPC, we considered as follows: Hitachi Zosen: 95% (1.393 billion yen), KKSI 2.5% (37 million yen), and EJBP: 2.5% (37 million yen).

Initial Investment

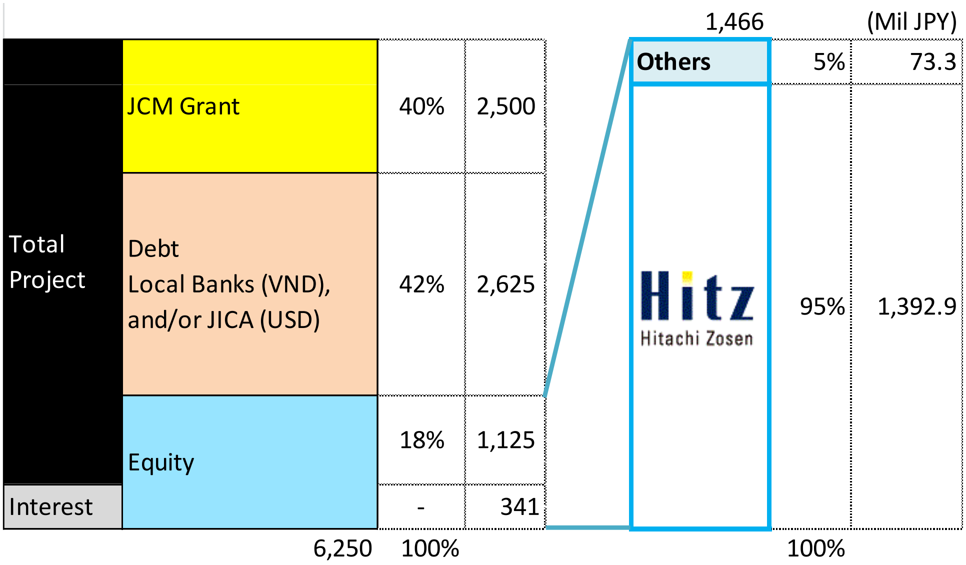
Cost		Amount
①PJ Development		USD 5,000,000
②EfW facility construction		USD50,000,000
(Details)	Civil engineering	USD 3,000,000
	Electric engineering	USD 4,000,000
	Equipment/Material	USD 40,000,000
	Design management	USD 3,000,000
③Others	Grid connection, waste water, etc..	USD 7,500,000
Total		USD 62,500,000

O&M cost

Cost	Amount
① Labour (20yrs ave.)	USD 623,000
② Maintainance/Supply (“)	USD1,992,000
③ Other cost (“)	USD 1,031,000
Total	USD 3,646,000

⑤ Financial Plan for the initial investment

Total is about 65.91 Million USD: Plant construction fee: 62.5 Million USD plus 3.41 Million USD for interests during construction. For funding plan, 40%(25 Million USD) is from JCM equipment auxiliary, 42% (26.25 Million USD) from local bank loan, 18% (14.66 Million USD) from our own capital.



⑥ Business feasibility and sensitivity analysis

The profitability of the project was calculated based on the assumptions below. The project IRR (P-IRR) and Equity IRR (E-IRR) of 20 years are calculated as 14.4% and 17.4%

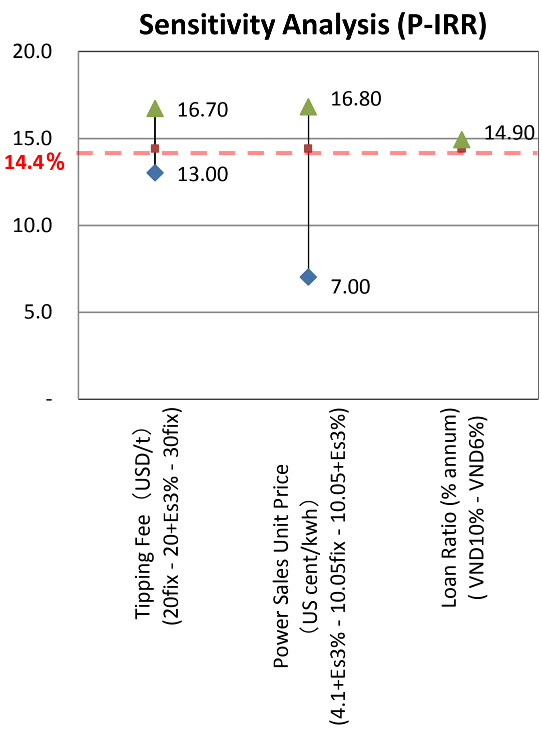
respectively. The project is assumed to be feasible enough. Also, we made the sensitivity analysis based on optimistic and pessimistic scenarios. As a result, we confirmed that the selling process of the electricity affect business profitability. To increase the IRR, we need to decrease the business fee (62.5 Million USD), increase the subsidy rate(40%, 25 Million USD), investigation of I&M fee, increase of the operation hours.

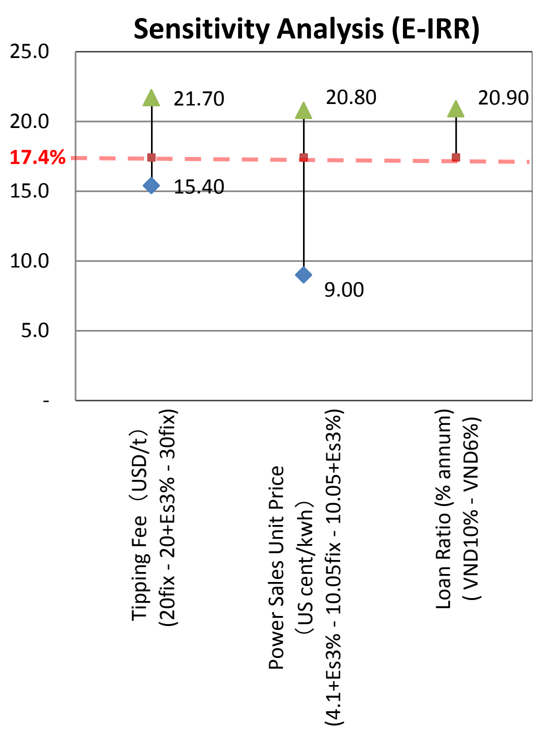
Prerequisite condition for business feasibility

Item	Conditions	Remarks
Project period	20 years	BOT contract with Ho Chi Minh City.
Waste disposal amount	600t/day	300 days x 24 hours/day = 7,200 hours of operation
Outsourcing disposal commissions(T/F)	20USD/t. 3% increase per year.	In current state, maximum price of Ho Chi Minh City.
Amount of power sold	64,800,000 kWh/year	Amount of power sold: 9.0 MW x 7,200 hours
Electricity sales price	10.05 cent/kWh *fixed	The president decisions regarding energy from waste auxiliary program (FiT) in May 2014.
Other income	None	Compost, recycled products, heat utilization, and so on.
Depreciation	20 years for civil engineering and construction, 7 years for mechanical and electrical construction.	straight line method
Tax and dues	4 years of corporate tax exemption after the revenue generated: 0% 50 % reduction of favorable taxation until 13 years :5% Favorable taxation until 15 years: 10% Normal taxation until 20 years: 20%	Preferential tax rate based on the investment incentives system such as wastes was applied.
Debt	By VND. 10% annual, 2 year extension and 8 year redemption.	Banking institution in Vietnam
Price fluctuation	Inflation rate of employment and item cost in Vietnam: 7.5%	

Sensitivity analysis

	Optimistic scenario	Basic	Pessimistic scenario
T/F	\$30/t w ESC. 0.0% (Maximum value from DONRE report)	\$20/t(2017) w ESC. 3.0%	\$20/t w Esc. 0.0% (Minimum value from DONRE report)
Electricity Price	FiT + Esc. 3% 10.05 cent/kWh(2013)	FiT + Esc. 0% 10.05 cent/kWh(2013)	4.0 cent/kWh + Esc. 3%
Project Cost	62.5 Million USD		
Subsidy	25 Million USD		
Loan	Local Soft Loan **<u>Interest rate 6% (VND)</u>** VEPF, HFIC, etc government fund. No foreign exchange risk. Unredeemed for 2 years and 8 years for payment.	Local 2step loan JICA/WB loan through local banks. **<u>Interest rate 10% (VND)</u>** TSL applied from local bank received by JICA and WB. There is no foreign exchange risk. Unredeemed for 2 years and 8 years for payment.	



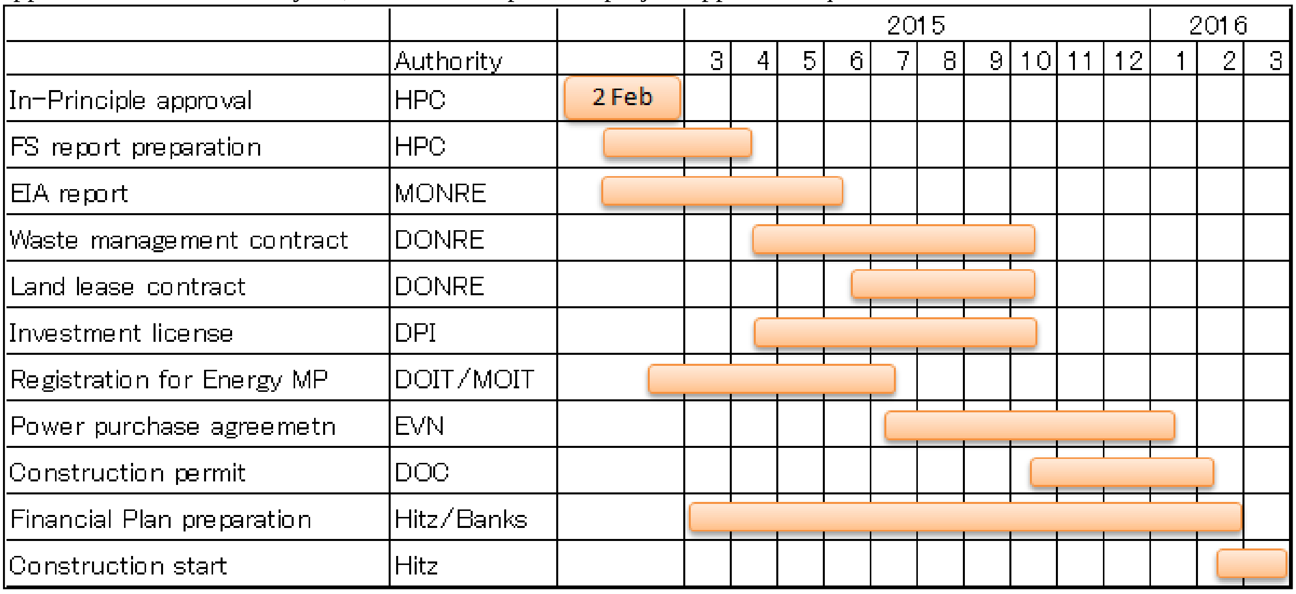


⑦ Risk Analysis

The risks at each stage of project planning, construction of the EfW facility, operation and project transfer were listed. The policy and necessity of measures were decided.

2) Permits for License

We submitted the principle approval request letter to HPC on August 5th, 2014, and we received the principle approval letter on February 3rd, 2015. Future plans of project approval acquisition are as follows:



3) Advantage of Japanese technology

Identification of competing technologies

There are 14 waste incineration facilities for MSW in 9 cities in Vietnam. The biggest waste treatment capacity is 150t/day and other facilities are less than 50t/day and initial investment cost is less than 50Billion VND. Therefore, the most of MSW is still landfilled and it is reasonable to assume that the competing technology is landfilling.

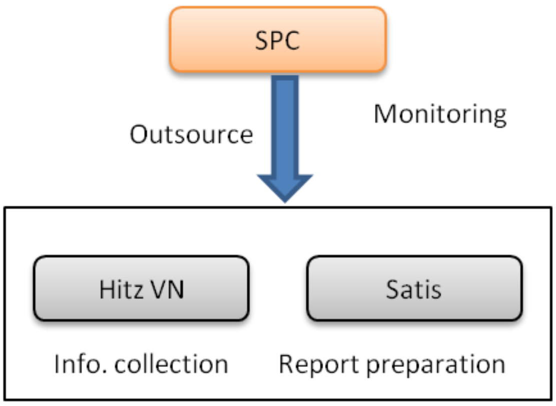
Methane fermentation of organic waste is considered as competing technology but complementing technologies since EfW facility targets waste plastics and paper which are not treated by Methane fermentation technology.

Comparison with competing technologies

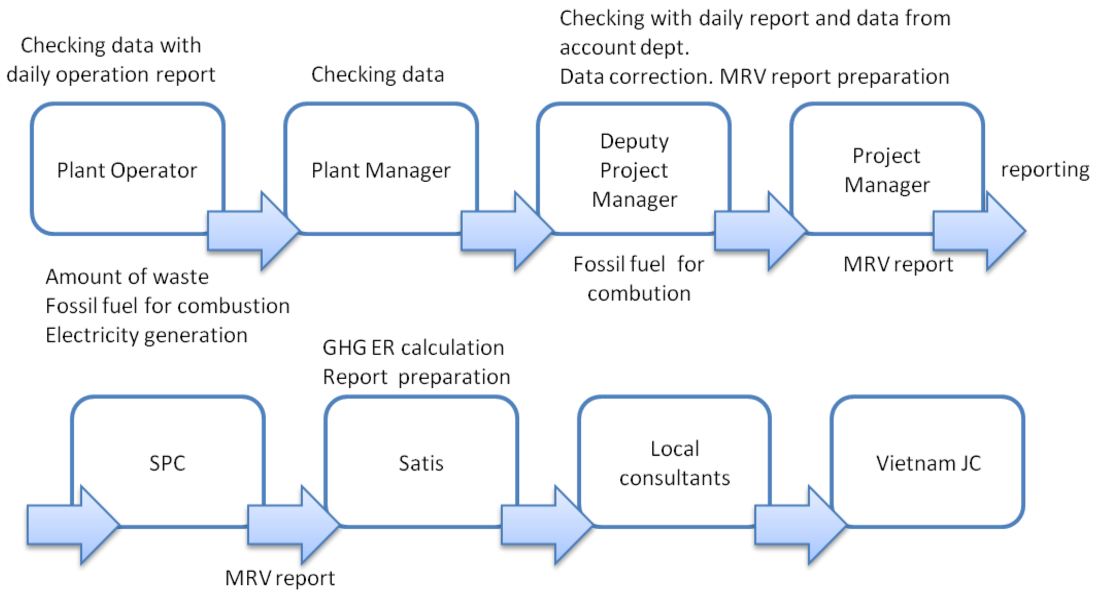
The capacity of only EfW facility in the above list is 48t/day and electricity generation capacity is not disclosed. The advantage of project technology is the waste treatment capacity of 600t/day and electricity generation from the heat recovery.

4) MRV structure

Organization chart of MRV (Measurement, Reporting and Verification) for this project is as follows. SPC will conduct MRV as a business operating company. And the SPC will contract out information collection to Hitachi Zosen Vietnam, and contract out preparing a report that calculates GHG reduction to Satis.



The Flow of preparing a report is as below. Monitoring items are the amount of waste input, the amount of fossil fuels used for waste incineration, and the volume of power selling. Data of these three items is aggregated into a central control room with other plant running data by monitoring system, and input to record file as a daily report. A plant operator matches operating diary and actual operating condition, and a plant manager confirms it, too. Vice plant manager matches the carrying numerical values in the accounting department and the operating diary. If necessary, vice plant manager corrects the data, and preparing MRV report based on MRV monitoring plan. After approval by a project manager, vice plant manager submit the written to Satis. After calculating GHG reduction and making report, Satis will send these three documents to government officers for JCM.



5) Environmental integrity and Sustainable development in host country

- Ensuring environmental integrity

Implementing this project will have both favorable effects and adverse effects to environmental aspects at implementing site and surrounding area.

・**Favorable effects**:

This project might contribute to reduce waste input to landfill site that are not well-organized, that means to reduce the environmental pollution around landfill site. Under insufficient separate collection, in addition to composting from sorted organic waste, introducing a technology that can incinerate huge volume of municipal waste, favorable effects on environmental aspects are expected more urgently, for example reducing methane gas, foul odor, and leachates from landfill site.

・**Adverse effects**:

This project has the potential to generate toxic substances such as heavy metals contained in the ash (especially fly ash). HCMC has responsibility to treatment way of ash so Hitachi Zosen will propose HCMC safety treatment ways of fly ash, for example cement solidification.

■ Contribution to sustainable development

From the view point of consistency between this project and development strategy of Vietnam and contribution to environmental remediation, through a survey for implement of this project, the following contribution points was found to be expected.

- Promotion of renewable energy use and resolution of energy supply problem
- Improvement of waste management in urban areas (such as separate collection system)
- Reduction of input to the final disposal site
- Corresponding to demand for advanced waste incineration power generation technology in Vietnam
- The financial support by JCM
- Contribution to GHG reduction and a low-carbon society of Osaka City and HCMC

6) Future plans and challenges

① Targeted waste for EfW

To obtain the information about the targeted waste for EfW from HCMC, and fully examine the waste composition an carrying route (including the operating status of the targeted waste at transfer station), and to fix them. But, provided information data has possibility not to be enough or not be guaranteed. So, planed data, will be set in the conditions which gave a margin for additional research and fluctuation range.

②Infrastructure of planed construction site

Getting information about planed construction site from HCMC, and conducted a field trip about utility conditions(road accessing, water supplying and drainage, electricity substation, geological conditions) in surrounding area, and confirm targeted construction site.

Maintenance for infrastructure of construction site surrounding area is free given from Vietnam freely. But conditions and not clear. So, after determination of construction site, confirmation to DONRE will be needed for this project. Especially connection conditions of system cooperation will be given priority to confirm due to large impact on profitability.

③ Condition for waste treatment contract and electricity sales contract

Negotiation will be based on the result of analysis for profitability of this research. Main negotiated points are below. These points should be confirmed by signature of letter from government and proceedings. The role and authority of each department of negotiating partner should be confirmed through additional supporting research. In preparation for negotiations with the governments in Vietnam, advises from MoE, Osaka city, consulate, JICA office, and legal experts in Vietnam are needed.

・Guarantee of waste treatment amount

The contract with existing contract, there is a consignment treating amount of warranty conditions. Based on these conditions, consideration about compensation conditions to DONRE for failure to duty of providing waste are required.

・Risk for delay of starting business

Due to delay of procedure for licenses and construction period, business starting has possibility to be delayed. It is important to clarify such situations to contemplate and decide about contract condition.

・Applying supporting mechanism for EfW（Circular 32/2014/TT-BCT）

There is no applied case of this supporting mechanism. FIT (10.05cent/kwh) is very important point for securing profitability. Preparation for applying documents and negotiation with related department should be prioritized.

(2) JCM methodology development

1) Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	To install incinerators that combust fresh MSW that would have been treated at landfills.
Criterion 2	The project facility has boilers and turbines to generate electricity from the heat created by waste incineration.
Criterion 3	The incinerators are designed and equipped to achieve the following criteria. Ignition loss: 5% or less Yearly operational period: Longer than 7200 hours
Criterion 4	The treatment capability of an incinerator is designed to be greater than 300t/day.
Criterion 5	The project facility is designed and equipped to satisfy the "National Technical Regulation on Emission of Industrial Waste Incinerators (QCVN30:2010/BTNMT)".

2) Calculation of GHG emissions (including reference and project emissions)

2-1) Reference emissions

Reference emissions are calculated on the basis of the amount and composition of the wastes that are fed into the incinerators, and net electricity supplied to the grid by the project.

Reference emissions from SWDSs are calculated based on First Order Decay (FOD) model. Reference emissions from grid electricity generation are calculated by multiplying the amount of electricity supplied to the grid and CO2 emission factor.

The methodology ensures net emission reductions by including the CH4 and N2O emissions from waste combustion both of which are negligible in the project emissions.

$$\mathrm{RE}_p = \mathrm{RE}_{CH4,SWDS,p} + \mathrm{RE}_{elec,p}$$

RE_p	Reference CO_2 emissions during the period p [tCO_2/p]
$\mathrm{RE}_{CH4,SWDS,p}$	Reference emissions occurring during period p generated from waste disposal at a SWDS during a time period ending in period p [tCO_2/p]
$\mathrm{RE}_{elec,p}$	Reference emissions from grid electricity during the period p [$tCO2/p$]

$$RE_{CH4,SWDS,p} = \varphi_p \times (1 - f_p) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,p} \times MCF_p \times \sum_{x=1}^{p} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj(p-x)} \times (1 - e^{-kj})$$

φ_p	Model correction factor account for model uncertainties for the period *p*
f_p	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere during the period *p*
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
$DOC_{f,p}$	Fraction of degradable organic carbon (DOC) that decomposes under specific conditions occurring in the SWDS for the period *p* (weight fraction)
MCF_p	Methane correction factor for the period *p*
$W_{j,p}$	Amount of waste type *j* disposed or prevented from disposal in the SWDS during the period *p*
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j* (weight fraction)
k_j	Decay rate for the waste type *j*
j	Type of waste in the MSW
x	Time period in which waste is disposed at the SWDS, extending from the first period in the time period (x=1) to period p(x=p)
p	Crediting period for which methane emissions are calculated

$$RE_{elec,p} = PEC_p \times EF_{grid}$$

PEC_p	Net electricity amount supplied to the grid by the project during the period *p* [MWh/*p*]
EF_{grid}	Emission Factor of the grid [tCO2/MWh]

2-2) Project emissions

Project emissions are calculated on the basis of monitored fossil fuel consumption, waste amount and its composition fed into the incinerators.

$$PE_p = PE_{FC,p} + PE_{COM\_CO2,p} + PE_{COM_{CH4N2O},p}$$

$PE_{FC,p}$	CO_2 emissions from fossil fuel consumption during the period *p* [tCO_2/*p*]

$PE_{COM\_CO2,p}$	CO_2 emissions from fossil waste combustion during the period *p* [tCO_2/p]
$PE_{COM\_CH4N2O,p}$	CH_4 and N_2O emissions from waste combustion during the period *p* [tCO_2/p]

$$PE_{FC,p} = FC_{,p} \times NCV_p \times EF_{CO2}$$

$FC_{,p}$	Amount of fossil fuel consumption during the period *p*[t]
NCV_p	Net calorific value of the fossil fuel[GJ/t]
EF_{CO2}	CO2 emission factor of the fossil fuel[tCO_2/TJ]

$$PE_{COM\_CO2,p} = EFF_{COM} \times \frac{44}{12} \times \sum_{j} Q_{j,p} \times FCC_{j,p} \times FFC_{j,p}$$

EFF_{COM}	Combustion efficiency of combustor
$Q_{j,p}$	Quantity of combusted waste type *i* [t]
$FCC_{j,p}$	Fraction of total carbon content in waste type *j* during the period *p* [tC/t]
$FFC_{j,p}$	Fraction of fossil carbon in total carbon content of waste type *j*

$$PE_{COM_{CH4N2O},p} = Q_{waste,p} \times (EF_{N2O} \times GWP_{N2O} + EF_{CH4} \times GWP_{CH4})$$

$Q_{waste,p}$	Quantity of waste fed into combustor during the period *p* [t]
EF_{N2O}	Emission factor of N_2O associated with combustion [tN_2O/t waste]
GWP_{N2O}	Global Warming Potential of N_2O
EF_{CH4}	Emission factor of CH_4 associated with combustion [tCH4/t waste]
GWP_{CH4}	Global Warming Potential of CH_4

2-3) Calculation of emissions reductions

Emission reductions are calculated as the difference between the reference emissions and project emissions, as follows:

$$ER_p = RE_p - PE_p$$

ER_p	GHG emission reductions during the period *p* [tCO_2/*p*]

2-4) Results of calculations

The emissions reductions are calculated based on the following assumptions.

- Waste treatment amount: 600t/day
- Yearly operation: 300 days
- Fossil fuel consumption: 121t/year

■ Waste composition (wet weight) and amount of electricity supply

The emissions reductions varies depending on the composition of the waste and the amount of electricity supply to the grid. Emissions reductions are calculated applying the different waste composition and electricity supply to the grid.

- Case 1: Prior sampling data of waste and electricity generation capacity of 9MW
- Case 2: Prior sampling data of waste and electricity generation capacity of 7MW
- Case 3: Prior sampling data with rate of plastics recycling rose 50%

	Case 1	Case 2	Case 3
Food waste	50.77	66.2	56.39
Shell – bone	1.13	1	1.25
Paper	2.93	3.1	3.26
Diaper	5.53	3.5	6.14
Plastic	19.97	17	11.11
Textile	12.86	5.8	14.28
Wood	1.02	0.6	1.13
Rubber – leather	3.17	0.7	3.52
Metal	0.64	0.2	0.71
Inorganic	1.76	1.6	1.95
Other	0.23	0.4	0.26
Total	100%	100%	100%

Case 1

■ Calculation of Reference emissions

・ Avoidance of methane from a SWDS

Year											Total
1	34,644										34,644
2	24,589	34,644									59,233
3	17,759	24,589	34,644								76,992
4	13,095	17,759	24,589	34,644							90,087
5	9,890	13,095	17,759	24,589	34,644						99,977
6	7,668	9,890	13,095	17,759	24,589	34,644					107,646
7	6,110	7,668	9,890	13,095	17,759	24,589	34,644				113,756
8	5,002	6,110	7,668	9,890	13,095	17,759	24,589	34,644			118,757
9	4,199	5,002	6,110	7,668	9,890	13,095	17,759	24,589	34,644		122,956
10	3,604	4,199	5,002	6,110	7,668	9,890	13,095	17,759	24,589	34,644	126,560

・ Electricity supply to the grid

64,800kWh×0.5408=35,044tCO2/year

■ Calculation of Project emissions

・ Fossil fuel consumption

121t×43×0.0728=380tCO2/year

・ CO_2 Emissions from fossil waste combustion

0.9×180,000t×37,666×3.67=124,296tCO2/year

・ GHG Emissions from combustion

180,000t×（0.0000605×310+0.000000242×25）=3,377tCO2/year

■ Calculation of Emissions reductions

Year	1	2	3	4	5	6	7	8	9	10	Total	Ave.
REp	69,688	94,277	112,036	125,131	135,021	142,689	148,800	153,801	158,000	161,604	1,301,047	130,105
$RE_{CH4,SWDS}$	34,644	59,233	76,992	90,087	99,977	107,646	113,756	118,757	122,956	126,560		
RE_{elec}	35,044	35,044	35,044	35,044	35,044	35,044	35,044	35,044	35,044	35,044		
PEp	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	1,280,530	128,053
PE_{FC}	380	380	380	380	380	380	380	380	380	380		
PE_{COM_CO2}	124,296	124,296	124,296	124,296	124,296	124,296	124,296	124,296	124,296	124,296		
PE_{COM_CH4N2O}	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377		
ERp	-58,365	-33,776	-16,017	-2,922	6,968	14,636	20,747	25,748	29,947	33,551	20,517	2,052

Case 2

■ Calculation of Reference emissions

・ Avoidance of methane from a SWDS

Year											Total
1	41,363										41,363
2	28,576	41,363									69,940
3	19,949	28,576	41,363								89,888
4	14,113	19,949	28,576	41,363							104,001
5	10,152	14,113	19,949	28,576	41,363						114,153
6	7,451	10,152	14,113	19,949	28,576	41,363					121,603
7	5,597	7,451	10,152	14,113	19,949	28,576	41,363				127,200
8	4,315	5,597	7,451	10,152	14,113	19,949	28,576	41,363			131,515
9	3,418	4,315	5,597	7,451	10,152	14,113	19,949	28,576	41,363		134,933
10	2,782	3,418	4,315	5,597	7,451	10,152	14,113	19,949	28,576	41,363	137,715

・ Electricity supply to the grid

50,400kWh×0.5408=27,256tCO2/year

■ Calculation of Project emissions

・ Fossil fuel consumption

Same as case 1

・ CO_2 Emissions from fossil waste combustion

0.9×180,000t×29,230×3.67=96,458tCO2/year

・ GHG Emissions from combustion

Same as case 1

■ Calculation of Emissions reductions

Year	1	2	3	4	5	6	7	8	9	10	Total	Ave.
REp	68,620	97,196	117,145	131,257	141,409	148,859	154,457	158,771	162,189	164,972	1,344,875	134,487
$RE_{CH4,SWDS}$	41,363	69,940	89,888	104,001	114,153	121,603	127,200	131,515	134,933	137,715		
RE_{elec}	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256		
PEp	100,215	100,215	100,215	100,215	100,215	100,215	100,215	100,215	100,215	100,215	1,002,153	100,215
PE_{FC}	380	380	380	380	380	380	380	380	380	380		
PE_{COM_CO2}	96,458	96,458	96,458	96,458	96,458	96,458	96,458	96,458	96,458	96,458		
PE_{COM_CH4N2O}	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377		
ERp	-31,596	-3,019	16,929	31,042	41,194	48,644	54,241	58,556	61,974	64,756	342,722	34,272

Case 3

■ Calculation of Reference emissions

・ Avoidance of methane from a SWDS

Year											Total
1	38,476										38,476
2	27,309	38,476									65,785
3	19,723	27,309	38,476								85,508
4	14,544	19,723	27,309	38,476							100,052
5	10,984	14,544	19,723	27,309	38,476						111,036
6	8,517	10,984	14,544	19,723	27,309	38,476					119,553
7	6,786	8,517	10,984	14,544	19,723	27,309	38,476				126,339
8	5,555	6,786	8,517	10,984	14,544	19,723	27,309	38,476			131,894
9	4,663	5,555	6,786	8,517	10,984	14,544	19,723	27,309	38,476		136,557
10	4,003	4,663	5,555	6,786	8,517	10,984	14,544	19,723	27,309	38,476	140,560

・ Electricity supply to the grid

Same as case 2

■ Calculation of Project emissions

・ Fossil fuel consumption

Same as case 1

・ CO_2 Emissions from fossil waste combustion

0.9×180,000t×27,256×3.67=82,154tCO2/year

・ GHG Emissions from combustion

Same as case 1

■ Calculation of Emissions reductions

Year	1	2	3	4	5	6	7	8	9	10	Total	Ave.
REp	65,732	93,041	112,764	127,308	138,293	146,809	153,596	159,150	163,814	167,817	1,328,324	132,832
$RE_{CH4,SWDS}$	38,476	65,785	85,508	100,052	111,036	119,553	126,339	131,894	136,557	140,560		
RE_{elec}	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256	27,256		
PEp	85,911	85,911	85,911	85,911	85,911	85,911	85,911	85,911	85,911	85,911	859,110	85,911
PE_{FC}	380	380	380	380	380	380	380	380	380	380		
PE_{COM_CO2}	82,154	82,154	82,154	82,154	82,154	82,154	82,154	82,154	82,154	82,154		
PE_{COM_CH4N2O}	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377		
ERp	-20,179	7,130	26,853	41,397	52,382	60,898	67,685	73,239	77,903	81,906	469,214	46,921

3) Data and parameters fixed *ex ante*

The source of each data and parameter fixed ex ante is listed as below.

Parameter	Description of data	Source
NCV_p	Net Calorific Value of fossil fuel [GJ/t]	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
EF_{co2}	CO2 emissions factor for fossil fuel (diesel) [tCO_2/GJ]	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
EF_{grid}	CO2 emissions factor of electricity [tCO2/MWh]	Ministry of Natural Resources and Environment, Vietnam/MONRE
Φ	Model correction factor account for model uncertainties	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
GWP_{CH4}	Global Warming Potential of methane	IPCC Fourth Assessment Report
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
F	Fraction of methane in the SWDS gas (volume fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOCf	Fraction of degradable organic carbon (DOC) that decomposes under specific conditions occurring in the SWDS (weight fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
MCF	Methane correction factor	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOCj	Fraction of degradable organic carbon (by weight) in the waste type j (weight fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
kj	Decay rate for the waste type j (1/year)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
$FCC_{j,p}$	Fraction of total carbon content in waste type *j*	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
FFC_j	Fraction of fossil carbon in total carbon content of waste type *j*	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
EF_{N2O}	Emission factor of N_2O associated with combustion	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
GWP_{N2O}	Global Warming Potential of N_2O	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)

EF_{CH4}	Emission factor of CH_4 associated with combustion	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
GWP_{CH4}	Global Warming Potential of CH_4	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
EFF_{COM}	Combustion efficiency of combustor	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)

(3) Development of JCM Project Design Document (PDD)

1) Environmental impact assessment

1-2) Procedures

During the process of applying investment license, foreign investors must submit the Environment Impact Assessment (EIA) report and must have environment license when they invest plant in Vietnam. So that we charged ETM to make EIA report.

2) Local stakeholder consultation

2-1) Boundary of Local stakeholders

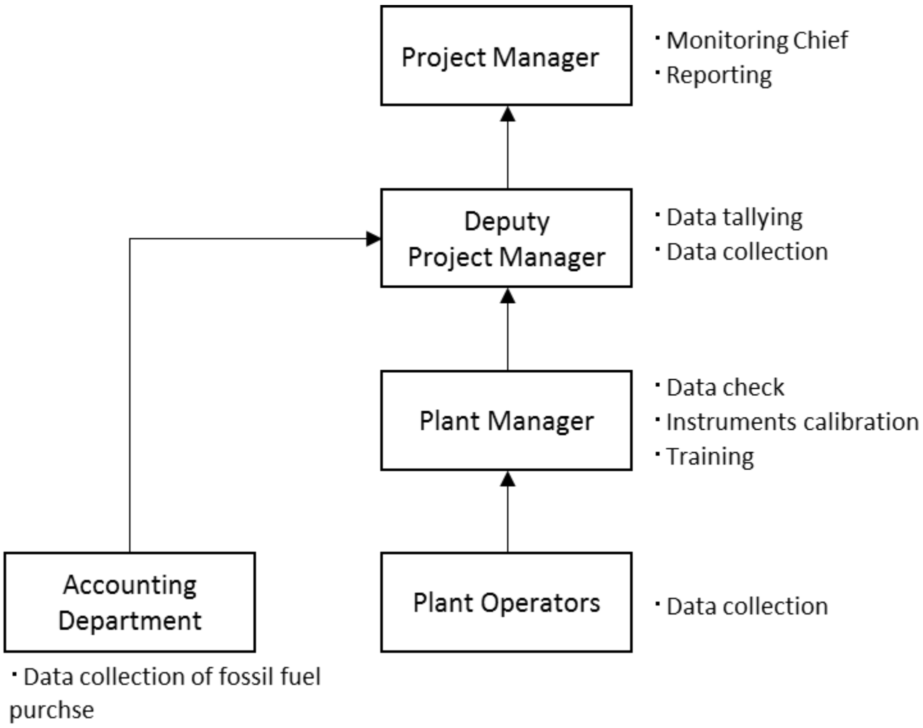
Central and local governmental bodies, such as Ho chi Minh city People's committee (HPC), Ho Chi Minh city Department of Natural Resources and Environment (DONRE), Vietnam Ministry of Natural Resources and Environment (MONRE), Ho Chi Minh city Department of Industry and Trade (DOIT), Ho Chi Minh city Department of Construction (DOC), Ho Chi Minh city Department of Planning and Investment (DPI). Vietnam Electricity (EVN), Verification agency of EIA report, organizations and communities (Waste management companies, Neighbors) affected by the project, are expected local stakeholders.

2-1) Comments from the Stakeholders

The comments were collected through the process of obtaining letter of In-principal agreement from HPC.

3) Monitoring plan

The monitoring of the parameters will be conducted by the Special Purpose Company (SPC) established by the Japanese project participants for the project. Hitachi Zosen will train the operators who are employed to operate the EfW facility including monitoring. The details of the monitoring structure and the flow of the monitoring data are as follows:


Project Manager
・Monitoring Chief
・Reporting
Deputy Project Manager
・Data tallying
・Data collection
Plant Manager
・Data check
・Instruments calibration
・Training
Accounting Department
・Data collection of fossil fuel purchse
Plant Operators
・Data collection