

## **APPENDIX-C**

ワーキンググループ、セミナー等の  
説明用資料

# 第1回ワーキンググループ資料

(2011年5月17日開催)

## **Working Group Progress Meeting (1) on 17<sup>th</sup> May, 2011**

### **PART (1): Development Schedule of Hanoi Sewerage PPP Model**

- Regulatory Frame Works
- Confirmation of Current Status, Schedule and Outputs

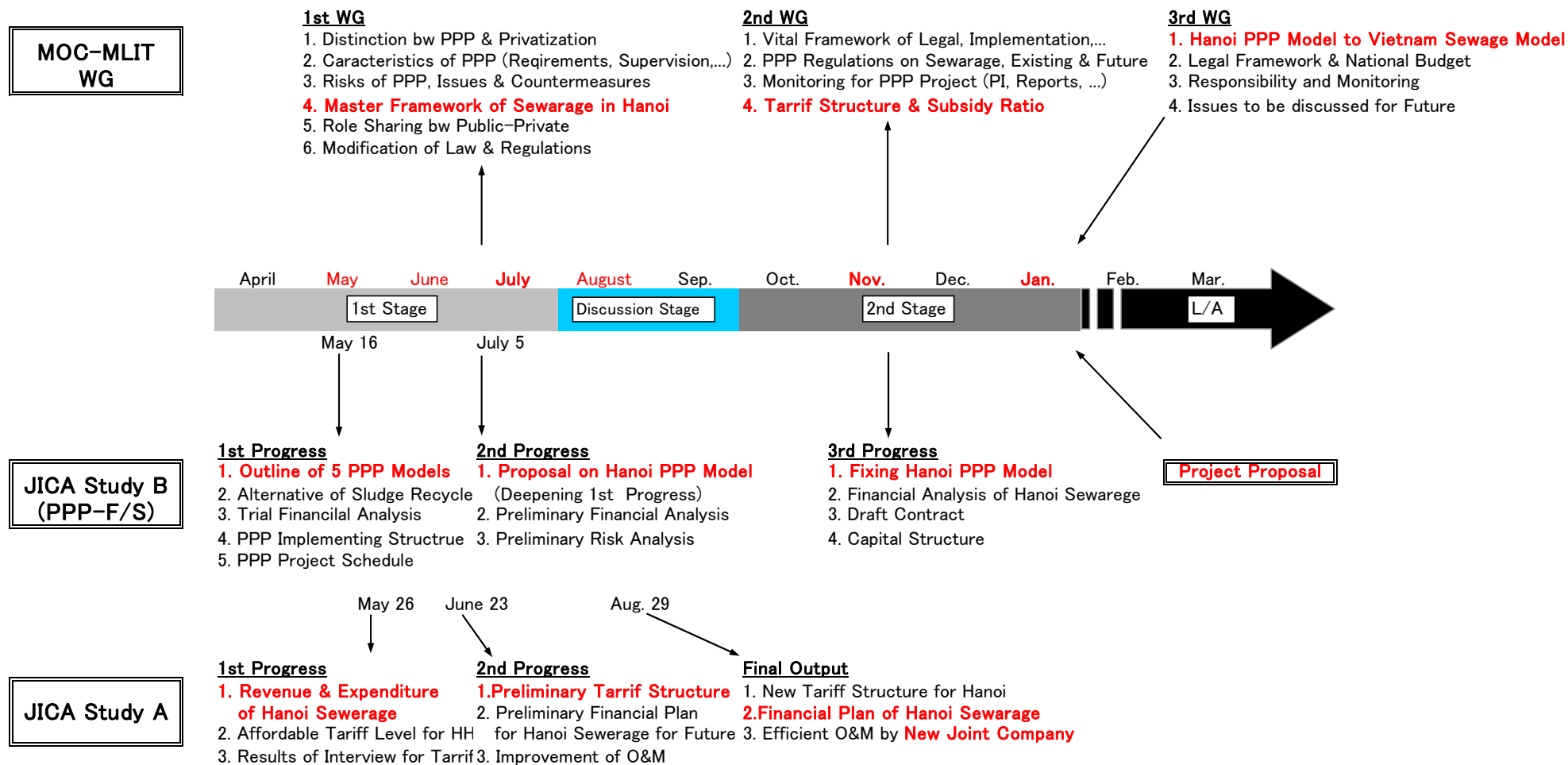
### **PART (2): Overall Progress of the Study B**

- (1) Purpose of the Study and Overall Progress
- (2) Project Implementation Schedule
- (3) Work Schedule of the Study
- (4) Alternatives of Facilities of Sludge Recycle
  - Three (3) Alternatives of Sludge Recycle Facilities
  - Two (2) Alternatives Sites for Sludge Recycle Center
- (5) Five (5) PPP Models
  - Classification of 5 PPP Models
  - Comparison of 5 PPP Models
- (6) Training Program
  - Consideration of Four Training Programs

### **PART (3): Planning for Sludge Recycle**

- Selection of Sewage Sludge Reuse
- Concept of Step-wised Project Programming
- Sludge Treatment Facility Planning for Recycle
- Alternative Study of Site for Sludge Recycle Center

## < Development Schedule of Hanoi Sewerage PPP Model >



## **PART (2) Overall Progress of the Study B**

### **(1) Major Purposes of the Study and Progress of the Study**

- 1) To realize Yen Xa WWTP Construction Project as soon as possible  
(To formulate suitable PPP sewerage project models with HPC, for smooth implementation and MPI approval.)



#### **[What we did]**

To prepare 5 Alternatives of PPP Sewerage Project Models  
To consider the Project Implementation Schedule

#### **[What we will do]**

To select the Best Models through Alternative Studies, through Financial Analysis, Risk Analysis and Study on Laws and Regulations, etc.  
To propose the Project Implementation Schedule

- 2) To realize sludge recycle in Hanoi  
(To propose suitable sludge recycle facility)



#### **[What we did]**

To prepare 3 Options of Sludge Recycle Facilities  
To prepare 2 Alternatives of Construction Site  
To carry out sludge recycle demand survey and sludge quality analysis

#### **[What we will do]**

To select the Best Option of Sludge Recycle Facility in the Best Location

- 3) To carry Training Program



#### **[What we did]**

To prepare outline of 4 Types of Training Program through discussion

#### **[What we will do]**

To fix details of the Training Programs and carry out the program

(2) Project Implementation Schedule

Table-1 shows the Draft Project Implementation Schedule for our discussion. The procedure of investment preparation of the SPC portion is still not clear. The procedure in the table is tentatively prepared, based on the Action Plan for the Period 2011 – 2013, PPP Inter-Ministerial Task Force, MPI.

The procedure of the ODA portion in the table is tentatively prepared, following a typical procedure of a normal ODA loan project. The time of the L/A shall be considered for the SPC portion and the ODAQ portion, respectively.

(3) Work Schedule of the Study

Table-2 shows the Work Schedule of the Study.

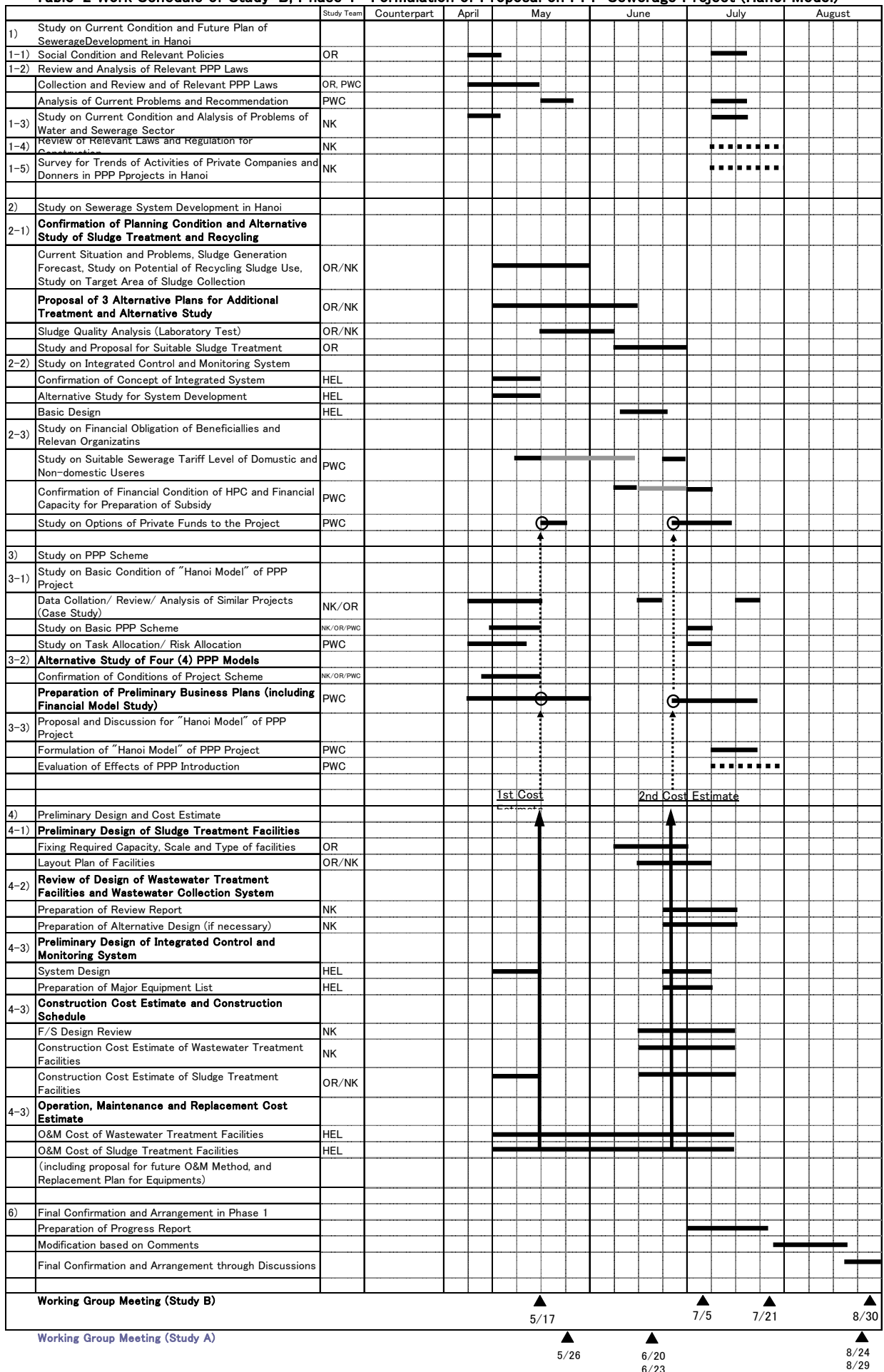
The major events are as below;

17 <sup>th</sup> May	First Progress Meeting
5 <sup>th</sup> July	Second Progress Meeting
Someday, July	PPP Lectures
21 <sup>st</sup> July	Third Progress Meeting
	Submission of the Progress Report
August	Preparation of comments to the Progress Report
End, August	Fixing Outline of the PPP Sewerage Project

**Table-1 Consideration of Project Implementation Schedule**

No.	Year	Period (month)	2011				2012				2013				2014				2015				2016				2017				2018			
			I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
			Preparation Phase												Construction Phase												Operation Phase							
1. SPC Portion																																		
A	<b>Investment Preparation Package</b>																																	
1	Approval of Selection Criteria																																	
2	Submission of Project Proposal																																	
3	Selection of Project																																	
4	Feasibility Study																																	
5	Tender Document Preparation																																	
6	Investor Selection (Bid, Evaluation, Approval)																																	
7	Project Contract																																	
B	<b>JICA-PSIF</b>																																	
1	Appraisal Mission																																	
2	Letter of Intent (LOI)																																	
3	L/A Sign																																	
C	<b>EPC Package</b>																																	
1	Detailed Design																																	
2	Procurement of Contractor																																	
3	Negotiation																																	
4	Contract Sign																																	
5	Construction																																	
6	Commissioning Test																																	
2. ODA Portion																																		
A	<b>Investment Preparation Package</b>																																	
1	JICA-ODA																																	
2	Appraisal of Financing																																	
3	Exchange of notes																																	
4	Loan Agreement																																	
B	<b>D/D, Pre-Con. Construction Package</b>																																	
1	Selection of Consultant for C/S																																	
2	Detailed Design																																	
3	Land Acquisition																																	
4	Pre-qualification																																	
5	Tendering to select Contractor																																	
6	Construction																																	
7	Commissioning Test																																	

**Table-2 Work Schedule of Study-B, Phase 1 “Formulation of Proposal on PPP Sewerage Project (Hanoi Model)”**



Study A  
Study B



(4) Alternatives of Facilities for Sludge Recycle

The Study Team selected suitable three (3) options of sludge recycle methods, 1) Solar Drying Bed/ Compost, 2) Mechanical Drying and 3) Carbonization, among six (6) alternative methods. Two alternative sites (Yen So and Yen Xa) are selected for construction of the facilities among three alternatives.

(5) 5 PPP Models for Sewerage Project

1) Outline of the Project

The outline of the Yen Xa WWTP Construction Project is shown in Table-3. In this stage, the Study Team study on the Phase 1 portion.

Table-3 Outline of Yen Xa WWTP Construction Project

	Service Population	Wastewater Collection System (Length of Pipe Installation)	Wastewater Treatment Plant (capacity)	Facilities for Sludge Recycle
<b>Phase-1</b>	<b><u>548,000</u></b>	<b><u>15,415 m</u></b>	<b><u>135,000 m<sup>3</sup>/day</u></b>	(under the Study)
Overall	882,000	27,641 m	270,000 m <sup>3</sup> /day	

2) Classification of PPP Models

Five PPP Models for Sewerage Project are proposed as below;

Table-4 Classification of Five PPP Models

	Wastewater Collection System	Wastewater Treatment Plant	Facilities for Sludge Recycle
Model-1	ODA	ODA	ODA
Model-2	ODA	ODA	SPC
Model-3	ODA	SPC	SPC
Model-4	ODA	SPC	ODA
Model-5	SPC	SPC	SPC

Conditions:

- As for ODA portion, the central government will arrange funding for the Project, and HPC will have responsibility for construction and O&M. The loan will be paid back by the central government. So it is same as a government subsidy for Hanoi.
- As for SPC portion, SPC will have responsibility for funding, construction and O&M. HPC will pay sewerage service fee to SPC, which will cover construction cost and O&M cost, etc.

### 3) Comparison of 5 PPP Models

The results of rough cost estimate are shown in Table-4. The estimated values are quite tentative ones, so they will be reviewed and modified. Table-5 shows Comparison of Five (5) PPP Models.

Table-5 Trial Calculation of Construction Cost and O&M Cost (Phase 1)

(1) Entire Project (Construction Cost and O&M Cost)

(million. US\$)

	Wastewater Collection System	Wastewater Treatment Plant	Facility for Sludge Recycle		Total
			Case-1	Case-2	
Construction Cost	114	220	13	24	347
			26	24	358
			0.5	0.9	360
O&M Cost (Yearly)	-	5.6	0.5	0.9	6.1
			0.9	0.9	6.5
			0.9	0.9	6.5

(2) SPC Portion

(Construction Cost)

(million. US\$)

	Wastewater Collection System	Wastewater Treatment Plant	Facility for Sludge Recycle			Total		
			1)	2)	3)	Case-1	Case-2	Case-3
Model-1	-	-	-	-	-	-	-	-
Model-2	-	-	13	24	26	13	24	26
Model-3	-	220	13	24	26	233	244	246
Model-4	-	220	-	-	-	220		
Model-5	114	220	13	24	26	347	358	360

(O&M Cost)

(million. US\$/year)

	Wastewater Collection System	Wastewater Treatment Plant	Facility for Sludge Recycle			Total		
			1)	2)	3)	Case-1	Case-2	Case-3
Model-1	-	-	-	-	-	-	-	-
Model-2	-	-	0.5	0.9	0.9	0.5	0.9	0.9
Model-3	-	5.6	0.5	0.9	0.9	6.1	6.5	6.5
Model-4	-	5.6	-	-	-	5.6		
Model-5	-	5.6	0.5	0.9	0.9	6.1	6.5	6.5

Case-1) Solar Drying Bed / Compost

Case-2) Mechanical Drying

Case-3) Carbonization

Table-6 Comparison of 5 PPP Models

	Required Cost for Sewerage Service		Funding	Control of Construction Work Schedule	Introduction of New Technology for Sludge Recycling
	Construction Cost and O&M Cost	Cost for Funding			
Model-1 (ODA/ODA/ODA)	 Expensive More	Cheaper	Difficult So large amount for ODA and GOV	Easy One executing agency will manage entire project.	Technical assistance program will be prepared under ODA program.
Model-2 (ODA/ODA/SPC)			Difficult So large amount for ODA and GOV	Easy Almost same as Model-1.	SPC will take the responsibility
Model-3 (ODA/SPC/SPC)			Relatively easy Funds come from ODA and SPC	Difficult Two executing agencies will manage each portion of project, separately.	Same as Model-2
Model-4 (ODA/SPC/ODA)			Relatively easy Funds come from ODA and SPC	Difficult Same as Model-2	Same as Model-1
Model-5 (SPC/SPC/SPC)		Cheaper	Expensive More	Difficult So large amount for SPC and HPC	Easy Same as Model-1

#### 4) Trial Financial Analysis

The sewerage tariff income from Yen Xa WWTP Service Area is roughly calculated on three cases as shown in Table-7. Rough Estimate of O&M and Replacement Cost is shown in Table-8.

Table-7 Rough Estimate of Tariff Income

Tariff Level	Tariff Income	
	Phase 1 Area	Entire Area
Case-1 Current Sewerage Tariff VND 391/m <sup>3</sup> (US\$ 0.019/m <sup>3</sup> )	0.75 million US\$/ year (US\$ 0.019 m <sup>3</sup> x 135,000 m <sup>3</sup> /day x 80% x 365 days)	1.50 million US\$/ year
Case-2 Affordable to Pay, based on around 1% of Household Income VND 1,564/m <sup>3</sup> (US\$ 0.076/m <sup>3</sup> ) (4.0 times of Case 1)	3.00 million US\$/ year (US\$ 0.076 m <sup>3</sup> x 135,000 m <sup>3</sup> /day x 80% x 365 days)	6.00 million US\$/ year
Case-3 Affordable to Pay, based on around 2% of Household Income VND 3,600/m <sup>3</sup> (US\$ 0.180/m <sup>3</sup> ) (9.5 times of Case 1)	7.10 million US\$/ year (US\$ 0.180 m <sup>3</sup> x 135,000 m <sup>3</sup> /day x 80% x 365 days)	14.20 million US\$/ year

Table-8 Rough Estimate of O&M and Replacement Cost  
(Yen Xa WWTP + Solar Drying Bed/ Compost)

Item	Rough Estimation of Average Yearly Expenditure
O&M Cost	US\$ 6.1 million /year
Replacement Cost of Mechanical and Electrical Equipment	US\$ 4.5 million /year (US\$ 90 million in 20 years)
Total	US\$ 10.6 million /year

Above rough estimate shows as below;

The tariff income from Yen Xa WWTP Service Area is expected US\$ 0.75 – 7.10 million/ year in the Phase 1 area and US\$ 1.50 million/ year in the entire area. It can hardly cover the total amount (US\$ 10.6 million/ year) of O&M cost and replacement cost of mechanical and electrical equipment of Yen Xa WWTP (Phase 1). The initial construction cost of Yen Xa WWTP shall be depending on government subsidy and/or other financial sources, except for sewerage tariff income in Yen Xa WWTP service area.

In order to formulate suitable PPP Sewerage Project Model in Hanoi, the Study Team will carry out on the followings;

**1) Study on cost reduction of O&M cost, Replacement Cost and Initial Construction Cost**

- Review of the O&M cost and replacement costs and initial construction cost, considering merits of introduction of PPP (the target is 30% reduction)
- Study on cost effectiveness of the entire project implementation of Yen Xa WWTP, (The Phase 1 Project implementation is more costly than the entire project implementation)

**2) Study on Possible Increase of Sewerage Tariff Income to Yen Xa WWTP**

- Consideration on yearly increasing tariff structure with household income increasing (except for inflation ratio)
- Consideration on higher tariff on commercial and industrial activities
- Consideration on transfer of sewerage tariff income from other areas to Yen Xa WWTP

**3) Study on Additional Financial Sources**

- Consideration on possibility of general account expenditure of HPC (financial source based on tax income)
- Consideration on governmental subsidy yearly basis

## **(6) Training Program**

### **1) PPP Lecture in Hanoi**

Period: 2 days in July, 2011

Attendants: 15 - 20

Contents of Program:

Draft Contents are shown in Table-9.

### **2) Visit to PPP Project Sites**

Period: ---

Attendants: around 10

Contents of Program:

Inspection of PPP Projects

(To be discussed with JICA, Tokyo)

### **3) Training Program in Japan(Original Proposal)**

#### **3-1) Training Program for Executive Class**

Period: 2 times of 10 days

(28<sup>th</sup> Sep. – 7<sup>th</sup> Oct.) & (6<sup>th</sup> Nov. – 15<sup>th</sup> Nov.) tentative

Attendants: 6 - 8

Contents of Program:

Draft Contents are shown in Attachment

#### **3-2) Training Program for O&M Group Leaders**

Period: 21 days (12<sup>th</sup> Oct. – 1<sup>st</sup> Nov.) tentative

Attendants: 6 - 8

Contents of Program:

Draft Contents are shown in Attachment

Table-9 Draft Contents of PPP Seminar in Hanoi, July 2011

(Seminar for 10 - 20 members in 2 days)

	Subject	Content of presentation
Part 1: Sewerage works in Japan		
9:00-9:15	Opening	
9:15-10:00	Sewerage works in Japan	Role of sewerage History of sewerage Water pollution control Safety in urban activity & disaster mitigation Global environmental issues Protection of sound water resources Policy, legal and financial system Public relation Sewerage in new era Water & waste cycle (from waste to resources) Asset management PI & sewerage works operation
10:00-10:20	Break	
10:20-11:05	Sewerage works in Hanoi	Wastewater management, water environment Storm water drainage
11:05-11:50	Sewerage works in Yokohama	Sewerage system Regional sewage sludge treatment Features of water environment restoration Flood mitigation Public relation
Part 2: PPP project		
13:15-14:00	PPP overview	History of PPP & PFI Features of PPP project What is PPP in sewerage?
14:00-14:45	PPP project in Sewerage Works	PFI projects of sludge treatment Procurement procedure & performance monitoring
	Break	
15:00-15:45	Proposed PPP in Hanoi (1)	Overview of PPP study in Yen Xa sewerage project PPP model simulation Issues of sustainable PPP project operation
15:45-16:30	Proposed PPP in Hanoi (2)	Projection of sewerage works operation in Hanoi Remaining issues on finance and regulation system Best solution and what is Hanoi PPP model?
16:30-17:30	Discussion	
	Closing	

	Subject	Content of presentation
Part 3: Sewerage Administration of local government		
9:00-9:50	Sewerage Ordinance	
9:50-10:40	Tariff system	Tariff system, poverty alleviation Tariff levy & tariff collection Financial operation
10:40-11:00	Break	
11:00-12:00	Water quality management	Business water monitoring House connection approval
13:30-15:00	Discussion on sewerage works operation	



**HANOI CITY:**  
**Preparatory Survey on Project for**  
**Yen Xa WWTP ( Study B )**

**Sludge Recycle Planning**

**JICA Study Team**  
**May. 2011**

**Methodology of sludge recycle facility  
planning**

**Discussion topics**

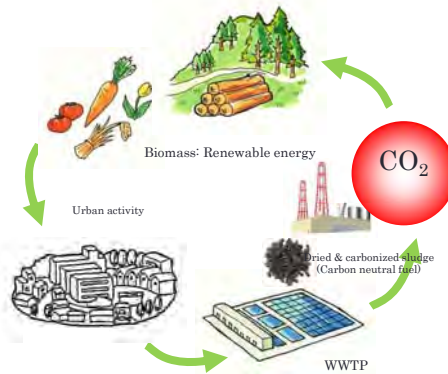
- Selection of sewage sludge reuse  
    Through Needs Survey on field and literature
- Concept of step-wised project programming
- Sludge treatment facility planning for recycle  
    Step-1: Selection of final sludge product  
    Step 2: Alternative study of sludge treatment process
- Alternative study of site of Sludge Recycle Center

## Sewage sludge reuse (1/2)

IPCC defines sewage sludge as “Renewable energy”.

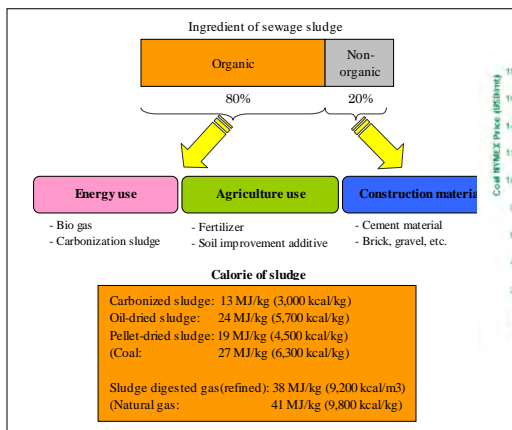
Sewage sludge is replaced to fossil fuel, therefore mitigates CO<sub>2</sub> & CH<sub>4</sub> emission in land fill site

Gas	Global warming potential
CO <sub>2</sub>	1
CH <sub>4</sub>	21
N <sub>2</sub> O	310



## Sewage sludge reuse (2/2)

contains calorie of approx. 60 % of coal



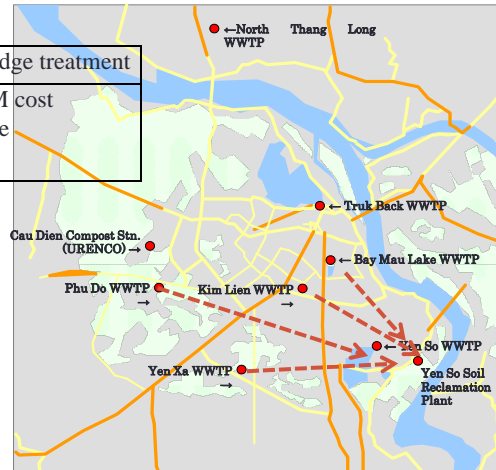
- Right: Coal price, New York Merchandize EX.50-80 USD/ton
- Left: Calorie of fuel sludge, Japan

## Sludge treatment facility planning (1/3)

- Regional sewerage sludge treatment

Advantages of regional sewage sludge treatment

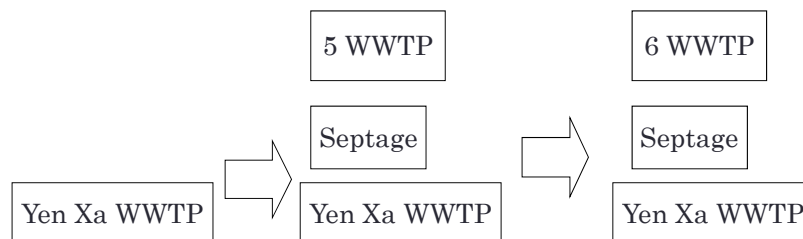
- Scale merit of construction & OM cost
- Qualified sludge product for reuse
- Offensive odor control



## Concept of project programming (1/2)

Step-wised development

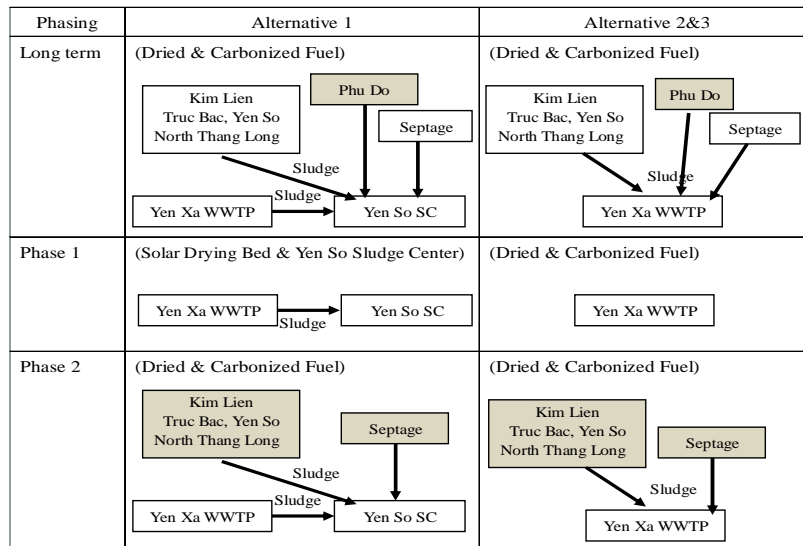
Individual treatment to regional sewerage sludge treatment



Natural treatment to artificial treatment due to sludge increase



## Concept of project programming (2/2)



## Sludge treatment facility planning (2/3)

Step 1: Selection of sewage sludge reuse (final product):

- Soil conditioner (soil improvement additive)
- Dried sludge fuel for bio-mass boiler or cement material
- Carbonized sludge fuel for bio-mass boiler

Step 2: Determine potential treatment process

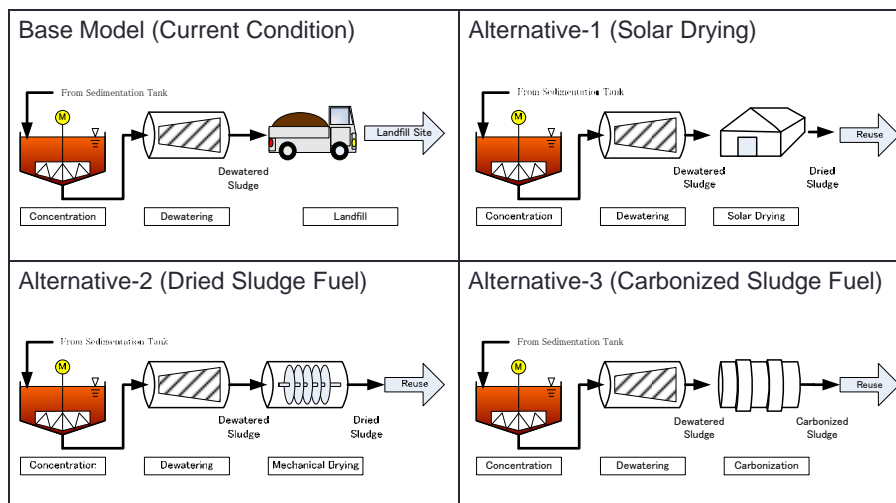
- **Alternative 1: thickening – dewatering – solar drying (green house)**  
----- 1<sup>st</sup> priority
- Alternative 2: thickening – dewatering – drying (mechanical drying)
- Alternative 3: thickening – dewatering – carbonizing

# Sludge treatment facility planning (3/3)

## Step 1: Primary Screening

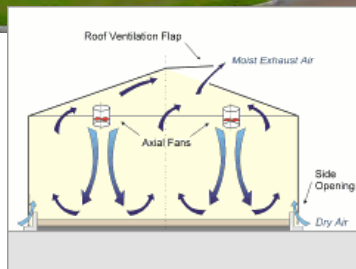
Final Form of Sludge Treatment	Estimation	Step 2
Landfill of Dewatered Sludge	Baseline (Current Condition)	○
Compost for Agriculture	Heavy Metals Accumulation in Soil High Competition against Kitchen Garbage Compost	×
Compost for Soil Conditioner (Solar Drying)	Low Cost, Sustainable	○
Dried Sludge Fuel for Biomass Boiler or Cement Material	Environmentally-Acceptable Sustainable Environment-Conscious Technology	○
Carbonized Sludge Fuel for Biomass Boiler	Environmentally-Acceptable Sustainable Environment-Conscious Technology	○
Construction Material of Burned Ash	High Cost of Incinerator LCC	×
Construction Material of Melt Slag	High Cost of Melting Furnace LCC	×

## Base Model and 3 Alternatives

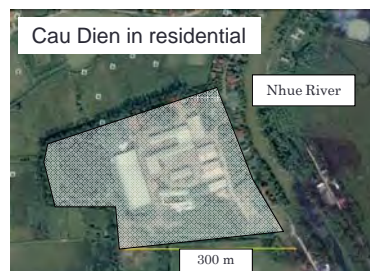


## Solar green house of sewage sludge drying

- Solar energy is environmentally friendly and low cost.
- Green house is applicable to Hanoi climate.



## Alternatives of Sludge Recycle Center (1/2)



- Conditions are area, environment issue, traffic access and EIA for land application.

## Alternatives of Sludge Recycle Center (2/2)

Alternatives	Yen So dredged soil land-reclamation site	Cau Dien Composting Plant	Yen Xa WWTP
Sludge treatment process	Green house & solar drying (Phase-1)	Mechanical drying & carbonization	Mechanical drying & carbonization
Existing land use	Opened space and reclaimed land	Solid waste composting plant	Planned WWTP
Area	Sufficient	Too small	Enough for mechanical drying & carbonization
Traffic accessibility	Easy	Congested small road	Easy
Environmental issue	Acceptable 500 m from residences	Difficult due to adjacent residences	Acceptable
Upgrading in future	Flexible	Less Possible	Flexible
Recommendation	Recommendable if complied with EIA	Not recommendable	Recommendable

## Conclusion of sludge recycle facility planning

- Step-wised project programming
  - Long term
    - Regional sewage sludge treatment = 7 WWTP + Septage
    - Phase-1 = PPP project
    - Yen Xa WWTP
  
- Alternatives of site & sludge treatment facility
  - Yen Xa WWTP
    - Mechanical drying or carbonization
  - Yen So land-reclamation site, if EIA approved
    - Solar drying of green house

## 第2回ワーキンググループ資料

(2011年7月15日開催)



# Consideration of PPP Model for Sewerage System Development in Hanoi

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July 15<sup>th</sup>, 2011

1

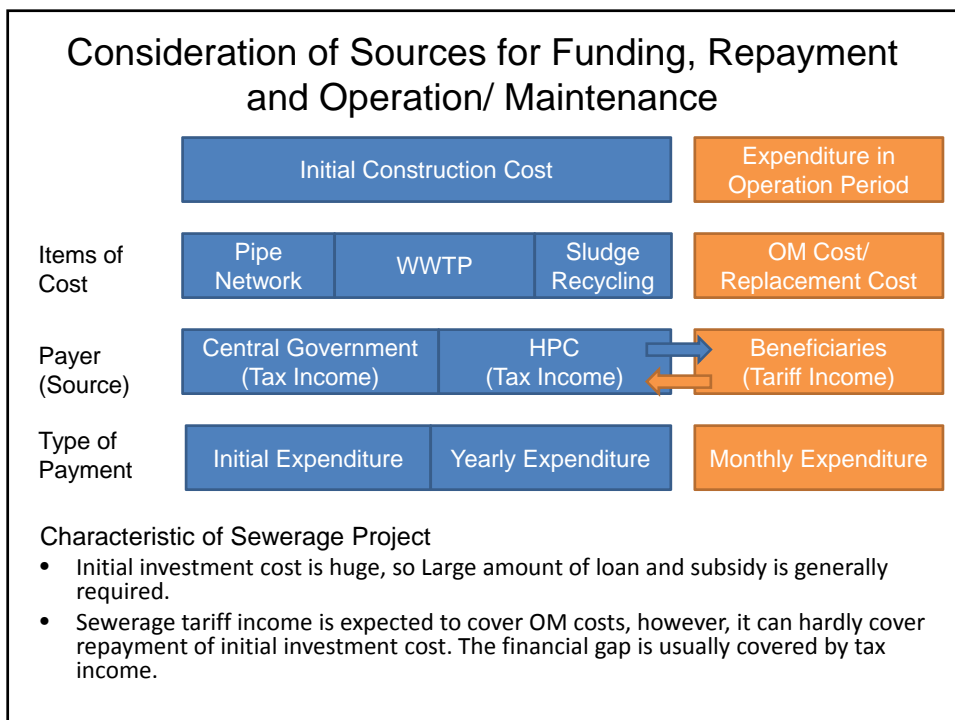
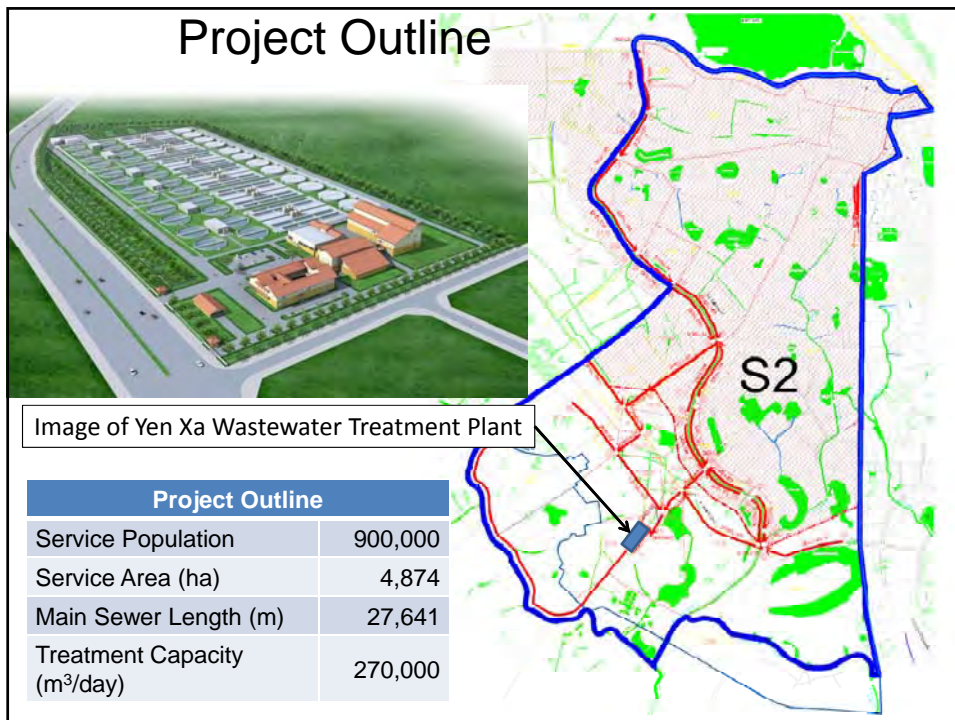
## Purpose of the Study

1. For Effective and Smooth Implementation of Construction of Yen Xa Wastewater Treatment Plant

## Topics

1. Outline of Construction Project of Yen Xa Wastewater Treatment Plant
2. Consideration of Source of Funding, Repayment, and Operation and Maintenance
3. Study on PPP Model for Hanoi Sewerage

2

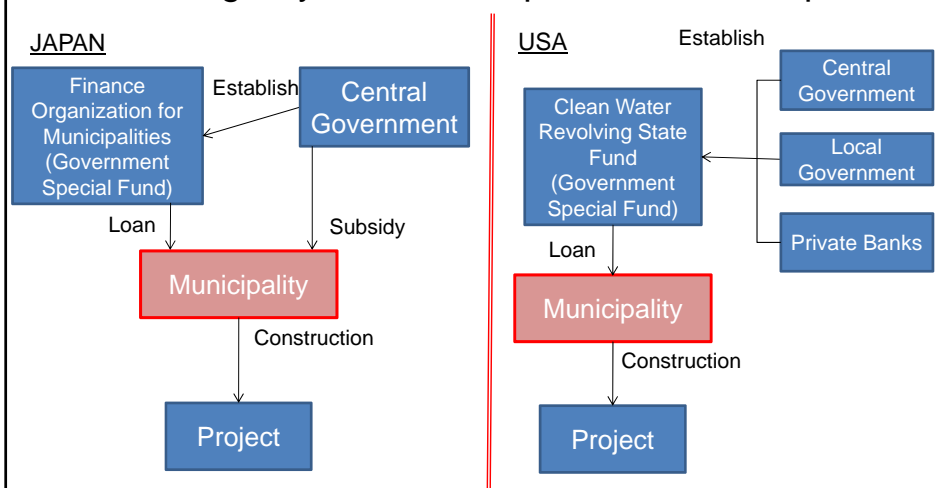


## Alternatives of Source of Funding for Initial Investment (Hanoi)

	Funding Source for Initial Investment	Interest (US\$ basis)
Public Funding Source		
1	Central Government Subsidy (including Funding by ODA Loan: 2.75-3.50%)	-
2	HPC Development and Investment Budget *18,249 billion VND ( 871 billion US\$) in 2011	-
3	Municipality Bond	(7-10%)
Private Funding Source		
1	Private Investment (including benefit and risk hedge cost)	12-18%
2	Private Investment with JICA PSIF (Private Sector Investment Fund: 4-5%)	5-10%

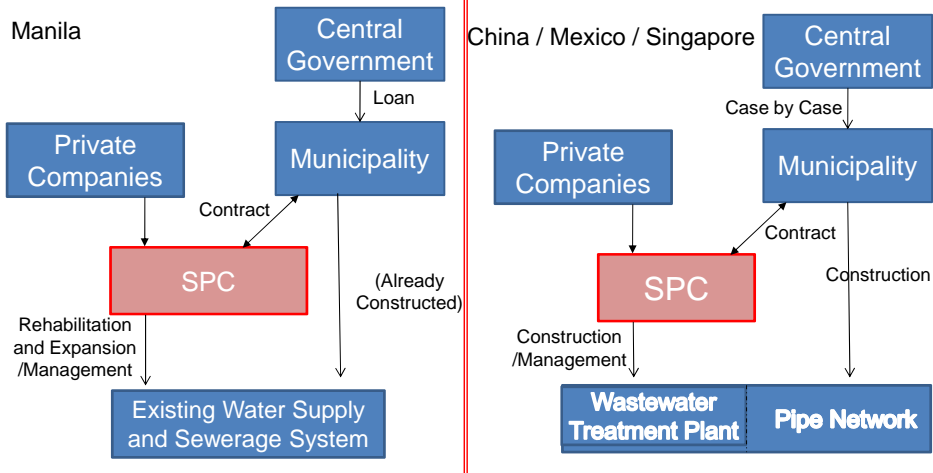
- From view point of fund preparation cost for HPC, “Central Government Subsidy “ is the best option, and “HPC own budget” is the second best. However, total of these sources is not enough to cover the initial investment cost for the sewerage system development.
- If municipal bond is not available, private project finance is only the method.

## Case Study of Funding Source in Traditional Sewerage System Development in USA/ Japan



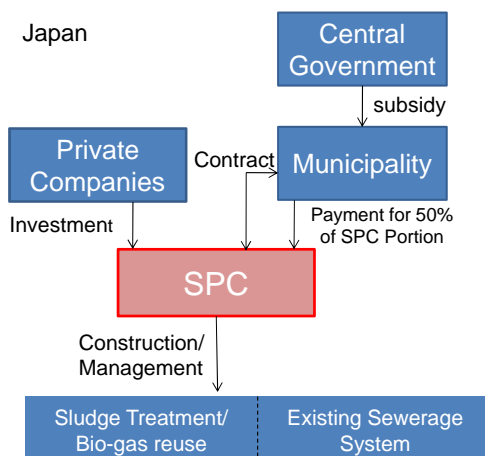
Both governments established organizations to provide low interest loan to municipalities for sewerage system development. This system is very useful for development of many municipalities in long term

## Case Study of Private Participation for Sewerage Sector



In these cases, private sectors (using private fund) have contributed to sewerage system development, in cooperate with public sectors. Public sector spent large amount of tax income for initial investment. SPC is expected to do effective management , using their own technologies and know-how.

## Case Study of Private Participation for Sewerage Sector



In case of Japan, only some specific technical fields (such as sludge treatment and bio-gas reuse) are applied by PPP, after sewerage system development by public sector. SPC is expected to do more effective mangement than Public Sector in these field.

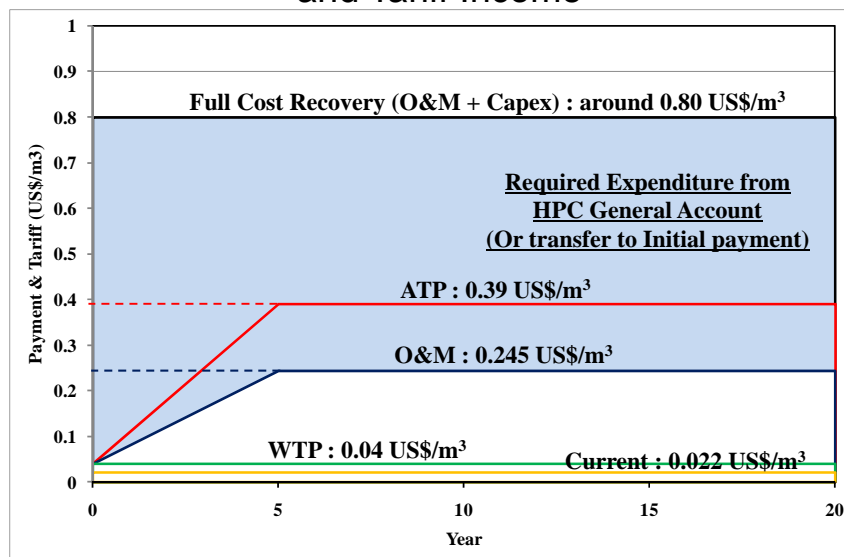
## Alternatives of Source of Repayment, Operation/ Maintenance

	Financial Source of Repayment, O&M, etc.	Amount
1	Sewerage Tariff	4500 VND/m <sup>3</sup> (0.022 US\$/m <sup>3</sup> )
2	HPC Ordinary Account in 2011 budget	21,431 billion VND (1,023 million US\$)

	Type	Amount
1	Current Sewerage Tariff	450 VND/m <sup>3</sup> (0.022 US\$/m <sup>3</sup> )
2	Current Water Tariff	4,500 VND/m <sup>3</sup> (0.220 US\$/m <sup>3</sup> )
3	For OM Cost Recovery	4,900 VND/m <sup>3</sup> (0.235 US\$/m <sup>3</sup> )
4	Full Cost Recovery (Initial and OM Cost)	16,800 VND/m <sup>3</sup> (0.800 US\$/m <sup>3</sup> )

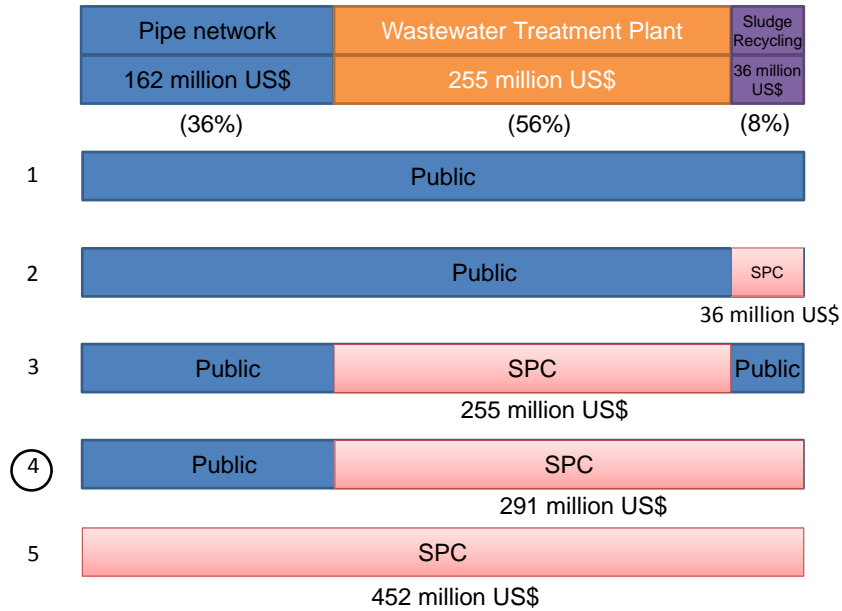
It is almost impossible to increase sewerage tariff to "Full Cost Recovery" level.

## Financial Gap between Full Cost Recovery and Tariff Income



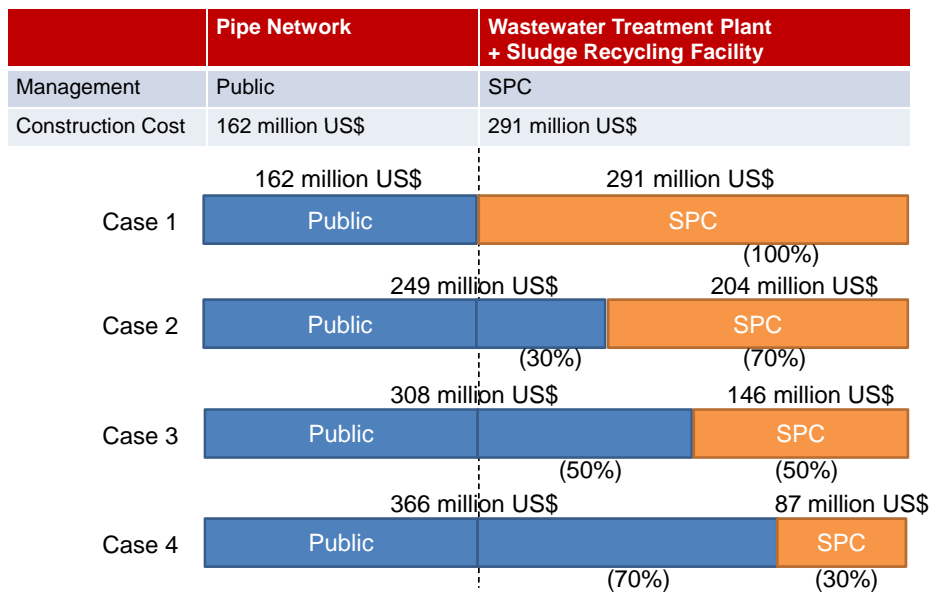
## Study on PPP Model for Hanoi Sewerage

Scope Sharing between Public and SPC/ PPP 5 Models

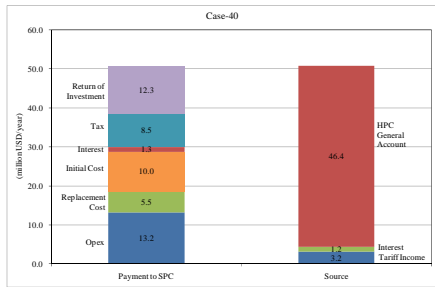


## Consideration of Funding Source for Initial Investment

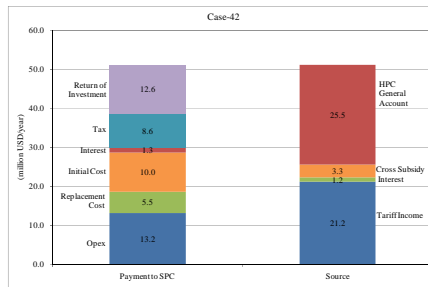
Case Study: PPP Model - 4



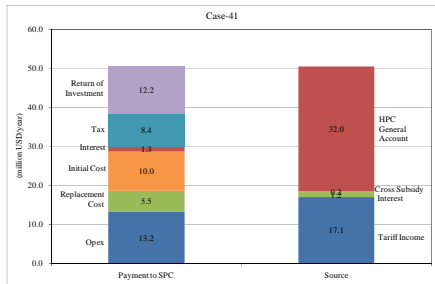
## Financial Analysis: Case (Subsidy: 30%)



**Tariff: 840 VND /m<sup>3</sup>(0.04 US\$/m<sup>3</sup>)**

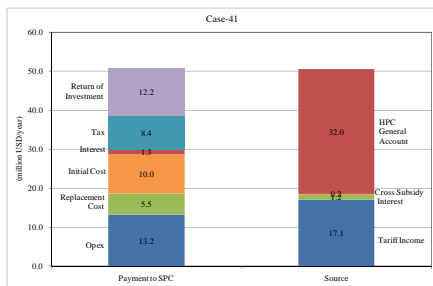


**Tariff: 5145 VND /m<sup>3</sup>(0.245 US\$/m<sup>3</sup>)**

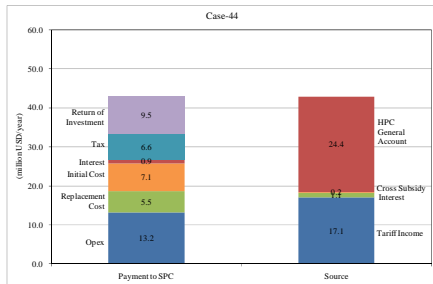


**Tariff: 8190 VND /m<sup>3</sup>(0.39 US\$/m<sup>3</sup>)**

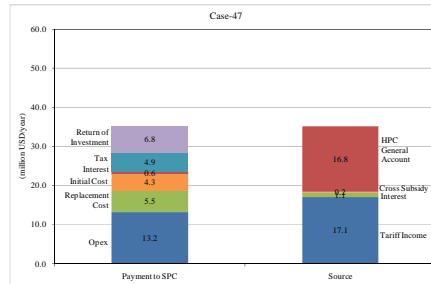
## Financial Analysis: Case (Tariff: 5150 VND /m<sup>3</sup>)



**(Subsidy: 30%)**

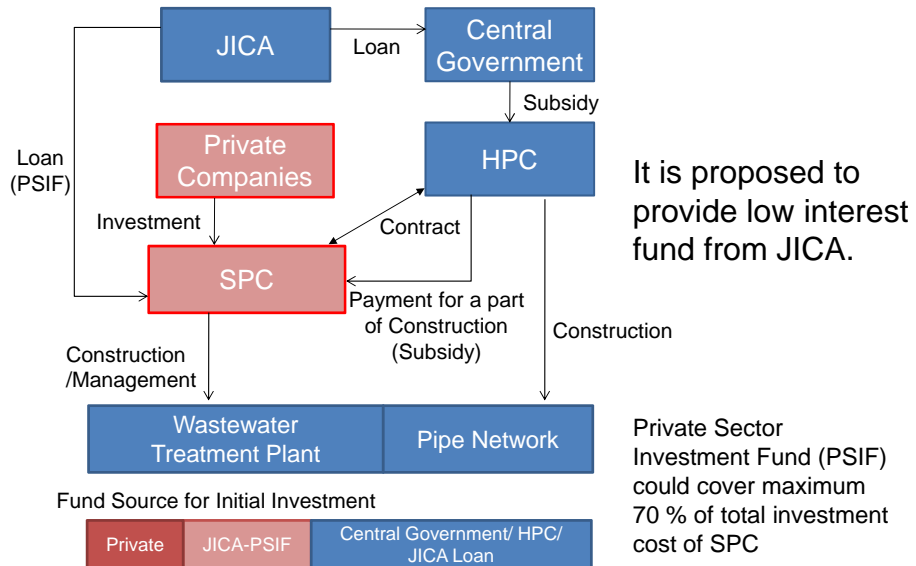


**(Subsidy: 50%)**



**(Subsidy: 70%)**

## Draft Proposal of Hanoi PPP Model



## Rough estimate of Yearly Expenditure from HPC General Account, for Sewerage Service

(million US\$/ year)  
(billion VND/ year)

	Subsidy:30%	Subsidy:50%	Subsidy: 70%
VND 840 /m <sup>3</sup> (US\$ 0.04/m <sup>3</sup> ) Willingness-to-Pay (0.2% of household Income)	46.4 (956)	38.8 (800)	31.3 (642)
VND 5,150 /m <sup>3</sup> (US\$ 0.245/m <sup>3</sup> ) Management Cost Recovery (1.1% of household Income)	32.0 (600)	24.4 (443)	16.8 (285)
VND 8,190 /m <sup>3</sup> (US\$ 0.39/m <sup>3</sup> ) Affordable-to-Pay (1.8% of household Income)	25.5 (332)	17.9 (174)	10.3 (17)



Thank you for your attention

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**HANOI CITY:  
Sludge Recycle Facility  
Planning on Project for Yen Xa  
WWTP  
( Study B )**

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**JICA Study Team  
15 July 2011**

**Methodology of sludge recycle facility  
planning**

**Out-standing topics of Progress Meeting in May**

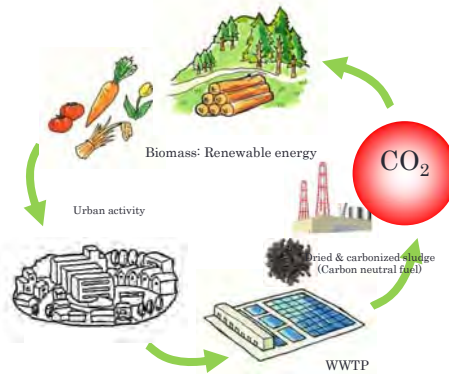
- Selection of Sewage Sludge Recycling Plant
- Applicability of Solar Drying Technology
- Potential Demand of Sludge Fuel & Soil Conditioner
- Selection of Sewage Sludge Treatment Process

## Sewage sludge reuse (1/2)

IPCC defines sewage sludge as “Renewable energy”.

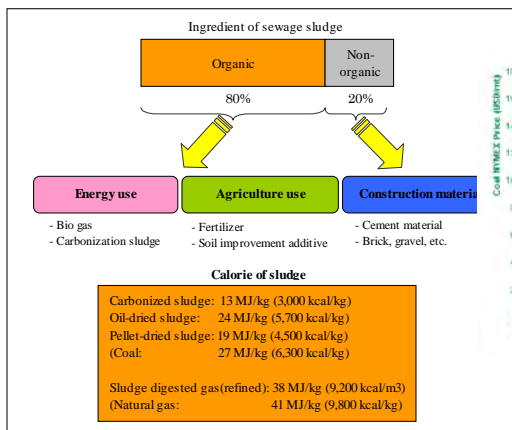
Sewage sludge is replaced to fossil fuel, therefore mitigates CO<sub>2</sub> & CH<sub>4</sub> emission in land fill site

Gas	Global warming potential
CO <sub>2</sub>	1
CH <sub>4</sub>	21
N <sub>2</sub> O	310



## Sewage sludge reuse (2/2)

contains calorie of approx. 60 % of coal



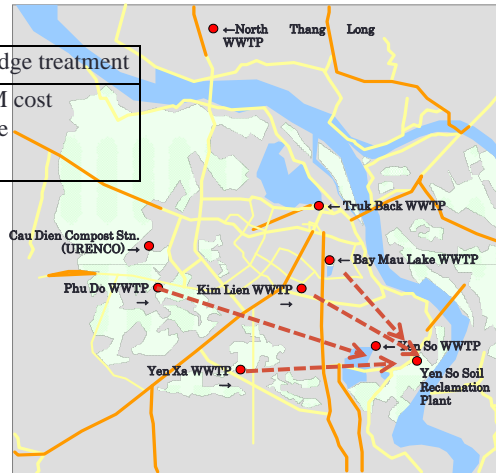
- Right: Coal price, New York Merchandize EX.50-80 USD/ton
- Left: Calorie of fuel sludge, Japan

# Sludge treatment facility planning

- Regional sewerage sludge treatment

Advantages of regional sewage sludge treatment

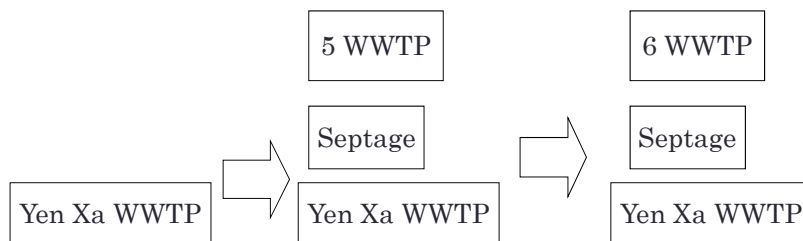
- Scale merit of construction & OM cost
- Qualified sludge product for reuse
- Offensive odor control



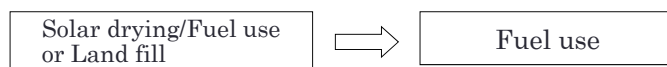
# Concept of project programming (1/2)

Step-wised development

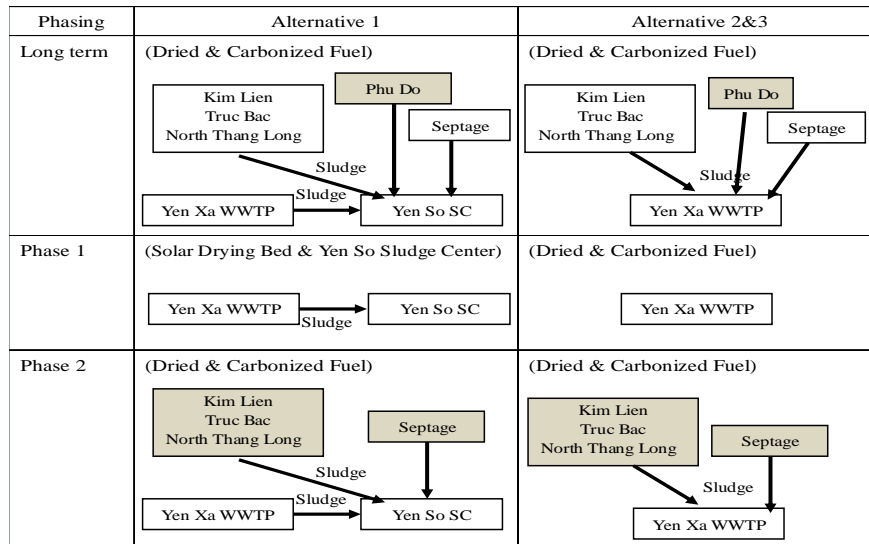
Individual treatment to regional sewerage sludge treatment



Natural treatment to artificial treatment due to sludge increase



## Concept of project programming (2/2)



## Conclusion of PGM in May

- Step-wised project programming

Long term

Regional sewage sludge treatment = 7 WWTP + Septage

Phase-1 = PPP project

Yen Xa WWTP

- Alternatives of site & sludge treatment facility

Yen Xa WWTP

Mechanical drying or carbonization

Yen So land-reclamation site, if EIA approved

Solar drying of green house

## Subjects in PGM in 15<sup>th</sup> July

### Part-1

- Applicability of Solar Drying Technology
- Selection of Sewage Sludge Recycling Plant
- Selection of SRC Site & Sludge Treatment Process

### Part-2

- Sludge Examination Plan

Continued to 3<sup>rd</sup> Field Survey in Oct.-Nov.

- Potential Demand of Sludge Fuel & Soil Conditioner

## Part-1

### Applicability of Solar Drying Technology (1)

- Lay out Plan of Yen So dredged soil reclamation site



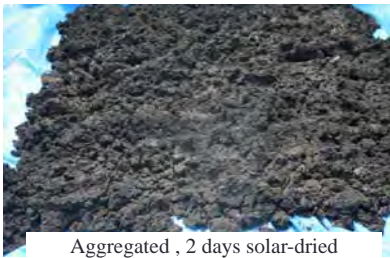
## Applicability of Solar Drying Technology (2)



Dewatered Sludge "Liquefied"



Demonstration Solar Green House



Aggregated, 2 days solar-dried



Dried Sludge, 6 days solar-dried

## Applicability of Solar Drying Technology (3)

### Examples in Overseas



Solar Green House, EU



Solar Drying, Nong Khaem WWTP, Bangkok



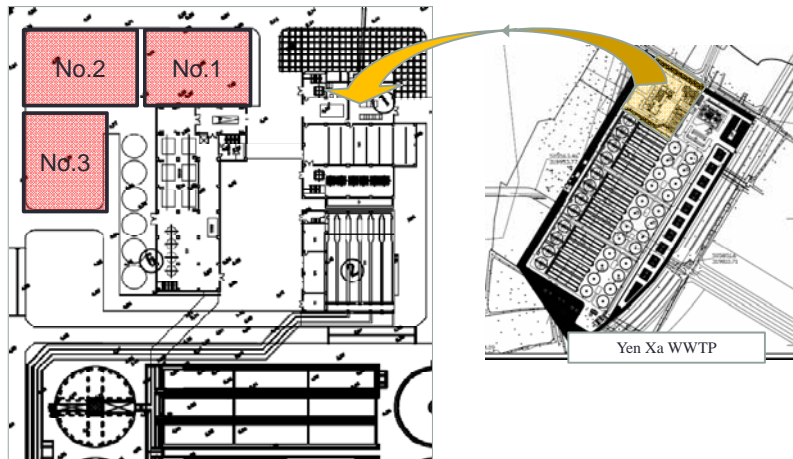
Sludge Turn-over & Drying, Johannesburg



Natural Composting, Johannesburg

## Applicability of Solar Drying Technology (4)

- Lay out Plan of Yen So Dredged soil reclamation site  
Mechanical Drying for Yen Xa WWTP



Construction Phasing  
Yen So Sludge Recycling Center  
Yen Xa WWTP

## Selection of SRC Site & Treatment Process(1)

### Project Programming (1)

Yen So Sludge Recycling Center

7 WWTP + Septage	Mechanical Dryer			No.3
Yen Xa 270,000m <sup>3</sup> /d			No.2	No.2
	Solar Green House	No.1	No.1	No.1
				No.4
Project Phase		Phase-1	Phase-2	Long Term
Wastewater Flow(m <sup>3</sup> /day)		270,000	485,450	606,200
Produced Sludge (m <sup>3</sup> /day)		108	201.4	384.6

Yen Xa WWTP

7 WWTP + Septage	Mechanical Dryer			No.4
Yen Xa 270,000m <sup>3</sup> /d			No.3	No.3
		No.2	No.2	No.2
		No.1	No.1	No.1
Project Phase		Phase-1	Phase-2	Long Term
Wastewater Flow(m <sup>3</sup> /day)		270,000	485,450	606,200
Produced Sludge (m <sup>3</sup> /day)		108	201.4	384.6



## Selection of SRC Site & Treatment Process(2)

### Project Programming (2)

#### Operation Mode of Yen So SRC, Phase-1

	Dry Season	Rainy Season	Dry Season
Mechanical Dryer	Off	On (54 m <sup>3</sup> /day)	Off
Solar Green House	On (108 m <sup>3</sup> /day)	On (54 m <sup>3</sup> /day)	On (108 m <sup>3</sup> /day)
Remarks: Solar Drying efficiency is high in dry season and declined in rain season.			

## Selection of SRC Site & Treatment Process(3)

### Comparison of SRC site

	Yen So (dredged soil reclamation site)	Yen Xa WWTP
Sludge drying process	<b>Solar Drying “natural energy” + Mechanical Drying</b>	Mechanical drying “using fossil fuel”
Technology	Easy for green house drying Moderate for mechanical drying	Moderate
Quality of product	Fluctuates, however acceptable	Uniform high quality attained
Environmental acceptance	<b>Sufficient distance from residences, however EIA required</b>	Close to residences
Traffic accessibility	Easy	Easy
Upgrading flexibility in future	Easy	Easy
Water supply & wastewater utility	Yen So WWTP supports (Zero emission)	In side of Yen Xa WWTP
Construction cost	<b>Low</b>	Moderate
OM cost	<b>Low</b>	Moderate
Recommendation	<b>Recommendable</b>	Provisional option

## Sludge Examination Plan (1)

### Examination subjects

- Production process development  
Solar drying, composting & carbonizing
- Evaluation on behavior & effectiveness of sludge use  
Element analysis, Germination test, Cultivating & Burning

### Questionnaire of for sewage sludge use of “Fertilizer & Soil Conditioner” and “Sludge Fuel”

Questionnaire will detects:

- Willing and potential demand
- Barriers on sludge product profile and assembly line

## Sludge Examination Plan (2)

### Sludge Examination aims “Sustainable Sludge Management”

- Practicable sludge reuse manner decides the sustainability of sludge management.
- Since land filling will be restricted, user’s willing affects sludge use practicability.
- Preliminary Sludge Examination Plan aims to detect sludge quality and willing of sludge product use of flower farms and cement factories.

## Sludge Examination Plan (3)

### Examined elements of sewage sludge

No.	Parameter	Unit	RESULTS			Analytical Method
			WWTP (A)	WWTP (B)	WWTP (C)	
<b>Elements Analysis</b>						
1	T- C	%	15.64	23.85	22.39	IET/DCMT TOC/ TN-2006
2	T-N	mg/kg	5142.5	6125.3	6577.2	
3	T-S	%	1.89	1.53	1.12	TCVN 4567-1998
4	T-P	mg/kg	20,449.89	24,183.26	23,014.89	TCVN 6202:2008
5	T-K <sup>(*)</sup>	mg/kg	10,853.52	3,644.52	9,352.81	EPA 3052-1996 SMEWW 3125-2005
<b>Other Parameter</b>						
19	Calorific value	Kcal/kg	3598.75	2395.62	3544.72	ASTMD 240-02
20	Loses of ignition	%	31.99	53.5	54.02	TCVN 4049-85
21	Ash content	%	39.5	26.13	33.44	TCVN 2688 – 1978
22	Moisture content	%	28.3	20.37	12.34	ASTMD 2216
23	Fixed carbon content	%	10.49	10.17	7.98	ASTM 3172 - 1997
24	pH	-	7.19	7.37	7.04	TCVN 6492:1999
25	Cl	mg/kg	689.68	662.32	674.9	EPA 9253

## Sludge Examination Plan (4)

### Elements:

- Elements of fertilizer contained.
- Ash content is a little higher than coal.
- Calorie is sufficient for fuel as 60 % of low quality carbon

### Potential use:

- Soil conditioner for flower farm, park, and construction projects, etc. Vegetable use shall be refrained due to urban-originated waste.
- Sludge fuel of cement material and bio-mass boiler

**Cement factories addressed Global Environment Concerns, and require more information on technical/political of sludge fuel use.**

\*-1 “Technical” by JICA Study and “Political” by Hanoi PC

\*-2 Collaborations with Flower & Cement are indispensable.

## Sludge Examination Plan (5)

3<sup>rd</sup> Sludge Examination on October

- Summarizes practicability on sludge elements & sludge processing.
- Applicability on soil conditioner/fertilizer through cultivating test, which is on-going, and Questionnaire of flower farm
- Applicability on sludge fuel of cement factories. Questionnaire survey will be examined.

## Sludge Examination Plan (6)

Composting Test



## Sludge Examination Plan (7)

### Carbonizing Test



## Sludge Examination Plan (8)

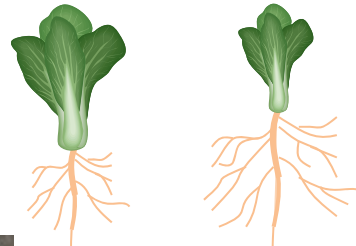
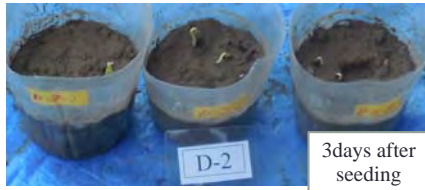
### Germination Test

Test samples of mixed soil of  
Dried sludge  
Carbonized sludge



## Sludge Examination Plan (9)

Cultivating Test : Test samples of mixed soil of  
Dried sludge & Carbonized sludge



Measure weight of leaf & root  
and EC (Electric Conductivity)

Thank you

# 第3回ワーキンググループ資料

(2011年9月23日開催)

## Working Group Meeting (23<sup>rd</sup> September, 2011)

### Agenda

- 1) Confirmation of Project Scheme (ODA Portion / SPC Portion)
- 2) Confirmation of Implementation Schedule the Project
- 3) Confirmation of Selection Procedures of Consultant and SPC in SPC Portion
- 4) Confirmation of Scale of Sludge Recycling Facility
- 5) Confirmation of the Work Schedule of the Study

End of the document



Yen Xa WWTP ODA-Portion and Private-Portion Comparative Table of Project Scheme

Option	Option-1 A / B / C	Option-2 A / B+C	Option-3 A+B+C																								
Outline	<p>(A) Construction of WWTP, (B) O&amp;M of WWTP, (C) Construction and O&amp;M of Sludge Recycling Facility,</p> <p>Each work is done separately.</p> <table border="1"> <tr> <td></td> <td>EPC</td> <td>O&amp;M</td> </tr> <tr> <td>WWTP</td> <td>A</td> <td>B</td> </tr> <tr> <td>Sludge Recycle</td> <td colspan="2">C</td> </tr> </table>		EPC	O&M	WWTP	A	B	Sludge Recycle	C		<p>(A) Construction of WWTP (B) O&amp;M of WWTP + Construction and O&amp;M of Sludge Recycling Facility are jointly done.</p> <table border="1"> <tr> <td></td> <td>EPC</td> <td>O&amp;M</td> </tr> <tr> <td>WWTP</td> <td>A</td> <td rowspan="2">B+C</td> </tr> <tr> <td>Sludge Recycle</td> <td></td> </tr> </table>		EPC	O&M	WWTP	A	B+C	Sludge Recycle		<p>(A) Construction and O&amp;M of WWTP + Construction and O&amp;M of Sludge recycling Facility are jointly done.</p> <table border="1"> <tr> <td></td> <td>EPC</td> <td>O&amp;M</td> </tr> <tr> <td>WWTP</td> <td colspan="2" rowspan="2">A+B+C</td> </tr> <tr> <td>Sludge Recycle</td> </tr> </table>		EPC	O&M	WWTP	A+B+C		Sludge Recycle
	EPC	O&M																									
WWTP	A	B																									
Sludge Recycle	C																										
	EPC	O&M																									
WWTP	A	B+C																									
Sludge Recycle																											
	EPC	O&M																									
WWTP	A+B+C																										
Sludge Recycle																											
Fund	<p style="text-align: center;">← EPC →                      O&amp;M</p> <p>WWTP    ODA                      Joint Company</p> <p>Sludge Recycle    SPC                      Joint Company</p>																										
Merit	<ul style="list-style-type: none"> <li>• Ordinary ODA Loan system and familiar to all.</li> </ul>	<ul style="list-style-type: none"> <li>• HPC have only to select 1 operator for whole O&amp;M.</li> <li>• Better &amp; sustainable sludge recycling can be secured.</li> <li>• HPC can get PSIF and TA through SPC.</li> <li>• HPC can establish JC for IOMS with SPC, and Training Center by Grant through SPC.</li> </ul>	<p>In addition to Option-2:</p> <ul style="list-style-type: none"> <li>• Through DBO, lifecycle cost is much lower than Option-1 because Quality of Construction and O&amp;M can be secured from both sides.</li> <li>• It streamlines the bidding process and shortens period up to Operation.</li> </ul>																								
Demerit	<ul style="list-style-type: none"> <li>• It takes longer time than DBO.</li> <li>• Operator cannot secure quality of construction.</li> <li>• Lifecycle cost is much higher than DBO.</li> <li>• SPC for Sludge Recycle cannot be feasible and no PSIF &amp; T/A (Grant) for the Project. (Sludge recycling contractor shall be the same as WWTP operator from the points of better &amp; sustainable recycling.)</li> </ul>	<ul style="list-style-type: none"> <li>• There is no big change from the standard procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Sludge recycle have to be done completely under ODA process and it needs discussion internally in HPC.</li> <li>• If FS for Sludge recycle is necessary, contractor have to make it and HPC shall make the direct appointment.</li> </ul>																								
Evaluation																											

Project for Yen Xa WWTP ODA-Portion Comparative Table of Project Scheme

Option	Option-1 D-B + O (Public)	Option-2-A D-B + O (Private) (1)	Option-2-B D-B + O (Private) (2)	Option-3 D-B-O (1)	Option-4 D-B-O (2)
Design / Construction	「Design-Bid- Build」 or 「Design-Build」	「Design-Bid- Build」 or 「Design-Build」	「Design-Bid- Build」 or 「Design-Build」	「Design-Build-Operation」 Contract of O&M: <u>less than 5 years</u>	「Design-Build-Operation」 Contract of O&M: <u>around 20 years</u>
O & M	Public (HSDC)	Contract with private company separately ( <u>less than 5 years</u> )	Contract with private company separately ( <u>around 20 years</u> )		
Total Project Cost (20years operation)	1) Design ~ Build = 2) 20years Operation = 3) Renewal =  Total =	1) Design ~ Build = 2) 20years Operation = 3) Renewal =  Total =	1) Design ~ Build = 2) 20years Operation = 3) Renewal =  Total =	1) Design ~ Build = 2) 20years Operation = 3) Renewal =  Total =	1) Design ~ Build = 2) 20years Operation = 3) Renewal =  Total =
Merit	<ul style="list-style-type: none"> <li>It is familiar to HPC because of conventional way.</li> </ul>	<ul style="list-style-type: none"> <li>It is not difficult to change the contract conditions and O&amp;M companies flexibly because of short-term O&amp;M contract.</li> </ul>	<ul style="list-style-type: none"> <li>O&amp;M work from long-term view makes the reduction of life cycle cost.</li> <li>It is expected to trim down the organization because it is not necessary to continue putting in the expert in the public sector.</li> </ul>	Similar to Option-2-A	<ul style="list-style-type: none"> <li>It is possible to consider the construction and long-term O&amp;M from design stage, and the drastic reduction of the life cycle cost is expected due to maximum use of know-how of the private sector.</li> <li>It is possible to shorten the amount of time to completion of construction because the ordering work shall be done only once.</li> </ul>
Demerit	<ul style="list-style-type: none"> <li>It takes time at each stage of design, construction and O&amp;M, and the procedure of bidding and contract is troublesome.</li> <li>Option-1 is existing specification order system, so cost reduction by the idea of private sector is not expected.</li> </ul>	<ul style="list-style-type: none"> <li>O&amp;M company will not maintain the facilities from long-term view, so drastic renewal works will be required.</li> <li>Private sector should check the condition of facilities at every time O&amp;M company changes.</li> <li>Private sector should put in the expert for a long period, so cost reduction from long-term view is not expected.</li> </ul>	<ul style="list-style-type: none"> <li>It is necessary to study the details of contract conditions due to the long-term contract of O&amp;M.</li> </ul>	Similar to Option-2-A	<ul style="list-style-type: none"> <li>It is necessary to study the details of contract conditions due to the very long-term contract of design, construction and O&amp;M.</li> </ul>
Experience	Previous precedents of Hanoi City	Some precedents	No precedent of Yen loan	Some precedents of Yen loan	No precedent of Yen loan

### Implementation Schedule of the Yen Xa Sewerage Project in Hanoi (Option-1,2)

	Month	2008				2009				2010				2011				2012				2013				2014				2015				2016				2017				2018				2019				2020				2021			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV												
(1) Feasibility Study		■																■ Revised FS																																							
(2) Land Acquisition and Resettlement	24																	■	■	■	■	■	■	■	■																																
(3) Funding Arrangement for Project	4																	■																																							
1) Appraisal for Financing	2													■																																											
2) Exchange of notes	1													■																																											
3) Loan Agreement	1													■																																											
(4) Selection of Consultant	6																	■	■	■	■																																				
(5) Detailed Design	30																					■	■	■	■																																
1) Site Survey	16																					■	■	■	■																																
2) Design Works	30																					■	■	■	■																																
3) Preparation of Tender Documents	8																									■	■	■	■																												
(6) Pre-construction Stage	24																					■	■	■	■																																
1) Prequalification	10																					■	■	■	■																																
2) Bidding Period	4																									■	■	■	■																												
3) Evaluation and Signing of Contract	10																									■	■	■	■																												
(7) Construction Stage	93																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																
1) Construction Works (A1, B1)	45																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
1) Construction Works (A2, B2)	36																									■	■	■	■	■	■	■	■	■	■	■	■																				
2) Test Operation	12																													■	■	■	■	■	■	■	■																				
(8) Sludge Recycle Facilities (PPP Project)	84																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
1) Technical Cooperation Project	24																					■	■	■	■																																
2) Selection of Consultant for F/S	6																									■	■	■	■																												
3) Feasibility Study and Appraisal	12																									■	■	■	■																												
4) Selection of Consultant for Preparation of T/D	6																									■	■	■	■																												
5) Preparation of Tender Document	12																									■	■	■	■																												
6) Selection of SPC	12																									■	■	■	■																												
7) Detailed Design	9																									■	■	■	■																												
8) Construction Stage	12																									■	■	■	■																												
(9) Investigation and Recommendation on Tariff Collection System	12																									■	■	■	■																												
(10) Capacity Development Program	81																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
1) Preparation of the Program	6																					■	■	■	■																																
2) Training Program in Overseas (intermittent)	75																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
3) Training in Vietnam (on the job training)	75																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				

### Selection of Consultant and SPC

	Consultant for F/S	Consultant for Tender Document Preparation and C/S	SPC
1	Local Consultant (To be selected by bid)		Private Companies (To be selected by bid)
2	ODA Consultant		Private Companies (To be selected by bid)
3	Local Consultant (appointed by HPC/MPI)		Private Companies (To be selected by bid)
4	Private Companies (direct appointment)		

## Outline of Sludge Recycle Project

### <Investment Cost>

(million US\$)

Items	Solar Drying Bed (Capacity = 54m <sup>3</sup> /day)	Mechanical Sludge Dryer (Capacity = 54m <sup>3</sup> /day)	Total (Capacity = 108m <sup>3</sup> /day)
Initial Cost	13	23	36

\*Initial Cost = Construction Cost + Engineering Fee + Contingency

### <Project Option>

	2013	2014	2015	2016	2017	2018	2019	...	20xx	Initial Cost
<b>Option-A</b> Yen Xa( 270,000m <sup>3</sup> /day) Capacity = 108m <sup>3</sup> /day					↓Beginning treatment Yen Xa sludge					36
					→Amount of sludge = 108m <sup>3</sup> /day					
<b>Option-B</b> Yen So in first Capacity = 108m <sup>3</sup> /day					↓Beginning treatment Yen Xa sludge					36
					↑Beginning treatment Yen So Sludge					

### <Expected Daily Average of Sludge Generation>

WWTP	Sludge Generation (m <sup>3</sup> /day)
Yen Xa	88.2
Yen So	40.3
Bay Mau	4.6
North Thang Long	13.7
Total	146.8
Capacity vs. Total Generation	73%

# 第4回ワーキンググループ資料

(2011年11月11日開催)

## Agenda of Working Group Meeting on 11<sup>th</sup> November, 2011

- (1) Introduction (Fujii)
  - Explanation of Outline of Today's Presentation
  - Confirmation of Several Discussions on Condition of Preparation of ODA Loan for Yen Xa Wastewater Treatment Project
  
- (2) JICA's understanding of the PPP Study and the Projects (Mr. Nagase or Mr. Yamamoto)
  - Procedure of selection of ODA Loan Project
  - ODA Projects attractive to Japanese side
  - Understanding of PPP Study and Advantage of the Study Team Member Companies to Participation of the Project
  
- (3) Approach of the Study (Fujii)
  - Basic Concept of the Study (Maximization of benefits of Vietnamese and Japanese both sides)
  - Outline of Project Scheme proposed by the Study Team
  
- (4) ORIX's Proposal (Mr. Yamamoto, Mr. Sasaki or Mr. Murakami )
  - ORIX's proposal on schedule of the Study
  - Advantage of ORIX participation
  
- (5) Outline of Proposal of Sludge Recycling Facility BOT Project (Mr. Kajiura or Mr. Fujii)
  
- (6) Outline of Proposal for Establishment of Joint Company (Mr. Fujii)
  
- (7) Approach to EPC of Yen Xa Wastewater Treatment Project (Mr. Yamamoto, Mr. Sasaki or Mr. Murakami )

### Attachment

Att.-1: Project Scheme

Att.-2: Implementation Schedule

Att.-3: Draft Proposal of Joint Company and BOT Project

Att.-4: Presentation Material (PPT) of Sludge Recycling Facility

## Introduction

- The Objectives of “PPP Study of Yen Xa WWTP Construction Project” (Study-B) is to promote Entry of Japanese Private Companies (lead by ORIX) to Business of Sewerage Field in Hanoi, in cooperation with HPC and JICA

- Frankly speaking, from commencement of the Study (April, 2011), it has taken so long time for both of Vietnamese and Japanese sides to understand what is required for sewerage system development in the Field of PPP.

- The Main Purpose of Today’s Meeting is to confirm the Possibility of Entry of ORIX Group into Business of “OM of Yen Xa WWTP”, “OM of Ten Xa WWTP” and “BOT of Sludge Recycling Facility”

- If HPC has no intention of doing above Business with ORIX Group, the Study Team had better to stop doing the Study, because any more study is meaningless.

## Approach of the Study

### Basic Concept of the Study:

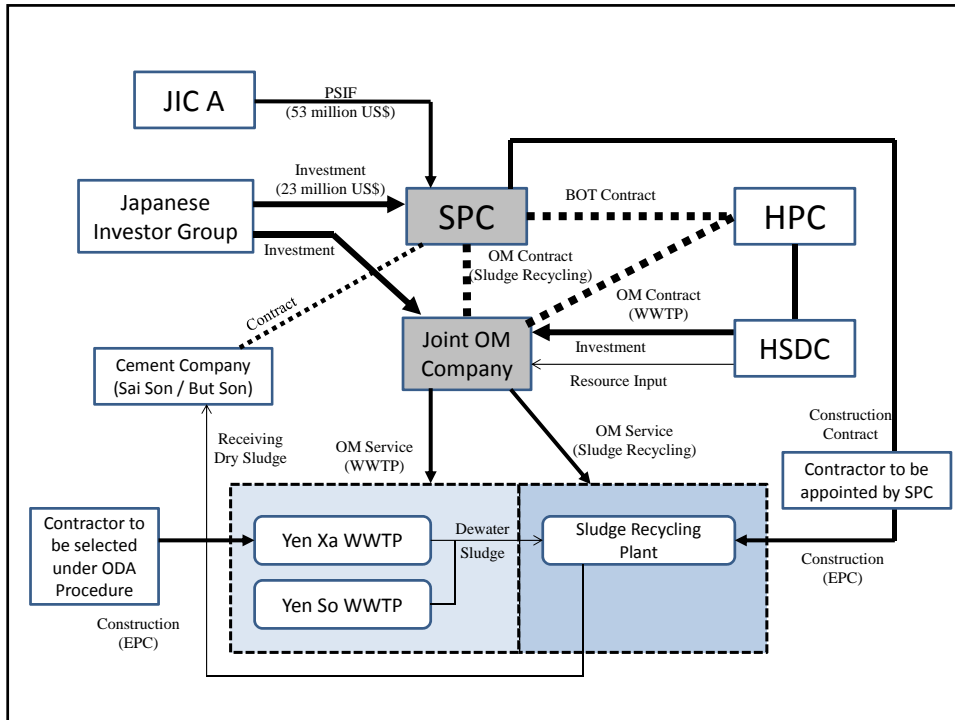
Maximization of Benefit of Both of Vietnamese and Japanese Sides

1. Benefit of Vietnamese Side  
Acquisition of ODA Loan, Reduction of Life Cycle Cost of the Projects, Technical Transfer from Japan, Development of sewerage System in Hanoi, etc
2. Benefit of Japanese Side  
Increase of Business Opportunities of Private Company

### Proposed Project Scheme:

1. Establishment of SPC for BOT Project of “Sludge Recycling Facility” with Japanese Private Companies
2. Establishment of Joint Company for OM of Yen So WWTP, Yen Xa WWTP and Sludge Recycling Facility with Japanese Private Companies





### Project Component and Selection of Companies for Construction and OM

	Construction Company	OM Company
1) Pipe Network	<u>Contractor to be selected by Open tender under ODA procedure</u>	<u>HSDC</u>
2) Yen Xa WWTP	<u>Contractor to be selected by Open tender under ODA procedure</u>	<u>Joint Company</u>
3) Sludge Recycling Facility		<u>SPC to be selected by procedure of BOT law</u>

## Proposal of Japanese Private Company Participation

	Construction Stage	OM Stage
Yen So WWTP	(already constructed)	<b>Joint Company</b> to be established by HPC/HSDC and <b><u>Japanese Private Company</u></b>
Yen Xa WWTP	Contractor to be selected by Open Tender (Same <b><u>Japanese Private Company</u></b> is preferable)	
Sludge Recycling Facility	Contractor to be appointed by <b>SPC</b> , which will be established by <b><u>Japanese Private Company</u></b>	

## Establishment of Joint Company

### Initial Stage:

JC will carry out operation and maintenance works for the following plants and facility;

- OM of Yen So WWTP
- OM of Yen Xa WWTP
- OM of Sludge Recycling Facility

### Development Stage:

- OM of other WWTP in Hanoi
- OM of WWTP in other municipalities
- Training service and engineering service for other municipalities
- Construction works

### Alternatives of Share of Joint Company for Discussion

Option	VN : JP	Remarks
1	35 : 65	Japanese side has majority (Around 10 years later, Japanese share will be reduced to minority)
2	51 : 49	Vietnamese side has power to appoint legal representative of the company, and Japanese side has power of dismiss.
3	65 : 35	Vietnamese side has majority Certain important issue shall be to subject to agreement of Japanese side. Japanese side shall have right to appoint a half of BOM members.

### Draft Schedule of Establishment for Discussion

#### January 2012

Preliminary Agreement on Establishment of JC

#### **March 2012**

Signing on Term Sheet to Decide Important Conditions  
(Appointment of Partner)

#### June 2012

Signing on Joint Venture Agreement, Charter, and OM  
Service Agreement

#### July 2012

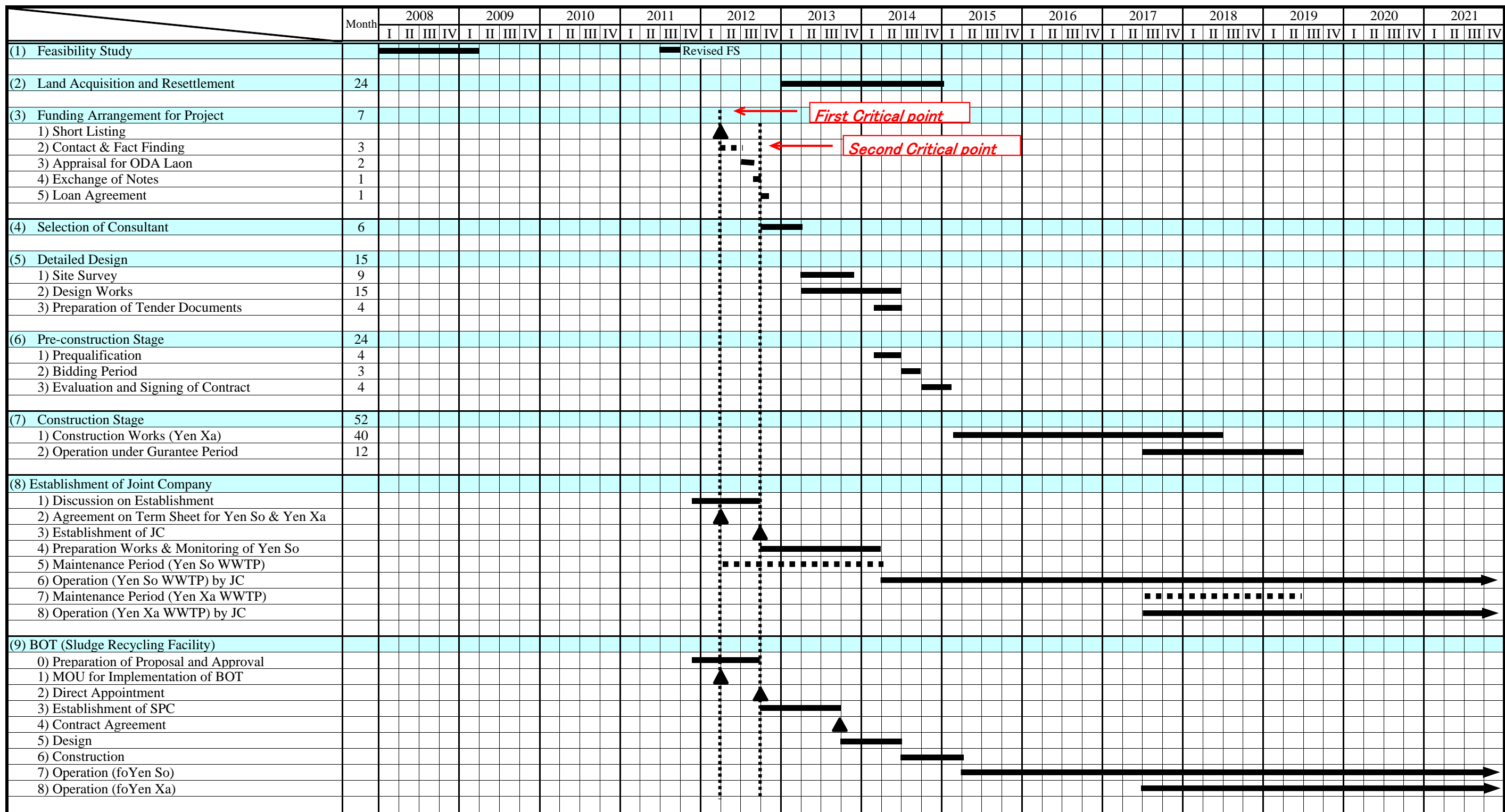
Submission of Application for Business Registration and  
Investment Certificate to HAPI

#### **August 2012**

Issuance of Business Registration and Investment  
Certificate by HPC (Establishment of Joint Company)

## **QUESTIONS**

- 1) How will you select partners of the **Joint Company**? (Could you give a direct appointment to ORIX or NOT?)
- 2) How do you select operators of **Yen So WWTP** and **Yen Xo WWTP**? (Could you give a direct appointment to the Joint Company or NOT?)



## Draft Proposal of Joint Company and BOT Project

## (1) Project Scheme and Selection of Construction and OM Companies

The Project of Yen Xa Wastewater Treatment Plant includes the constructions of 1) Pipe Network, 2) Yen Xa Wastewater Treatment Plant and 3) Sludge Recycling Facility. It is proposed that the structures will be constructed and operated by the following companies;

Table 1-1 Selection Method of Construction and OM Companies

	Construction Company	OM Company
1) Pipe Network	<b>Contractor to be selected by Open tender under ODA procedure</b>	<b>HSDC</b>
2) Yen Xa WWTP		<b>Joint Company</b>
3) Sludge Recycling Facility	<b>SPC to be selected by procedure of BOT law (Joint Company will have OM sub-contract)</b>	

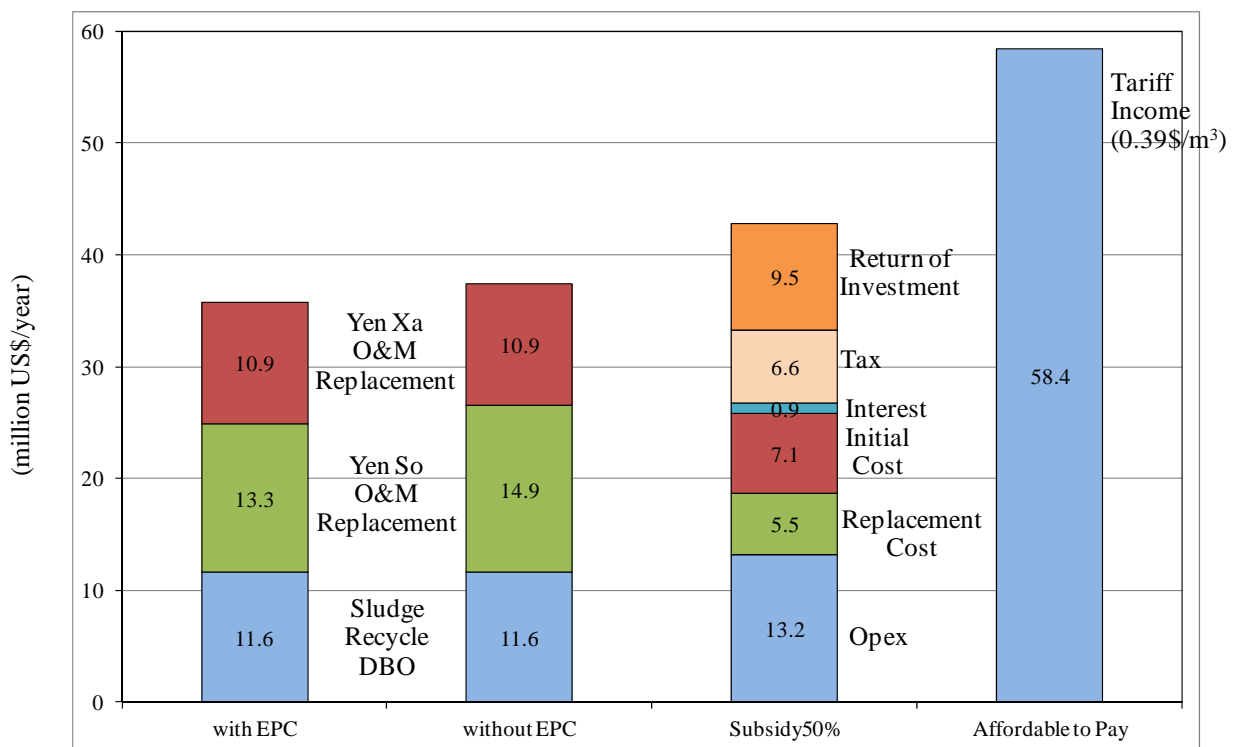
To give advantage to the Yen Xa WWTP Project for selection of ODA loan project, it is recommendable that Japanese private company will participate in OM of Yen Xa WWTP and BOT project for Sludge recycling facility. As the conclusion of the Study so far, the Study Team propose the Project Scheme as shown in Attachment-1, and propose Japanese companies participation as shown in Table 1-2.

Table 1-2 Proposal of Japanese Private Company Participation

	Construction Stage	OM Stage
Yen So WWTP	(already constructed)	<b>Joint Company to be established by HPC/HSDC and <u>Japanese Private Company</u></b>
Yen Xa WWTP	Contractor to be selected by Open Tender (Same <b><u>Japanese Private Company</u></b> is preferable)	
Sludge Recycling Facility	Contractor to be appointed by <b>SPC</b> , which will be established by <b><u>Japanese Private Company</u></b>	

The service charge of above works is roughly estimated as shown in Figure 1-1. It can be mentioned as below;

- The total service charge is estimated at 37.4 million US\$/year (without EPC)
- The total service charge is less than expected sewerage tariff income, which is calculated based on consideration of Affordable to Pay for residents in Hanoi (3% of household income).
- Comparing with the case 50% subsidy (50% supported by ODA loan), the total service charge is much cheaper.
- If EPC is carried out by same company (ORIX), the service charge could be reduced.



## **(2) Proposal of Establishment of JOINT COMPANY**

### 1) Necessity

It is preferable that one organization will carry out operation and maintenance of Yen So WWTP, Yen Xa WWTP and sludge recycling facility, because each operation works are closely related. In addition, high technical skill and knowledge are required for the overall operation and maintenance, so that it is proposed for HPC/HSDC to establish Joint OM Company with Japanese private companies, which have enough technical and financial skills.

The tasks of Joint Company is planned to do not only OM of WWTPs and sludge recycling facilities in Hanoi, but be developed to the field of engineering service, training service and construction works, by using their own technical skill and knowledge to be gotten.

### 2) Contents of Service of Joint Company

Initial Stage:

JC will carry out operation and maintenance works for the following plants and facility;

- OM of Yen So WWTP (Operation from 2018, Total capacity: 190,000 m<sup>3</sup>/day)
- OM of Yen Xa WWTP (Operation from 2014, Total capacity: 270,000 m<sup>3</sup>/day)
- OM of Sludge Recycling Facility (Operation from 2016, Total capacity: 237 m<sup>3</sup>/day of sludge)

Development Stage:

- OM of other WWTP in Hanoi
- OM of WWTP in other municipalities
- Training service and engineering service for other municipalities
- Construction works

### 3) Proposed Schedule of Establishment of Company

In order to have Loan Agreement of Yen Xa WWTP Construction Project in September, 2012, the following schedule shall be followed;

January 2012	Preliminary Agreement on Establishment of JC
March 2012	Signing on Agreement on Term Sheet to Decide Important Conditions (Appointment of Partner)
June 2012	Signing on Joint Venture Agreement, Charter, and OM Service Agreement
July 2012	Submission of Application for Business Registration and Investment Certificate to HAPI
August 2012	Issuance of Business Registration and Investment Certificate by HPC (Establishment of Company)



4) Rough Estimate of Service Charge

The charges for OM service are tentatively calculated as below:

Amount to be charged to HPC

- OM of Yen Xa WWTP (15.2 million US\$/year, 0.202 US\$/m<sup>3</sup>)
- OM of Yen So WWTP (11.1 – 14.5million US\$/year, 0.161 – 0.202US\$/m<sup>3</sup>)

Amount to be charged to SPC

- Sludge Recycling Facility の OM (3.2 million US\$/year, 40 US\$/m<sup>3</sup>)

Total service charge 31 – 35 million US\$ /year

Benefit around 1.6 – 1.8million US\$/year (5% of service charge)

5) Share of Equity (Vietnamese and Japanese)

Required equity of the JC is tentatively estimated at 1.8 million US\$, and several alternatives of share are proposed for discussion as below:

Option	VN : JP	Remarks
1	35 : 65	Japanese side has majority (Around 10 years later, Japanese share will be reduced)
2	51 : 49	Vietnamese side has power to appoint legal representative of the company, and Japanese side has power of dismiss.
3	65 : 35	Vietnamese side has majority Certain important issues shall be subject to agreement of Japanese side. Japanese side shall have right to appoint BOM members

Remarks;

VN: HPC/HSDC, JP: Japanese company group lead by ORIX

6) Participants of the Project

HPC (HSDC on behalf of HPC) will establish Joint Company with Japanese partners. If HPC select ORIX as a partner, Orix will be in charge of financial arrangement and arrangement of participants of Japanese other companies to the Joint Company.

### **(3) Proposal for Sludge Recycling Project (BOT)**

#### 1) Necessity of the Project

- It is required to reduce amount of landfill waste of dewatered sludge from WWTPs.
- It is required to reduce required scale of new landfill site (solid waste disposal site)
- It is required to utilize resource (sludge) effectively

#### 2) Necessity and advantage of implementation in the form of BOT

- The lifecycle cost of the Project could be minimized. In the form of BOT, the SPC (which is established for the purpose of the Project) will try to minimize lifecycle cost of the Project, because the SPC is required to carry out design, construction, operation and maintenance as a package, so that the SPC will consider effective operation and maintenance from design stage.
- The latest technology and know-how for sludge recycling could be introduced by Japanese Private company.
- The initial investment cost could be provided by Japanese private company (the SPC). (HPC don't need to do financial arrangement for the Project.)

#### 3) Contents of Service

The services of the BOT Project are considered as below;

- To make drying 237 m<sup>3</sup>/day of dewatered sludge, which are generated from WWTPs in Hanoi
- To reduce volume of sludge: 237 m<sup>3</sup>/day of dewater sludge (80% moisture contents) to around 60 m<sup>3</sup>/day of dry sludge (10% of moisture contents)
- To provide suitable dry sludge to cement companies as an alternative fuel of coal
- To provide reaming dry sludge for gardening of public green space, if all the dry sludge cannot be used in cement factories.

However, step wised development plan will be considered in later stage.

If all amount of dry sludge to be provided by the SPC cannot be used in the cement companies and the gardening under effort of the SPC with HPC support, HPS shall consider receiving reaming amount of dry sludge. It can be used for construction material in construction works in Hanoi. HPC shall consider providing new law for promotion of recycling of dry sludge.

#### 4) Principal Feature of Facility and Technical

(Please see Attachement-4)

5) Service Charge

- Service Charge to HPC (11.1 million US\$/year, 138 US\$/m<sup>3</sup>)
- OM cost to be charged from Joint Company (3.2 million US\$/year, 40 US\$/m<sup>3</sup>)

6) Equity and Share

Construction Cost:	64 million US\$
Required Fund:	76 million US\$
Equity (30%) :	23 million US\$
Debt: PSIF (70%) :	53 million US\$

As for share of equity, ORIX will has major portion, and some Japanese companies will have remaining.

7) Consideration of Schedule and Form of Investment

It seems to take more than one year to get approval of the BOT project and make a contract with an investor for the BOT project. It means the investor can hardly be selected before September, 2012, even before March, 2013 (which is expected month for the Loan Agreement). In order to have Loan Agreement of Yen Xa WWTP Construction Project in September, 2012, it may be required to have MOU between Vietnamese and Japanese sides, which shows condition of BOT bidding with something like Japanese tied bidding.

The Study Team is considering the possibility of adopting FDI (Foreign Direct Investment) also for the sludge recycling facility project.

# Sludge Recycling Facilities (BOT)

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November 11<sup>th</sup>, 2011

1

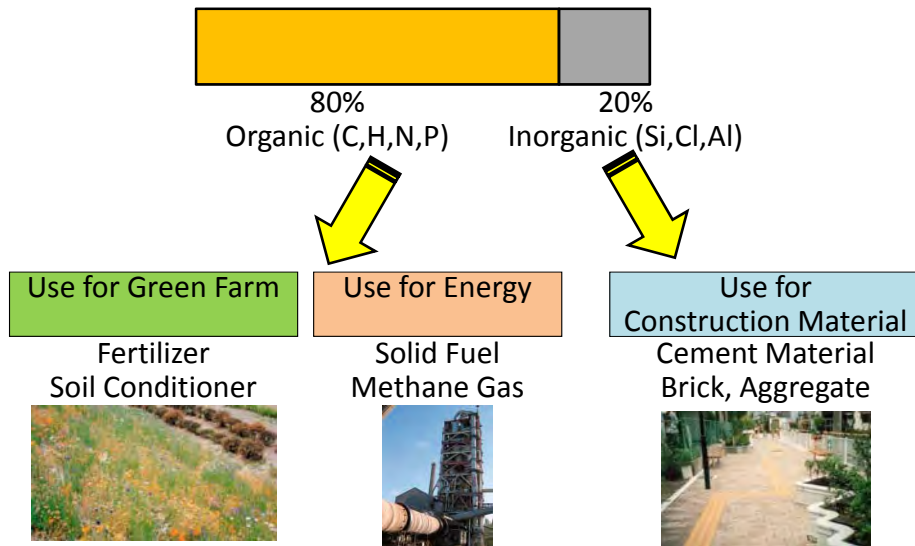
## (1) Necessity of Sludge Recycle

- Large amount of sludge will be generated from new construction WWTPs (Yen So, Yen Xa), and they are to be disposed to landfill sites.
- Capacities of landfill sites are very limited in Hanoi.
- It is required to reduce and recycle these sludge.

2

## (2) Introduction of Sludge Recycle Method

Sewage Sludge components can be used.



(Source: Ministry of Land, Infrastructure, Transport and Tourism, Japan)

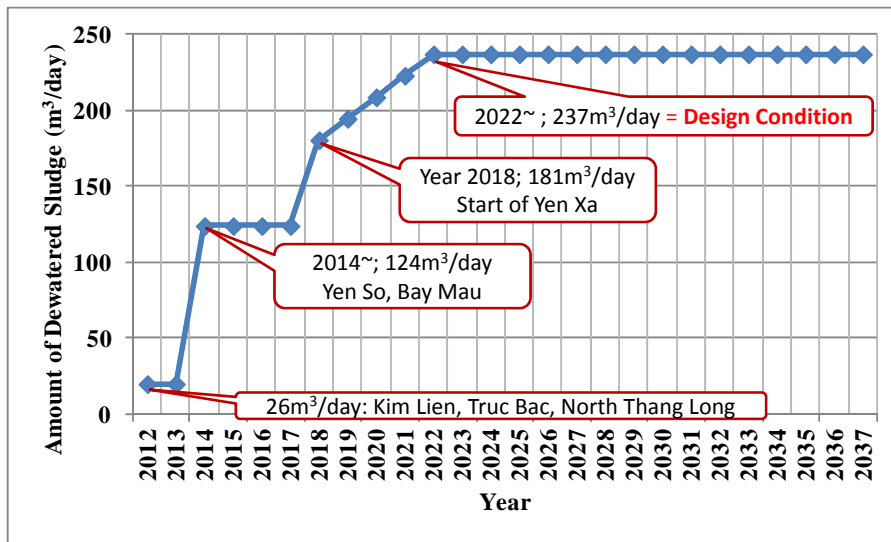
3

## (3) Potential Demand of Sludge

	Power Company	Cement Company	Floriculturist
Consumption of Coal or fertilizer	4100t/day (1,500,000t/year)	950t/day (350,000t/year)	20t/day (7,000t/year)
Potential Demand	205t/day (75,000t/year) (5% Alternate Fuel)	51t/day (18,600t/year) (5% Alternate Fuel)	32t/day (11,600t/year) (50% Alternate Nitrogen of Fertilizer)

4

### (4) Amount of Dewatered Sludge in Hanoi



5

### (5) Needs Survey of Sewage Sludge Products

	Power Company	Cement Company	Floriculturist
Current Situation & Interest	They have high interest in environmental problems.	It is difficult to procure enough coal because coal demand of China is rapidly increasing. So they have high interest in alternate fuel.	They are used to buy fertilizers from fertilizer companies. They are interested in the material leads to higher productivity.
Opinion	It is too early to use sewage sludge as a alternate fuel. It is necessary to do F/S and demonstration experiment under the Ministry of Industry.	If sludge products have acceptable quality, they can consider using sludge products proactively.	If sludge products have an advantage, they intend to try to use them. One of the floriculturist has also interested in the demonstration test in his field.
Evaluation	<b>Not recommendable</b> (Considerable for future use)	<b>Recommendable</b> as most stable consumer	<b>Recommendable as sub-consumers,</b> if sludge products have acceptable quality.

6

## (6) Specification of Sludge Products

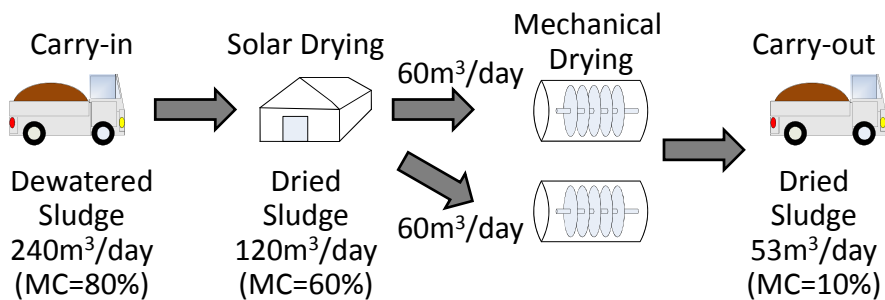
Request from Cement Companies

Item	Condition	Situation
Moisture Content	Less than 10%	Possible to be made by Mechanical Drying
Calorific Value	More than 3,000kcal/kg	Supposed to be acceptable at the existing Data. (Future confirmation required)
Exhaust Gas	Meet the Exhaust Standard	Now under testing in Butson Cement

7

## (7) Sludge Drying Process

Hybrid Process of Solar Drying & Mechanical Drying

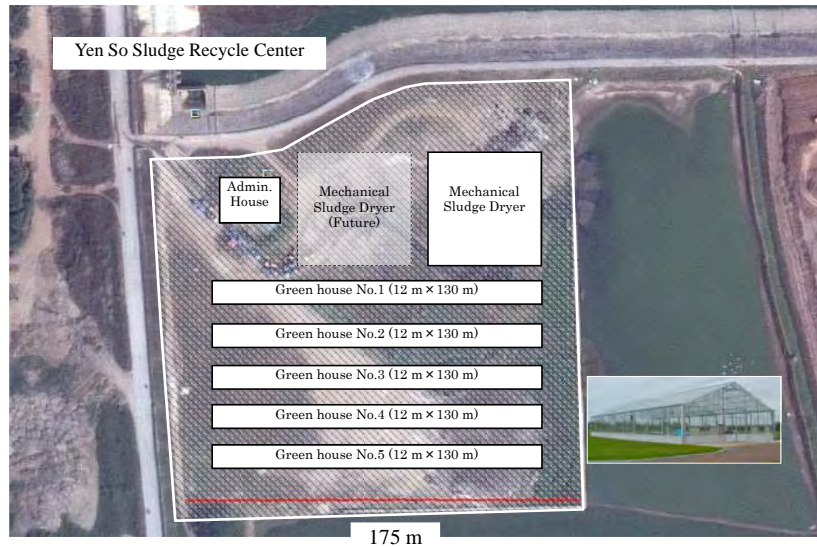


Process	Merit	Demerit
1) Solar Drying	Lowest cost, Save energy	Impossible to make MC=10%
2) Mechanical Drying	No need for extensive site	More expensive
3) Hybrid (Solar & Mechanical)	Save energy, Low cost	Little bit difficult O&M
4) Carbonization	No need for extensive site	Most expensive

(MC: Moisture Content)

8

### (8) Layout Plan of Sludge Drying Facilities



9

### (9) Outline of Cement Companies

Item	Butson Cement Joint Stock Company	Saison Cement Joint Stock Company
Amount of Cement Production	3,000,000t/year	300,000t/year
Coal Consumption	900t/day	120t/day
Main Share Holder	Vietnam Cement Industry Corporation: 75% Asian Commercial Bank: 10% Others: 15%	State Capital Investment Corp.: 17% General Director: 10% Others: 73%

10

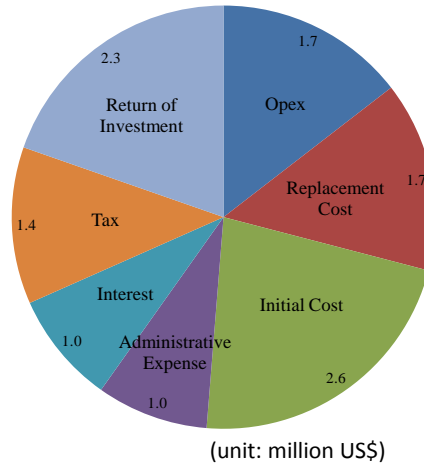


### (10) Investment Cost and Service Charge

Investment Cost

Item	Cost (million US\$)
EPC (Civil Works)	14.4
EPC (Mechanical, Electrical)	38.9
Contingency	5.3
Tax	5.9
<b>Total</b>	<b>64.5</b>

Annual Service Charge (Total:11.6million US\$)



11

Thank you for your attention

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# 第5回ワーキンググループ資料

(2012年1月10日開催)

## **Agenda of Working Group Meeting on 10<sup>th</sup> January, 2012**

### (A) Issue of Joint Company Establishment (M. FUJII, NK)

- 1) Working Staff (See Attachment-1)
- 2) Working Progress and Schedule (See Attachment-2)

### (B) Issue of BOT for Sludge Recycling Center

- 1) Confirmation of Major Points of Proposal in Interim Report (See Interim Report and Attachment-3) (M. Fujii, NK)
- 2) Outline of the Proposed BOT Project (See Attachment-4) (T. Kajiura, NK)
- 3) Sludge Recycling in Cement Industry (See Attachment-5) (Terunuma, Mitsubishi)
- 4) Remaining Issues to be solved (See Attachment-6&7) (Y. Inoue/M. Fujii, NK)

### (C) Questions and Answers

- 1) Comments on the Interim Report
- 2) Questions and Answers on Presentation of the Meetings

Attachment-1	List of Working Staff (prepared)
Attachment-2	Schedule for Establishment of Joint Company (prepared)
Attachment-3	Schedule of BOT Project (prepared)
Attachment-4	Outline of the Proposed BOT Project (to be prepared by Mr. Kajiura)
Attachment-5	Sludge Recycling in Cement Industry (to be prepared by Mr. Y. Inoue)
Attachment-6	Remaining Issues to be solved (to be prepared by Mr. Y. Inoue and M. Fujii)
Attachment-7	Draft of MOU (to be prepared by Dr. Islam and M. Fujii)

## **APPENDIX-1**

### **List of Working Staff (Japanese side) for Establishment of Joint Company with HSDC**

Position	Name
1) Team Leader	Tomoyuki SASAKI (ORIX)
2) Sub Team Leader	Yosuke MURAKAMI (ORIX)
3) Advisor	Kenichi YAMAMOTO (ORIX)
4) Financial Issue	Takahiko INOUE (PWC)
5) Personnel Issue	Tomoyuki SASAKI (ORIX)
6) Institutional Issue (Law, Regulation)	Yoshiki TSUCHIDA (ORIX)
7) Technical Issue	Masayuki FUJII (NK)

## **APPENDIX-2**

### **Tentative Schedule of Establishment of Joint Company (In case of the Loan Agreement in September 2012)**

January 2012	Preliminary Agreement on Establishment of JC
March 2012	Signing on Term Sheet to decide Important Conditions (Appointment of Partner)
June 2012	Signing on Joint Venture Agreement, Charter, and O&M Service Agreement
July 2012	Submission of Application for Business Registration and Investment Certificate to HAPI
August 2012	Issuance of Business Registration and Investment Certificate by HPC (Establishment of Joint Company)

### APPENDIX-3

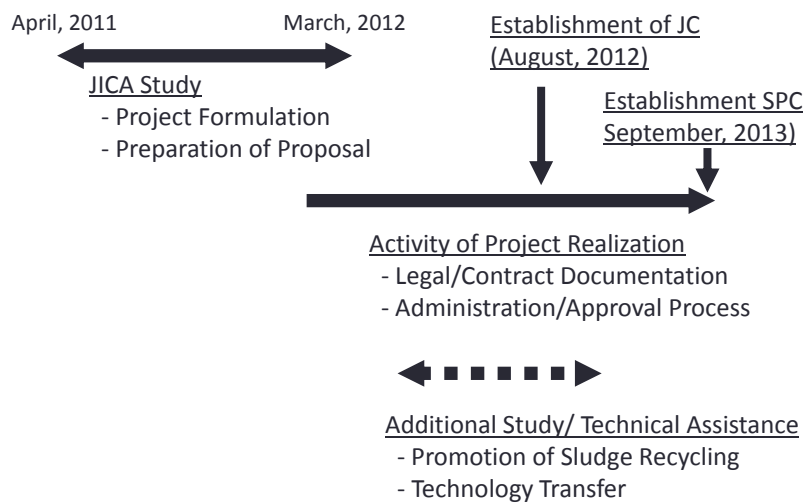
#### **Tentative Schedule of BOT Project**

January 2012	Preparation of Preliminary Proposal of BOT Project
March 2012	MOU for Selection of Investor of BOT Project (Japan Tied?)
March 2012	Preparation of Proposal of BOT Project
September 2012	Approval of Proposal of BOT Project by Prime Minister's Office
October 2012	Selection of Investor of BOT Project
August 2013	Submission of Application for Business Registration and Investment Certificate to HAPI
September 2013	Issuance of Business Registration and Investment Certificate by HPC (Establishment of SPC)
September 2013	Commencement of Feasibility Study
September 2014	Approval of Feasibility Study
September 2014	Commencement of Detailed Design
January 2015	Commencement of Construction

## WORKING GROUP MEETING (10<sup>TH</sup> JANUARY 2012)

Material for Explanation

### (A) Activities up to Establishment of JC and SPC



## (B) Establishment of Joint Company

The negotiation has been carried out between HSDC and the Proponent of ORIX Group, since December 2012.

### List of Working Staff (Japanese side) for Establishment of Joint Company with HSDC

Position	Name
1) Team Leader	Tomoyuki SASAKI (ORIX)
2) Sub Team Leader	Yosuke MURAKAMI (ORIX)
3) Advisor	Kenichi YAMAMOTO (ORIX)
4) Financial Issue	Takahiko INOUE (PWC)
5) Personnel Issue	Tomoyuki SASAKI (ORIX)
6) Institutional Issue (Law, Regulation)	Yoshiki TSUCHIDA (ORIX)
7) Technical Issue	Masayuki FUJII (NK)

### Tentative Schedule of Establishment of Joint Company (In case of the Loan Agreement in September 2012)

January 2012	Preliminary Agreement on Establishment of JC
March 2012	Signing on Term Sheet to decide Important Conditions (Appointment of Partner)
June 2012	Signing on Joint Venture Agreement, Charter, and O&M Service Agreement
July 2012	Submission of Application for Business Registration and Investment Certificate to HAPI
August 2012	Issuance of Business Registration and Investment Certificate by HPC (Establishment of Joint Company)

## (C) BOT Project

### Tentative Schedule of BOT Project

January 2012	Preparation of Preliminary Proposal of BOT Project
March 2012	MOU for Selection of Investor of BOT Project
March 2012	Submission of Proposal of BOT Project
June 2012	Approval on addition to national BOT Project List by relevant ministries
September 2012	Selection of Investor of BOT Project (Direct Appointment)
August 2013	Submission of Application for Business Registration and Investment Certificate to HAPI
September 2013	Issuance of Business Registration and Investment Certificate by HPC (Establishment of SPC)
September 2013	Commencement of Feasibility Study
September 2014	Approval of Feasibility Study
September 2014	Commencement of Detailed Design
January 2015	Commencement of Construction

4

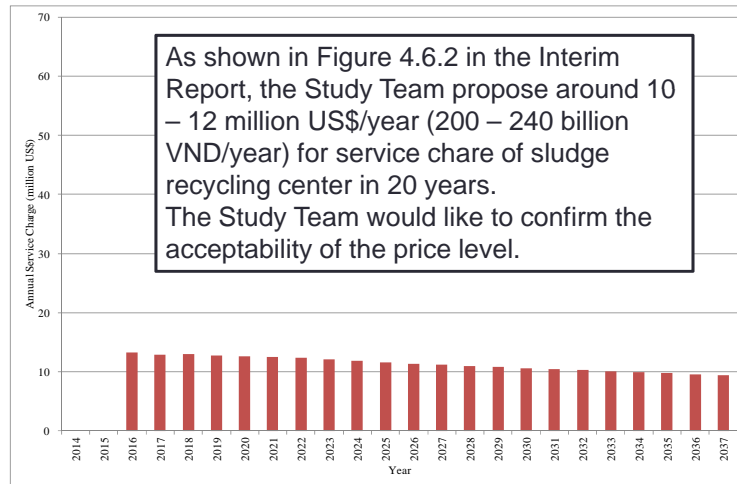
## Major Issues to be solved on BOT Project Formulation

- 1) Confirmation of Acceptable Service Charge**  
**Feasibility of BOT Project depends on level of service charge for sludge recycling**
- 2) Confirmation of End Use of Dry Sludge**  
**Sustainability of the sludge recycling depends on efficient and effective end use of dried sludge**

5



## (C-1) Level of Service Charge



Service Charge to be paid by HPC for BOT of Sludge Recycling facility

6

## (C-2) End Use of Dry Sludge

The study for end use of the dry sludge has been carried out. The issue shall be solved for realization of the BOT Project

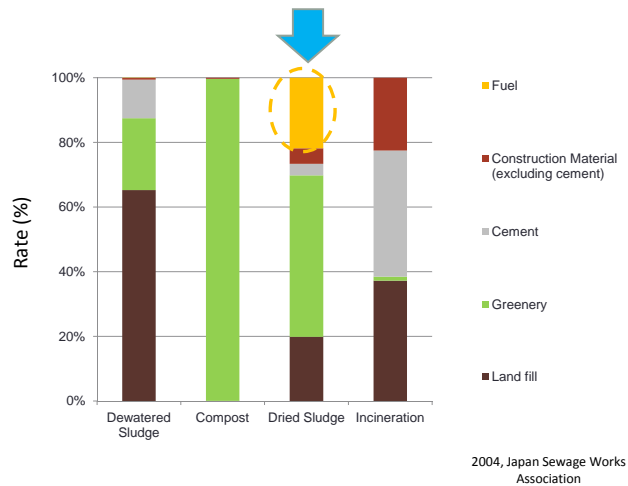
### Potential Demand of Dry Sludge in Hanoi

	Power Company	Cement Company	Greenery
Consumption of Coal or fertilizer	4,100t/day (1,500,000t/year)	1,040t/day (380,000t/year)	20t/day (7,000t/year)
Potential Demand	205t/day (75,000t/year) (5% Alternate Fuel)	52t/day (18,900t/year) (5% Alternate Fuel)	32t/day (11,600t/year) (50% Alternate Nitrogen of Fertilizer)

Planning Dry Sludge Generation: 39ton/day

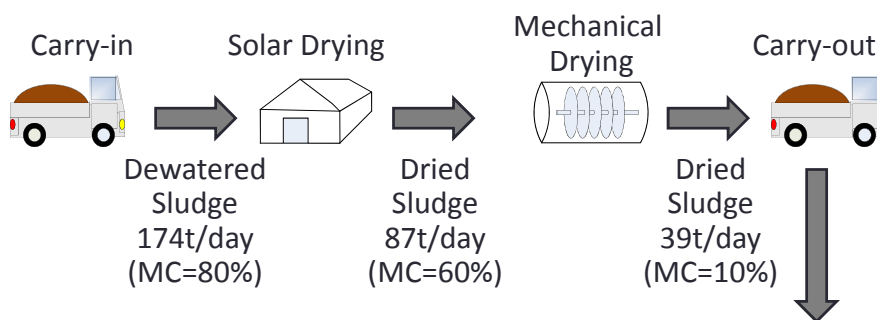
7

## Percentage of End Use Method in Japan after Sludge Treatment



2

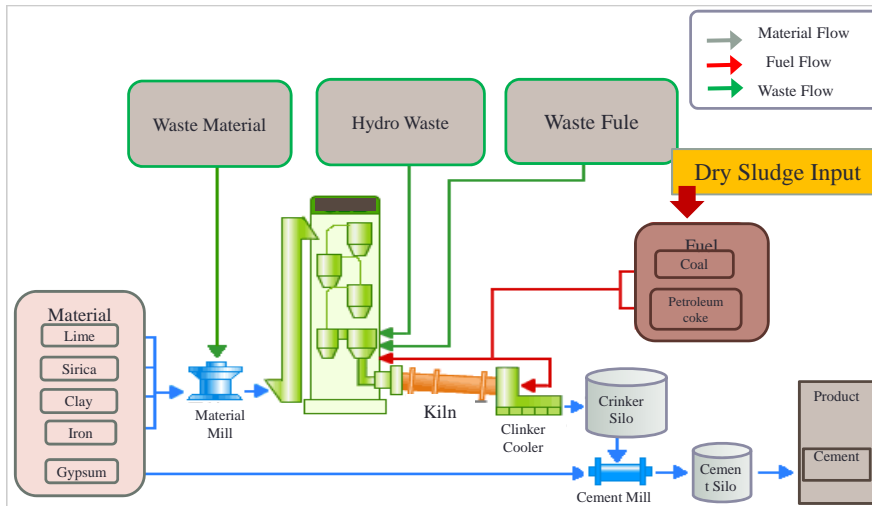
## 1) Proposed Sludge Drying Process under the BOT Project



- The cement companies are expected to be the major consumer of the dry sludge.
- Greenery could be another end user. (It could be managed easier under HPC. But the potential demand is limited.)

9

## 2) Proposed End Use of Dry Sludge in Cement Factory



However, there is still no agreement with cement company

Completed

5

## Outline of Cement Companies

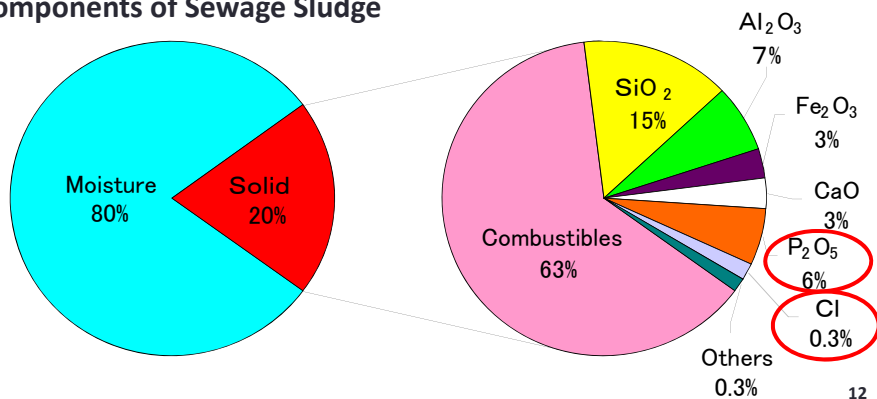
Item	Butson Cement Joint Stock Company	Saison Cement Joint Stock Company
Amount of Cement Production	3,000,000t/year	350,000t/year
Coal Consumption	900t/day	140t/day
Main Share Holder	Vietnam Cement Industry Corporation: 75% Asian Commercial Bank: 10% Others: 15%	State Capital Investment Corp.: 17% General Director: 10% Others: 73%

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## Potential Problem caused by Dry Sludge input to Cement Factory

- 1) Offensive Impact of Cl to Cement Production Facilities
- 2) Offensive Impact of  $P_2O_5$  to Quality of Cement Production
- 3) Offensive Impact caused by Lack of Uniformity of Fuel Calorie  
(Normal coal: 6,300 kcal/kg , Dry Sludge : 3,000 kcal/kg)

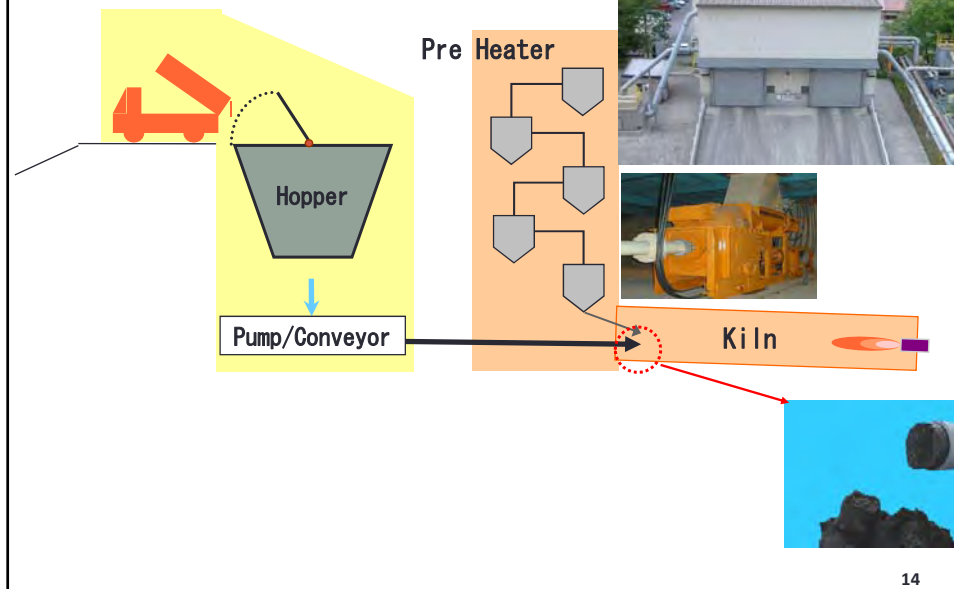
### Components of Sewage Sludge



## Solution of Potential Problem

- 1) Offensive Impact of Cl  
Considering experience in Japan, the input amount of the Dry Sludge is recommended less than 2% of cement production amount, in order to avoid offensive impact. (It is equivalent to about 20 % of coal consumed in cement factory. The Study Team proposed only 5% )
- 2) Offensive Impact of  $P_2O_5$   
Considering experience in Japan, the input amount of the Dry Sludge is proposed less than 15% of cement production amount, in order to void offensive impact.
- 3) Lack of Uniformity of Fuel Calorie  
Suitable mixture of coal and dry sludge is very important for stable burning for suitable operation of cement production system. It is required to install a mixture facility in cement factory.

## Sample of Sludge Mixture Facility



## Issue to be solved in Short Term

- 1) Agreement of dried sludge use in cement industry on;
  - i) How to install a mixture facility of dry sludge and coal
  - ii) Free or charge of receiving of dry sludge
  - iii) Capacity building on operation process
- 2) Confirmation of real demand of greenfly use by HPC construction projects

## Activities to promote sludge recycling

- Policy making of public work sector in order to address global environmental issues/ carbon reduction
- Institutional system development of eco-product use in order to solve concerns of cement factory

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## Addressing the Issues

- The issues must be solved for smooth realization of the BOT scheme for the Sludge Processing Center
- HPC can seek Japanese technical cooperation project to address this issue

### Expected components of Technical Cooperation Project on Promotion of Sewage Sludge Reuse

- Sludge fuel use technology in cement factory
- Capacity building on operation process
- Institutional mechanism of Eco-product use/ carbon reduction

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## Target Scenario in Long Term

- Development of multi user market for dried sludge to ensure fail safe end use (Power plant could be large consumer.)
- Public awareness for social better acceptance
- Policy to reward the end users by branding them as green companies

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## Achievement of the Target Scenario in Long Term

- Policy for renewable energy use
- Public awareness campaign
- Certification for eco-product reuse promotion

サカイカンピ  
(つぶつぶくん)



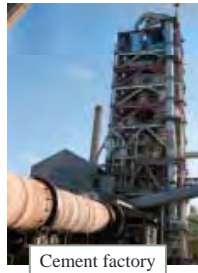
Dried sludge



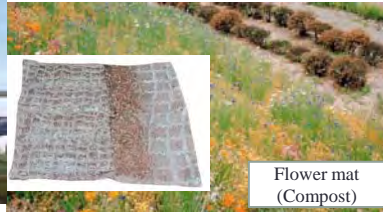
Eco mark



Pavement (Mortar block)



Cement factory



Flower mat  
(Compost)

# Sludge Recycling Facilities (BOT)

---

January 10<sup>th</sup>, 2012

1

## (1) Necessity of Sludge Recycle

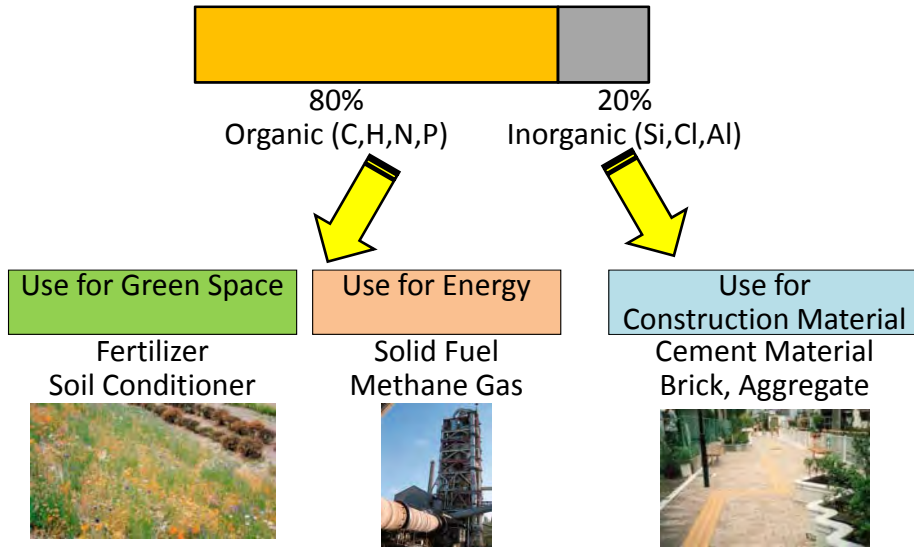
- Large amount of sludge will be generated from new construction WWTPs (Yen So, Yen Xa), and they are to be disposed to landfill sites.
- Capacities of landfill sites are very limited in Hanoi.
- It is required to reduce and recycle these sludge.

2



## (2) Introduction of Sludge Recycle Method

Sewage Sludge components can be used.



(Source: Ministry of Land, Infrastructure, Transport and Tourism, Japan)

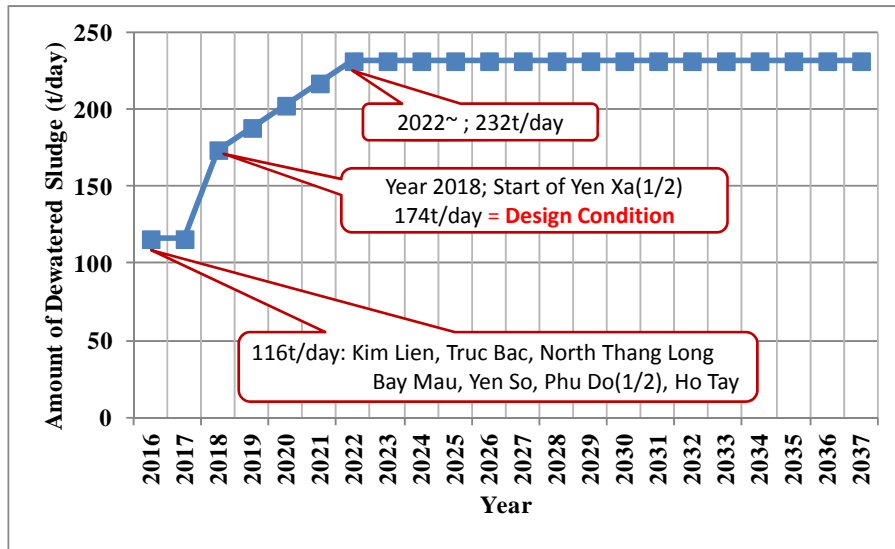
3

## (3) Potential Demand of Sludge

	Power Company	Cement Company	Floriculturist
Consumption of Coal or fertilizer	4,100t/day (1,500,000t/year)	1,040t/day (380,000t/year)	20t/day (7,000t/year)
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4

### (4) Amount of Dewatered Sludge in Hanoi



5

### (5) Needs Survey of Sewage Sludge Products

	Power Company	Cement Company	Floriculturist
Current Situation & Interest	They have high interest in environmental problems.	It is difficult to procure enough coal because coal demand of China is rapidly increasing. So they have high interest in alternate fuel.	They are used to buy fertilizers from fertilizer companies. They are interested in the material leads to higher productivity.
Opinion	It is too early to use sewage sludge as a alternate fuel. It is necessary to do F/S and demonstration experiment under the Ministry of Industry.	If sludge products have acceptable quality, they can consider using sludge products proactively.	If sludge products have an advantage, they intend to try to use them. One of the floriculturist has also interested in the demonstration test in his field.
Evaluation	<b>Not recommendable</b> (Considerable for future use)	<b>Recommendable</b> as most stable consumer	<b>Recommendable as sub-consumers,</b> if sludge products have acceptable quality.

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## (6) Specification of Sludge Products

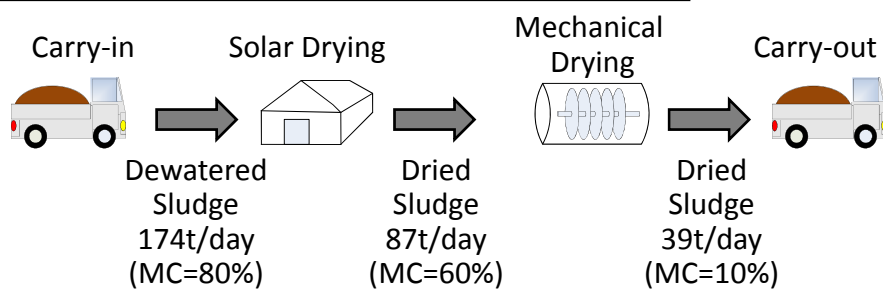
Request from Cement Companies

Item	Condition	Situation
Moisture Content	Less than 10%	Possible to be made by Mechanical Drying
Calorific Value	More than 3,000kcal/kg	Supposed to be acceptable at the existing Data. (Future confirmation required)
Exhaust Gas	Meet the Exhaust Standard	Now under testing in Butson Cement

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## (7) Sludge Drying Process

Hybrid Process of Solar Drying & Mechanical Drying

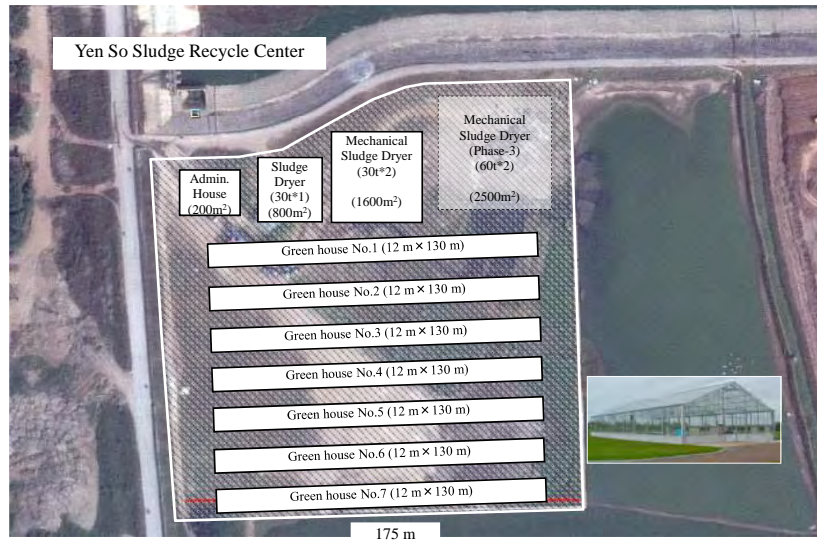


Process	Merit	Demerit
1) Solar Drying	Lowest cost, Save energy	Impossible to make MC=10%
2) Mechanical Drying	No need for extensive site	More expensive
3) Hybrid (Solar & Mechanical)	Save energy, Low cost	Little bit difficult O&M
4) Carbonization	No need for extensive site	Most expensive

(MC: Moisture Content)

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### (8) Layout Plan of Sludge Drying Facilities



### (9) Outline of Cement Companies

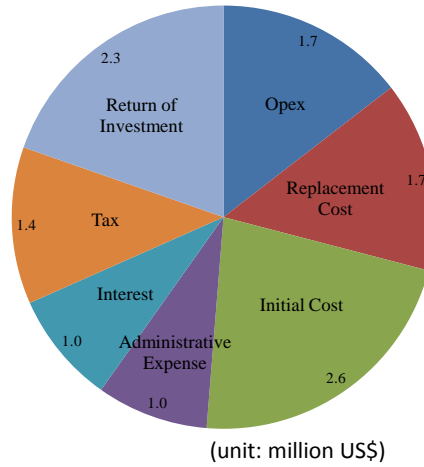
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Coal Consumption	900t/day	140t/day
Main Share Holder	Vietnam Cement Industry Corporation: 75% Asian Commercial Bank: 10% Others: 15%	State Capital Investment Corp.: 17% General Director: 10% Others: 73%

## (10) Investment Cost and Service Charge

Investment Cost

Item	Cost (million US\$)
EPC (Civil Works)	14.4
EPC (Mechanical, Electrical)	38.9
Contingency	5.3
Tax	5.9
<b>Total</b>	<b>64.5</b>

Annual Service Charge (Total:11.6million US\$)



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Thank you for your attention

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ワークショップ資料

(2011年7月13日開催)

*13 July 2011*

**PPP – Work Shop Document**

**1) Public-Private-Partnerships (PPPs)**

**Mô hình đối tác Công – Tư (PPP)**

**JICA Study Team**

**(Study B)**

www.pwc.com

# ***Public-Private-Partnerships (PPPs)***

July 13, 2011

PricewaterhouseCoopers Co., Ltd.

**pwc**

Strictly Private and Confidential

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## ***Contents***

1. Definition of PPP
2. Why PPP?
3. Development of PPPs in Global Market
4. Different Types of PPP Schemes
5. Typical Contractual Framework
6. Pros and Cons of PPPs for the Public Sector
7. Case Study
8. Recommendations

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## ***Definition of PPP***

# 1

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## ***Definition of PPP***

According to “System of National Accounts 2008”, PPP is typically defined as follows:

*Public-private partnerships are long-term contracts between two units, whereby one unit acquires or builds an asset or set of assets, operates it for period and then hands the asset over to a second unit. Such arrangements are usually between a private enterprise and government...*

- \* “System of National Accounts 2008” provides for the international statistical standard for the national accounts (e.g., GDP, Public debt, etc.) and adopted by the UN, World Bank, IMF, EU and OECD.)

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## Definition of PPP in Vietnam

According to “Decision 71”, PPP is defined as follows:

*Public-private partnership investment means the form of investment in which the state and the investor coordinate to implement projects for infrastructure development or public service provision on the basis of a project contract, ...the contract signed by Authorized state agency and the investor, in which the investor is granted with the right to invest, operate the infrastructure facilities, or provide public services in a fixed period.*

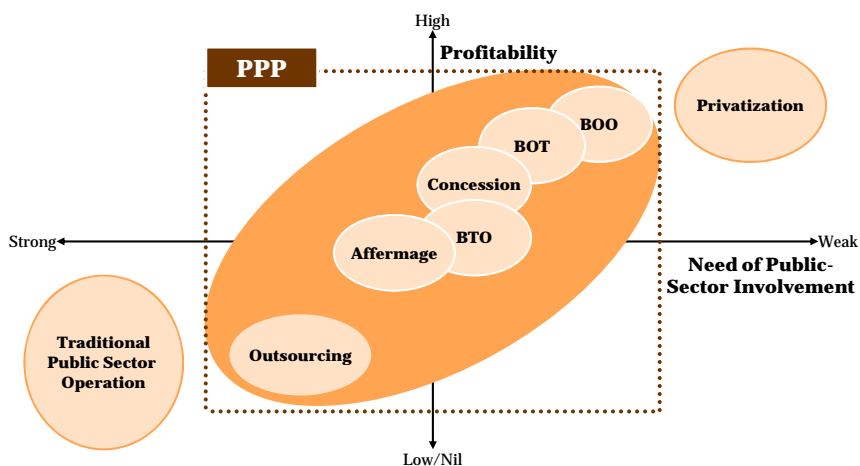


- PPP is generally used to include a wide range of PPP types under Decision 71.
  - BOT law defines not only BOT (similar to the previous definition), but also BTO and BT .
  - A Public Private Partnership is
    - a long-term contractual relationship
    - between the public sector and the private sector
    - for the purpose of delivering an infrastructure asset and related services
- We identify an appropriate PPP scheme from a wide range of possible PPP types.

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## Various models of PPPs



- PPP can be applied to projects, which had been traditionally served by the public sector, due to low profitability and need of public sector involvements.

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## Why PPP?

# 2

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## Hanoi City Budget in 2011 and Initial Project Costs

### Expenditure for Hanoi City Budget 2011

	VND (billion)	JPY (billion)	%
Basic Construction	17,728	69.5	41%
Regular Expenses	21,431	84.0	49%
Others	4,454	17.5	10%
Total	43,614	171.0	100%

### Initial Project Costs of Yenxa Wastewater Project

VND10,633 billion  
(JPY41.7 billion)

||

✓58% of annual basic construction budget

✓23% of annual fiscal budget

✓High initial investment for wastewater treatment plants amount to about 23% of annual expenditure or about 58% of annual basic construction budget of Hanoi City.

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## ***Possible Financing Gap in Hanoi***

- High investment needs in Hanoi wastewater sector, but constraints in Government funds
  - Limitation in self financing of Hanoi City (ex. Bond, Fiscal budget)
  - Long-term finances is required (Project takes long time to repay funds)
- Cost increase in the maintenance of the existing and newly opening facilities



- Better **investment prioritisation** and planning through national infrastructure bodies
- Use of **private sector investment** to achieve fiscal sustainability
  - Introduction of long term project financing under the PPP scheme
- Better **management of project risks** collaborating with the private sector
  - Reduction of lifecycle costs utilizing PPP scheme

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## ***Why PPP?***

There are many different drivers of PPPs.

Need to control public sector borrowing but fill the gap between infrastructure needs and fiscal constraints

Obtain innovative ideas/technology and economic efficiency

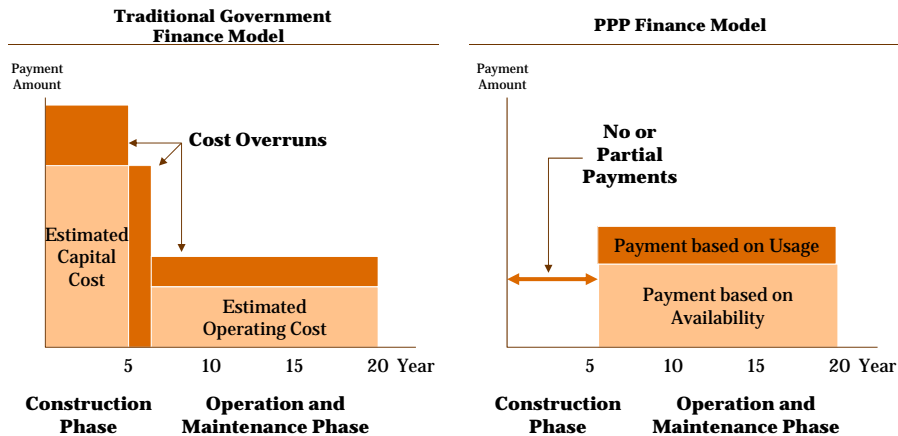
**PPP**

Accelerate the delivery of infrastructure services

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## Traditional Government Finance vs. PPP Finance

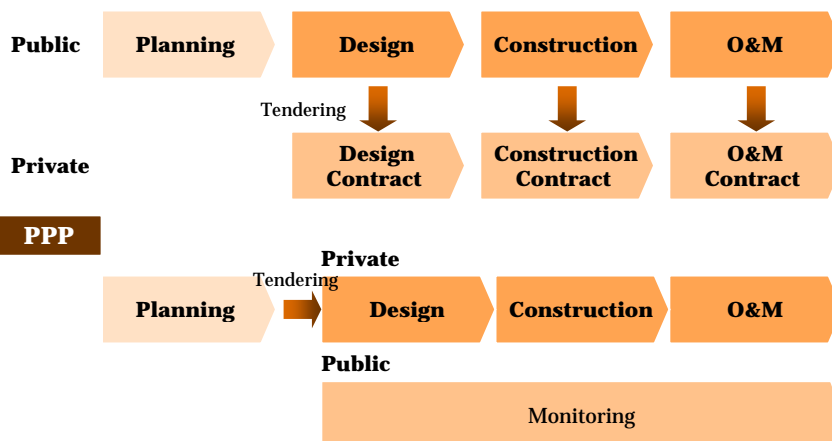


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## Differences in the ways to tender

### Traditional Procurement



- The private sector takes responsibility for the quality of design and construction it undertakes, and for the long term maintenance of the assets.

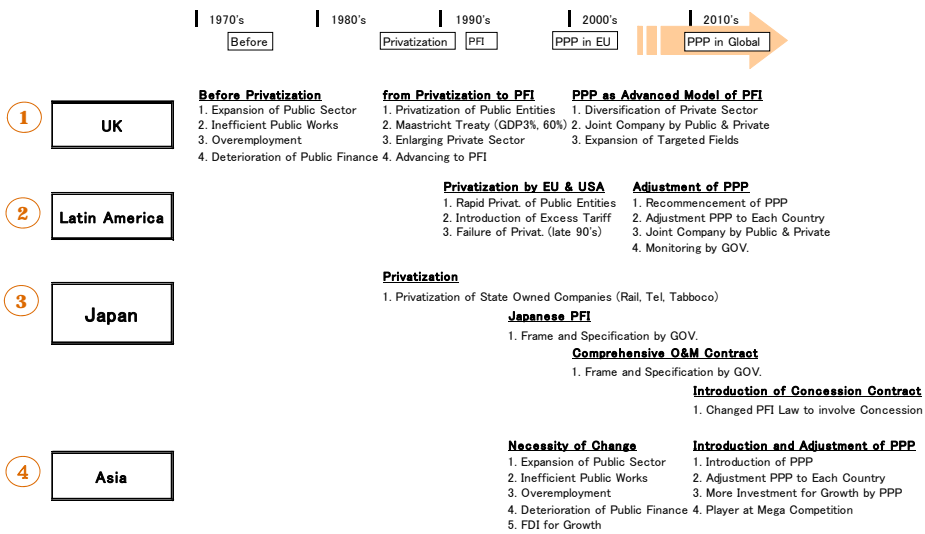
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# Development of PPPs in Global

# 3

# Development of PPP in Global



## ①UK -Success of PFI

“Small Government” Policy by Margaret Thatcher

Large and inefficient government (1970's)

Started privatization first and reduced Government involvement

Gradual development of PFI (1990's) and increase in public private partnership

- Average 15-17% VFM (savings against traditional procurement) has been delivered
- 89% of PFI projects surveyed were delivered on time or early. Only 30% of non-PFI major construction projects were delivered on time and only 27% were within budget
- 77% of public sector managers using PFI stated that their projects were meeting their initial expectations
- Private sector's financing and operation were highly promoted
- Foreign Investors participated in the PPP market in UK

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## ①UK -Evolution in PPPs

- The UK PFI has been evolved into PPP by 2000's.
- It's conditions has gained more flexibility and wider scope.

1 <sup>st</sup> Generation	2 <sup>nd</sup> Generation	3 <sup>rd</sup> Generation	4 <sup>th</sup> Generation
Rigid contracts	More flexibility	Complex partnerships	Range of contract options
Single assets	Grouped assets	Higher technology content	Greater risk aversion
Contractor finance	Independent equity	Secondary market sales	Operating businesses



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**①UK -Characteristics of UK PFI (1)**  
**Unitary Payment for the Services**

- ✓Public sector purchases “Services” based on Unitary Payment
  - Since the public sector does not purchase assets, it will not provide payments if required output specification are not met by the private sector.
  - Assets will be transferred at the end of contract termination at a market price.
  
- ✓Off-balance sheet of PPP project from Government is important
  - Completion risk/Rehabilitation risk is transferred to the private sector.

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**①UK -Characteristics of UK PFI (2)**  
**Appropriate Risk Sharing**

- ✓ UK has experienced few unsuccessful cases in PPP projects by successfully sharing risks with private firms.

**<<Example>>**



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## ② *Latin America – Privatization and PPP*

- ✓ Water sector reforms in the 1980s, resulted considerable investment needs
- ✓ The first water PPP in the Latin America was a concession awarded in 1991 (Argentina), and the Latin America played leading role in private water operation during 1990s
- ✓ The acute economic crisis in Argentina in 2001

### ✓ Series of contract cancellation (half of them took place in Argentina)

- Significant noncompliance with contractual obligations by one or both sides due to the rather bullish nature of the market in the 1990s
- Substantial and socially unsustainable tariff hikes were needed to make viable the large investment required from the private operator (eg. Cochabamba, Bolivia)

### ✓ Hybrid PPPs evolved (eg. cross-subsidies, mixed ownership, concession with public grants etc.), adjustments through more regulations and public involvements

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## ③ *Japan – Grown into a Big Market*

- ✓ Japan has conducted more than 400 PFI/PPP projects since 1999 when it adopted the model.
- ✓ For 234 projects conducted during 1999-2009, the accumulated VFM is estimated as 8.2 billion USD.
- ✓ PFI/PPP has successfully reduced projects costs, and its market has grown big in Japan.

### ✓ Concerns about rapid change through privatization (employment issues, etc.)

### ✓ Japanese PPP has maintained the government's involvement more than in UK <<Example>>

Japan has not transferred project-related risks to private firms as much as they do in UK. In many cases, the government takes project facilities' devaluation risk, which are taken by private firms in many PPP project in UK. Instead, the interest rates for Japanese PPP funding are often set as low as those for the government bonds.

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#### **④ *Asia –in Transition***

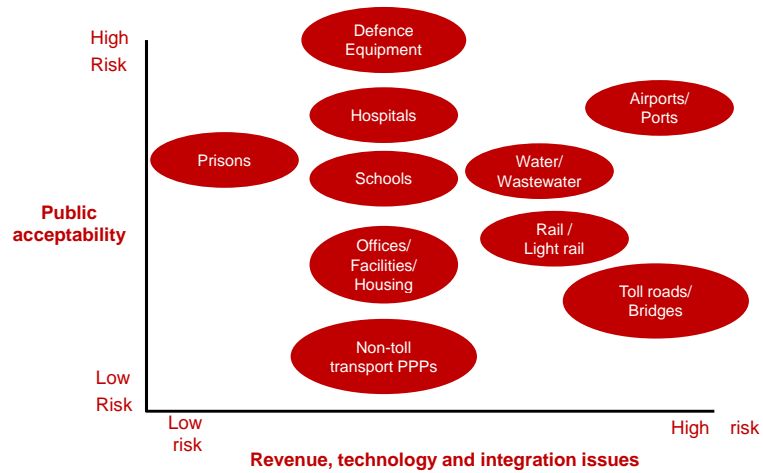
- ✓ Started adoption of PPP since 2000's
- ✓ Successful cases in Power and Water sectors have realized.
- ✓ Lifecycle Approach including initial investments and operation and maintenance has been successfully implemented in some sectors.
- ✓ Main issue is risk sharing mechanism in demand, tariff collection, land acquisition, viability gap funding etc.
- ✓ Off-balancing needs of the public sector could be an issue in near future.

For those countries in transition, it is important to develop PPP models that suit their social and economic environment.

#### ***Different Types of PPP Schemes***

# 4

## Various models of PPPs



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## Categorization of PPPs

Based on the definition of PPPs, we categorize PPPs by three factors:

- Factor 1: Role of Public and Private Sectors
  - Who finances initial capital investments?
  - Who owns infrastructure assets?
  - Who operates infrastructure services?
- Factor 2: Source of revenues for the private sector
  - Type 1: Payment for the services from the public sector
  - Type 2: Self-sustaining PPP with user fees
  - Type 3: Combination of payment from the public sector and users
- Factor 3: Rate Setting
  - Regulated
  - Deregulated
  - Agreed formula

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### ***Categorization of PPPs Role of Public and Private Sectors***

	<i>State Utility</i>	<i>BT</i>	<i>Affermage</i>	<i>BTO/ Concession</i>	<i>BOT</i>	<i>BOO</i>	<i>Privatization</i>
<b>Ownership</b>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Private*</i>	<i>Private</i>	<i>Private</i>
<b>Initial Investment/ Financing</b>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Private</i>	<i>Private</i>	<i>Private</i>	<i>Private</i>
<b>Operation</b>	<i>Public</i>	<i>Public</i>	<i>Private</i>	<i>Private</i>	<i>Private</i>	<i>Private</i>	<i>Private</i>
<b>Accountable for service provision**</b>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Public</i>	<i>Private</i>

Private Involvement/ Project Profitability ← Low → High

\*For contract length \*\*Sets level of quantity and standard of service quality

✓PPP ensures provision of services to general public, but at lower cost and better quality by the use of private-sector management skills and finance capabilities

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### ***Categorization of PPPs Source of revenue for the private sector***

	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
<b>Tariff/User Fee Revenue</b>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
<b>Payment from the Public Sector</b>	<i>No</i>	<i>Yes</i>	<i>If necessary</i>

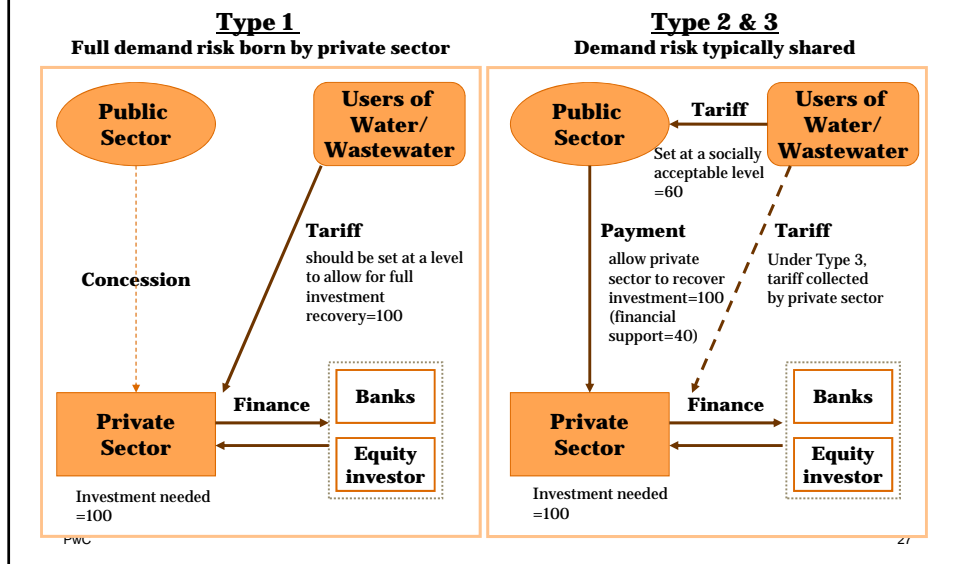
In Vietnam, BTO and BOT are generally considered as PPPs without payment from the Public Sector.

✓PPP can be structured for low profitable projects by combining tariff revenue with payment from the public sector.

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## How to deal with demand risk?



## Categorization of PPPs Rate Setting

When tariffs are collected by the private sector directly, there are three types of price setting.

- Regulated
  - Public sector periodically regulates rate setting.
- Deregulated
  - Private sector periodically regulates rate setting.
- Defined by agreed formula between the public and private sectors
  - Rate setting is revised based on the agreed formula between the public and private sectors.

✓Tariff structure can be defined to allow private sector to initiate an innovative way to generate cashflow while public sector ensures affordable services to the general public.

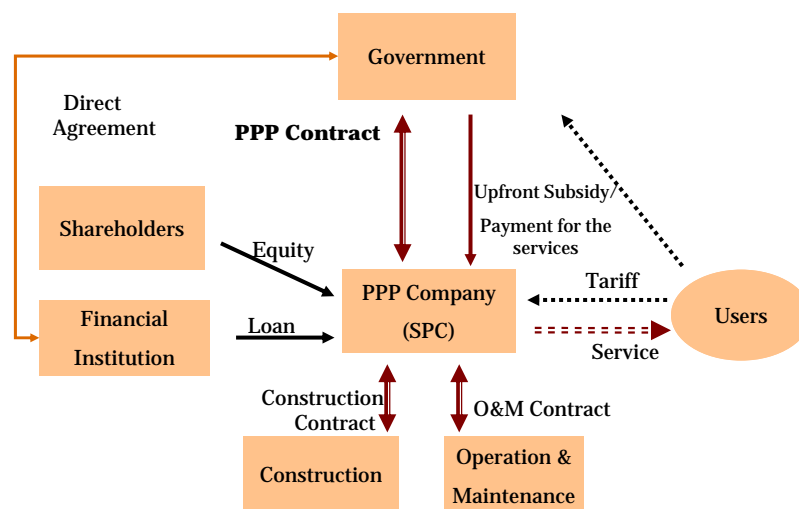
## Typical Contractual Framework

# 5

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## Typical Contractual Framework



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## *Pros and Cons of PPPs for the Public Sector*

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## *Pros of PPPs for the Public Sector*

- **Better quality of services** is realized by utilizing private sector's know-how, innovation, new technologies, and management

- The private partner designs, builds, operates and usually finances the asset (**whole life approach**) and the minimization of life cycle costs is expected

- Payments are based on **outputs not inputs**, which provides the private partner with room for innovation

- **Long term finances** is available

- **Risks can be transferred** to the private partner when the private partner is best able to manage it

- Obsolete assets/deterioration of assets are managed by the private partner

- The public partner contracts with **one integrated supplier**

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### ***Cons of PPPs for the Public Sector***

- Public sector needs to have an appropriate monitoring capabilities of the private partner's performance
- Public sector needs to commit a long-term payment from its fiscal budget for the project and could result in inflexible budgets.
- Public sector needs to provide certain payments in compensation for transferring risks to the private sector.

---

### ***Case Study***





## Case 1. Ulu Pandan NEWater PPP Project

- **Location:** Within existing Ulu Pandan Water Reclamation Plant in Singapore
- **Public Agency:** Public Utilities Board
- **Contractor:** Keppel Integrated Engineering Ltd
- **Operational Period:** 20 years (2007-2027)
- **Background & Summary of the Project:**



- NEWater is recycled, used water that has undergone stringent purification and treatment process using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. The plant is the fourth and the largest NEWater plant in Singapore with a capacity of 148,000m<sup>3</sup> per day, and has started its operation in 2007.

### Achievement

- Together with the existing 3 NEWater plants, it meets more than 15% of Singapore's water demand.
- Before the contract to build Ulu Pandan was announced, PUB had charged the public \$1.30/m<sup>3</sup> for the NEWater services. The price has decreased once the contract was announced to \$1.15/m<sup>3</sup>, and dropped further in April 2007 to \$1.00/m<sup>3</sup>, due to economies of scale, productivity gains and improved membrane technologies.
- The Ulu Pandan plant itself made a post-tax profit of \$1.95 million in 2010.

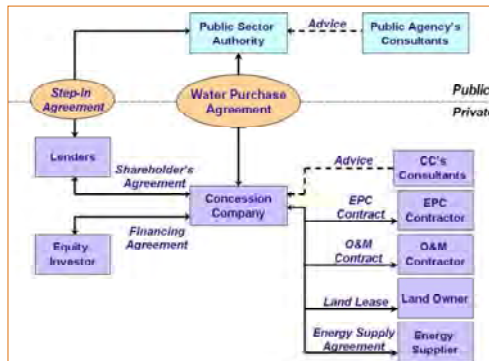
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## Case 1. Ulu Pandan NEWater PPP Project

### Project Description & Management Structure

- The Ulu Pandan NEWater Plant is built on a scheme, in which private sector designs, builds, finances, owns and operates the facility for 20 years.
- Awarded the PPP contract in 2005, Keppel Seghers NEWater Development Company (SPV) has designed and built the Ulu Pandan NEWater plant, and started the operation in 2007. It has also introduced the improved technology for producing the NEWater.
- The land for the Ulu Pandan NEWater Plant was part of a larger lease for the Water Reclamation Plant. The land is sub-divided with a separate land title, and sub-leased to the contractor.
- PUB purchases the NEWater, instead of the NEWater plant, from the contractor.



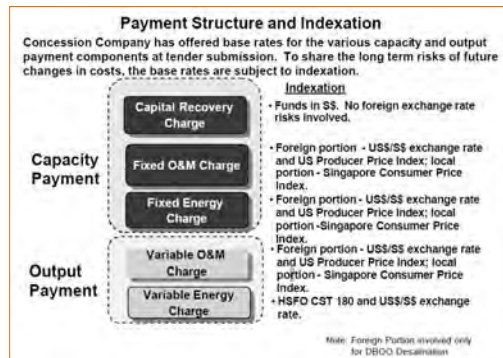
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## Case 1. Ulu Pandan NEWater PPP Project

### Tariff Structure

- “Two-part tariff” based on fixed availability payment and output payment adopted
  - Fixed payment covers project costs, partially remove market risks from the Concession Company
  - Variable payment provides returns on costs associated with the production volumes, partially exposing it to market demand risks.



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## Case 1. Ulu Pandan NEWater PPP Project

### Other Key Features Contributed to Success

- **Clear Measurements of the Contractor's Performance**
  - Clear and measurable outcomes are specified for quantity and quality of water. (e.g. As for the quantity, 32 million gallons per day of NEWater capacity is required.)
- **Monitoring System**
  - On-line continuous monitoring of key water quality parameters
  - Regular analysis of a comprehensive range of water quality parameters by an accredited laboratory
  - Regular audit by PUB's internal and external audit committee
- **Step-In Agreement**
  - Tri-partite Agreement between PUB, the Concession Company and the lenders/ Financiers, to help mitigate the impact on service continuity. In cases of failure, provisions are included for PUB to step-in and manage the Concession Company's staff and equipment to ensure production and delivery. There is also the provisions to allow private financiers to identify other potential service providers who can take over the operations.

PwC

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## ***Case 2. Shanghai Zhuyuan No.1 Wastewater Treatment Plant***

- **Location:** Shanghai, China
- **Public Agency:** Shanghai Water Authority & Shanghai Sewage Company (state-owned)
- **Contractor:** Youlian Consortium
- **Contracting Date:** 2002
- **Operational Period:** 20years

- **Background & Project Description:** Shanghai Zhuyuan No.1 WWTP is the biggest BOT wastewater project with a treatment capacity of 1.7 million cubic meters per day (advanced primary treatment) and an advanced primary treatment, serving an area of 107 km<sup>2</sup> and about 23.5 million inhabitants. The Youlian Consortium has won the competition and made concession contract with the Shanghai Water Authority as well as the service management contract with the Shanghai Sewage Company.
- **Risk Allocation:** In the project, the contractor invests, constructs, operates, and maintains the WWTP facilities, and the government pays a service fee to the contractor's work. The price of the payment to the contractor is negotiated between the government and the contractor, and it depends on the investments and agreed performance levels, rather than on the user fee level.
- **Achievement:** The Consortium enabled to reduce the service fee compared to the former treatment cost by the government. Also, according to the random water examinations conducted by Shanghai Sewage Company as well as other monitoring systems stated on the contract, the WWTP has fulfilled all the contracted responsibilities up till 2008, including meeting the water quality standards.

PwC

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## ***Case 3. Performance Management Contract for a Waterworks Authority***

- ◆ **Public Agency:** A Local Waterworks Authority in a country in the Asia-Pacific Region ("the WA")
- ◆ **Contractor:** A famous operators in water and wastewater services ("the Contractor")
- ◆ **Operational Period:** 2006–
- ◆ **Background & Summary of the Project :**

The WA outsourced the management, operation, and maintenance of its wastewater treatment plants with a total capacity of approximately 50 thousand cubic meters a day for a population of 120,000. The Purpose of the project is to improve the efficiency and reliability of the wastewater system.

### **Achievements**

–The operating standards were introduced to the wastewater treatment operations. The percentage of the WA's personnel, who owns the certification of wastewater treatment, has developed from 50% to 75% since the project started.

– The process of annual planning and budgeting was introduced for the refurbishments of the wastewater treatment and other related plants, equipments and pipes, etc., although the budget for such refurbishments are not satisfactory (which is one of the demerits of PMCs compared to PPPs, i.e., the risks of the long term maintenance are within the public sector and not transferred to the contractor.)

PwC

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### Case 3. Performance Management Contract for a Waterworks Authority

#### Project Description & Management Structure

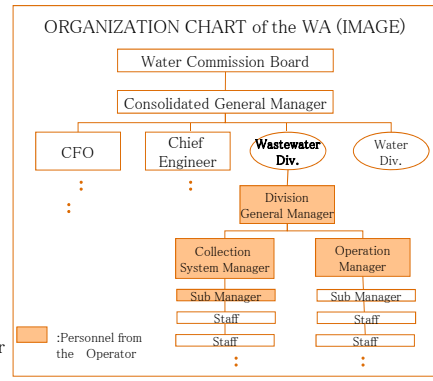
-Awarded the PMC contract in 2006, the Contractor has been responsible for the management, operation, and maintenance of all wastewater treatment plants of the WA.

-The Contractor continues to utilize all the existing employees of the WA working in its Wastewater System.

-The Contractor sends management level personnel to the WA's Wastewater Division to provide management/planning work as well as trainings for the WA employees, who are involved in the day-to-day operation of the plants.

-The training for the WA's employees includes educations on treatment technology, O&M, preparatory courses for the certification exams, etc.

-The WA's employees were regularly sent to and trained in the Contractor's central training center to learn operational standards of the Contractor.



PwC

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### Case 3. Performance Management Contract for a Waterworks Authority

#### Tariff Structure & Risk Allocation

-Payment milestones have been set to clearly identify the actual status of the portion of the work completed.

-Fixed management fees include all travel costs, living allowances, expenses, and all other matters related to the price of this contract.

-O&M budget for the first year constitutes the amount submitted with the Contractor's bid and thereafter will be negotiated on an annual basis reflecting, among others, the conditions of the treatment and other related plants, equipments, pipes, etc.. The Contractor needs to maintain O&M cost within the budget.

-O&M expenses do not include non-routine repairs or replacements of equipment or systems to improve the performance, regarding which the Contractor annually prioritizes and proposes the necessary repairs and replacements with priority, and the WA decides and agrees with the Contractor on the annual budget.

-The Contractor pays penalty if failed to meet other performance requirements. (e.g. Environmental compliance)

Payments to the Contractor from the WA include:	
Fixed Monthly Management Fees	
Reimbursement Payments for budgeted and approved O&M expenditures as agreed to and scheduled between the WA and the Contractor	
Reimbursement Payment for repair and replacement expenditures as agreed to and scheduled between the WA and the Contractor	
Incentive Compensation Payments	e.g. Penalty Compensation Payments due to Contractor's failure to meet its minimum performance guarantees

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### **Case 3. Performance Management Contract for a Waterworks Authority**

#### **Other Key Features Contributed to Success**

##### ***Clear Measurements of the Contractor's Performance***

-Clear and measurable indicators are set for quality assurance.

< e.g. Environmental Compliance >

##### ***•KPIs***

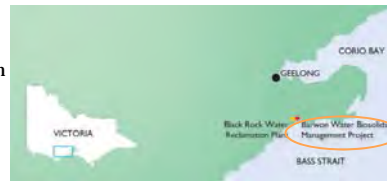
- Operate and maintain the wastewater system within various environmental regulations and requirements set forth by the Environmental Protection Agency, etc.
- Pump stations must not have any overflow incidents.
- Collection lines must be kept free of grease and other material to prevent sewage overflows

##### ***•Penalties in case of failure to meet the requirements***

- When failed to meet the above requirements, the Contractor pays penalty fee, and if failure was not recovered within agreed period of time, additional penalty payment will be required.

### **Case 4. Barwon Water Biosolids Management Project**

- **Location:** Geelong, Victoria State, Australia
- **Public Agency:** Barwon Region Water Corporation (BRWC)
- **Contractor:** Plenary Environment
- **Operational Period:** 20years



##### **• Background & Project Description:**

BRWC owns water reclamation plants, which produce sludge (biosolids) approximately 54,000 tones per year. In the project, the contractor designs, builds, finances, and operates facilities to receive biosolids produced and delivered from the those water reclamation plants to process them into fertilizers and fuels for beneficial use.

- **Tariff Structure:** BRWC makes service payment to the contractor. The monthly availability charge reflects the contractor availability to accept biosolids 24 hours a day, 7 days a week. Up to 70% of this charge is subject to deductions for failing to accept delivery. Up to 30% is subject to quality failure deductions based on performance requirements in such areas as: odor nuisance, environment impacts, etc. The monthly variable charge is based on the volume of biosolids processed at the monthly variable rate, and the monthly beneficial use charge is based on the volume of biosolids beneficially used.
- **Status:** The operation has been delayed due to commissioning issues with the contractor's technology for the biosolids drying process. Under the PPP contract, this technology risk was transferred to the contractor and has not resulted in the BRWC bearing any financial implications. (Under traditional contract, the technology risk would have been all or in part been retained by BRWC.)

## *Other Projects*

### **Guangzhou Xilang Wastewater Treatment Plant (China)**

**Public Agency:** Guangzhou Government  
**Contractor:** Guangzhou LEMNA Xilang Wastewater Treatment Ltd. Co.  
**Operational Period:** 20 years

- The Guangzhou Xilang Wastewater Treatment Plant (WWTP) is the BOT project combining WWTP and sewers. In 2001, Guangzhou Government awarded a twenty-year concession contract (including a 3-year construction period) .
- Significance of the project is due to the contractor's active risk allocation. The contractor takes on the investment, construction and operation risk according to the 7 concession contracts. Then, it transferred the constructing risk to an experienced engineering company by an EPC contract in 2001 and delivered the operating risk to another experienced operator by an operation service contract in 2003. Till now, Xilang wastewater treatment system is being operated well and meeting the agreed service requirements.

### **Wodonga Wastewater Treatment Plant (Australia)**

**Public Agency:** North East Region Water Authority (NERWA)  
**Contractor:** PURAC Pty Ltd now EGL Water Operations Pty Ltd  
**Operational Period:** 10 years (2003-2013)

- The Wodonga Wastewater Upgrade Project involves the design, construction and operation of a new wastewater treatment plant in order to meet environmental performance and effluent re-use requirements. The upgrade also addresses the need to provide additional wastewater treatment capacity to effectively treat and manage the current and future needs of the Wodonga and outer areas.
- In December 2000, NERWA contracted PURAC Pty Ltd for the design, building and operation of upgraded wastewater facilities. The contract is for a ten-year term, with two additional terms of five years at the Authority's discretion. The facility has been operational since July 2003.
- This was the first of the Non Metropolitan Urban Water projects to be executed under the Victoria state's PPP program.

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## *Recommendations*



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## ***Recommendations for the Success of Yenxa Wastewater Project***

- Packaging the project with initial investments, and operation and maintenance (O&M) for a long term
  - Considering financial limitation of Hanoi City, utilize private sector finances by packaging initial investment and long-term O&M will accelerate the infrastructure delivery.
  - Otherwise, Hanoi City needs to finance initial investment by its own finances, borrowing from the central government, sales of concession rights of other businesses etc.
- Appropriate risk sharing between public and private sectors
  - The essence of any long-term private financing is the identification of all key risks associated with the project and the allocation of those risks among the various parties participating in the project.
  - A risk should be assumed by the party best able to manage and control that risk.
- Minimizing lifecycle costs
  - The project agreements clearly defines payments based on outputs (not for the facility construction) and monitoring of the private partner's performance, and realizes minimising lifecycle costs.
- Well structured PPP scheme to attract international private players
  - Well structure PPP scheme with a security package for political uncertainty, clear definitions of role and responsibilities of public and private sectors, reasonable risk allocation etc. is important for international players to invest the project.

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## ***Possible Project Models for Yenxa***

- The following five patterns of role sharing models between public and SPC are considered for construction of the Yenxa facilities.

	Facilities		
	Wastewater Collection	Wastewater Treatment	Sludge Treatment
Model 1	Public	Public	Public
Model 2	Public	Public	SPC
Model 3	Public	SPC	Public
Model 4	Public	SPC	SPC
Model 5	SPC	SPC	SPC

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*13 July 2011*

**PPP – Work Shop Document**

**2) Failures and Recover for Water Sector**

**PPP in Malaysia, Manila, and Jakarta**

**Thất bại và thành công của ngành nước theo**

**mô hình PPP tại**

**Malaysia, Manila, và Jakarta**

**JICA Study Team**

**(Study B)**

*Failures and Recover  
for Water Sector PPP  
in Malaysia, Manila, and Jakarta*

*July 13, 2011*

*Water Business Project , ORIX Corporation*



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*Case of Malaysia*

- 1. Municipal Owned & Management (previous)*
- 2. Problem of Municipal Owned & Management*
- 3. How did they innovate Privatization for their Problem?*
- 4. Result of Privatization (factor of failure )*
- 5. How did they restructure after the failure?*
- 6. Lesson learned*

**Reference:**

**Council of Local Authorities for International Relation CLAIR REPORT NUMBER203**



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1

## 1. Municipal Owned & Management

### ➤ *Sewage Works Before 1993*

- There were 144 local governments owned and managed about 6,100 wastewater treatment plants.
- 4,900 plants (almost 80% of all) were fully broken down or in ghastly quality.
- Sludge was merely treated only 1% of all the amount.

## 2. Problem of Municipal Owned & Management

### ➤ *Municipal finance*

- They were shortage of finance for Sewage works  
Because Municipalities had to address other rapid urbanization.

### ➤ *Lack of human resources*

- They didn't have enough number of qualified Engineers for both construction and maintenance at all.

### ➤ *Low level of tariff collection rate*

- Municipalities could not collect enough tariff for Sewage Works  
Because people could not realize its benefit.



## 3. How did they introduce Privatization for Problems?

### *~ In case of sewerage service ~*

### ➤ *Act and Institutional design*

- In 1993, they put Sewerage Service Act 1993 into effect.  
(EPU established the legal framework and ICP formulated the structure)
- FedGovt took over authorities of Sewerage Service from all municipalities.
- Under MHLG, FedGovt set up Sewerage Services Department as the regulatory body.
- It grants license and supervises facilities planning and other works.
- Also, it made only one BOT contract for all over the country with the Indah Water Konsortium (hereinafter IWK) that was a consortium of existing 7 operators (such as United Utilities).
- The reason why FedGovt introduced IWK scheme was because they expect IWK to give impartial service to people over the country regardless of big regional differences.



➤ **Summary of BOT scheme between FedGovt and IWK**

- Method: BOT
- Term: 28year (from1994 to 2022)
- Area: All over the Country
- Business contents:  
Rehabilitation and OM of waste water treatment plants (about 4,900), OM of existing pipes (about 6,900km) and building of new pipes (about 6,900km), sludge treatment of septic tanks (about1,200mil. units) etc.
- Improvement of service: mark below

	types	privatization	
		previous	after
Large Local GOV(49)	connected to pipes	45%	85%
	unconnected	44%	45%
	residual	11%	—
Small Local GOV(95)	connected to pipes	10%	30%
	unconnected	52%	70%
	residual	38%	—

- Cross-Subsidy Principle: “HouseHold” ← “Industry, Public, Commerce”  
(C-S scheme made it possible for people in rural area to have Sewage.)
- IWK must get FedGovt approval to modify tariff structure



4. Result of Privatization (factor of failure)

~ In case of sewerage service ~

➤ **Tax and Tariff**

- Before privatization, people thought that tariff for sewerage was included in Assessment Tax. Then, people are very reluctant to pay new sewerage tariff because they felt new tariff was additionally put on or double-bill.

➤ **Approval for Tariff modification**

- IWK couldn't set up an appropriate tariff due to political interest.

➤ **Indirect Benefit**

- Different from Water Service, people can't realize sewerage services beneficially that much.
- So, people didn't want to pay sewerage tariff.  
(※ water and sewerage tariff were collected separately at that time.)

➤ **Lack of PR activities**

- IWK and FedGovt did not have enough PR activities for benefit and necessity of sewerage services and tariff before and after the commencement of its operation.



After 6 years operation, IWK bankrupted in fact.



## 5. How did they restructure after the failure?

~ In case of sewerage service ~

### ➤ **Re-nationalization**

- FedGovt (MFI) purchased all IWK Assets and took over Debt in June 2000.
- Nevertheless, IWK can't recover the expected business result.
- Finally, FedGovt subsidized about 1.5 hundred million RM annually.  
(As the time of 2008, 2.5 hundred million RM was estimated for 2009)
- In 2008, integral collecting of water and sewage tariff  
(It's one of the effects of Water Service Industry Bill Act 2006)

### ➤ **Current Status**

- In 2006, Malaysia introduced many important policies for the restructuring of water sector.
- Now, IWK have been restructuring on along the line with above policies.
- In January 2009 Runhill Utilities (one of the infrastructure company listed on BursaMalaysia Securities) was entrusted with FS for the integration of water and waste water service in JohorBahru and Pasir Gudang.



## 6. Regulatory Body for Ensuring Sustainability

~ Thinking-over of Water Sector Privatization ~

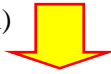
### ➤ **Regulatory Body**

⇒ Responsibility for setting tariff level and service standards

	Tariff setting	Licensing	Regulations	Approval	Supervision of Operation
SPAN	-Planning	-Reception & Evaluation of License -Embodiment of Licensing Standards by Minister	-Drawing up Regulations	-Approval for Project Plan -Advice for Tariff setting	-Monitoring -Instruction for Improvement
WAMCo				-Funding to Capex	
Ministry	-Decision	-Setting up of Licensing Standards -Approval of License	-Enforcement		

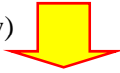


(All above are based on)



**Water Services Industry Bill Act 2006**  
**National Water Service Commission Act 2006**

(bring the effects below)



**7. Lesson learned**

- Assets light (No Debt & Capex can extract profit)  
⇒ Proper Subsidy for initial investment is necessary
- Tariff Escalation (Necessary but should be Modest)
- Single Bill (for sewerage and water supply services)
- Strengthening PR activity  
(Ex. Annual Report, Water Industry Report on HP)

**abbreviation**

- BOT            Build-Own-Operation
- EPU            Economic Planning Unit
- FedGovt      Federal Government
- ICP             Inter-departmental Committee on Private
- MHLG         Ministry of Housing and Local Government
- MFI             Minister of Finance Incorporated
- OM             Operation Maintenance
- SPAN          Suruhanjaya Perkhidmatan Air Negara

## Case of Manila

1. *Flow until privatization (Issues)*
2. *Detail of Concession Contract*
3. *MWSI vs. MWCI (Point of Failure or Success)*
5. *Negative cycle toward Bankruptcy*
6. *Revenue water flow rate*
7. *Lesson learned*  
~ *Verification toward Success* ~

## Flow until Privatization

- MWSS (Metropolitan Waterworks and Sewerage System) was established for operation of Waterworks and Sewerage in 1982.

### 《Issues》

- Low income and high cost (high rate of leakage, collection business inefficiency, labor cost increase)
- Lack of budget, Inefficient operation and maintenance
- Deterioration of service level
- Nonpayment and difficulties of price increase due to above issues.

## Privatization



- August, 1997 From the point of competition, 2 Private companies started their operation.

East Area: Manila Water Company (MWCI)  
West Area: Maynilad Water Services (MWSI)

**Details of Concession contract**

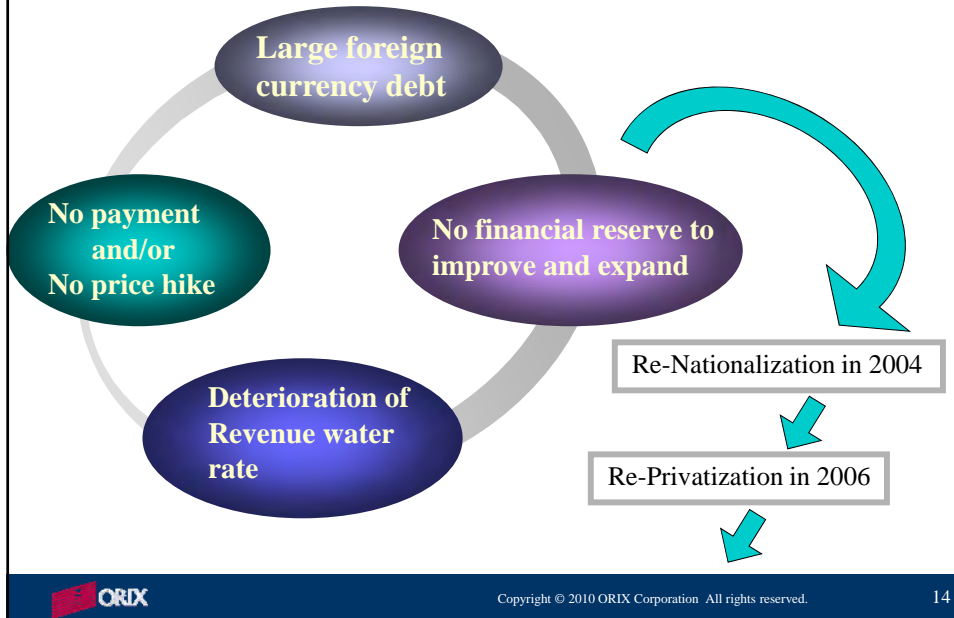
- Tender’s composition shall be “domestic operator” and “international operator”
- Concession contract for 25 years
- Concession fees shall be appropriated for the MWSS’s foreign currency debt repayment and No subsidy from the national Gov.
- Water supply for all over the service areas within 10years
- Non revenue water rate from 56% to 32% for 10years
- Fulfillment of 24hour’s water supply within 3years
- Water-supply service shall be provided for the poorest
- 80% coverage of sewerage system within 25 years
- 7.5BIL(USD) capital expenditure during the contract terms and 4BIL(USD) payment of income tax
- Substantial price hike is prohibited for ten years
- MWSS-RO as the supervisor of Concessionaires

**MWSI vs. MWCI**

<b>MWSI</b>	<b>MWCI</b>
<ul style="list-style-type: none"> <li>• <u>Old urban area (90% of Asset)</u></li> <li>• <u>Large foreign currency debt equivalent to transferred Asset</u></li> <li>• No budget for capital expenditure</li> <li style="text-align: center;">↓</li> <li>• Deterioration of facilities much faster than in normal situation</li> <li>• Deterioration of revenue water rate</li> <li style="text-align: center;">↓</li> <li>• <b><i>Bankrupt even in the next year !</i></b></li> <li>• Re-Nationalization in 2004</li> </ul>	<ul style="list-style-type: none"> <li>• <u>newly-developed urban area (10% of Asset)</u></li> <li>• <u>small foreign currency debt equivalent to transferred Asset</u></li> <li>• Enough budget for capital expenditure</li> <li style="text-align: center;">↓</li> <li>• Improvement of revenue water rate</li> <li style="text-align: center;">↓</li> <li>• <b><i>Success Story of PPP until now !</i></b></li> </ul>



## Negative Cycle of MWSI



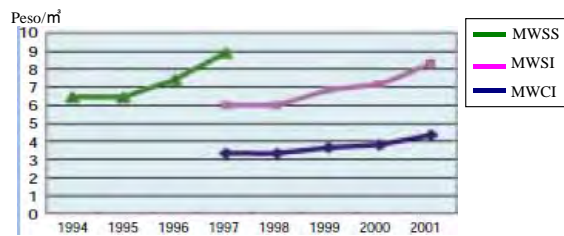
### < Change of revenue water rate >

Source: Foundation Fukuoka Asian urban studies place

		1987	1996	1999	2000	2001	2002	2003	2004	2005
総人口(人)	MWSI	4300000	4310000	4770000	5250000	5540000	5560000	5700000		
	MWCI	3000000	3130000	3560000	3760000	3940000	4030000	4400000		
普及率(%)	MWSI	59	59	64	70	82	84	84		85
	MWCI	66	66	73	74	89	90	90		90
給水量(c.m./d)	MWSI					2347000	2362000	2325000	2279000	2169000
	MWCI					1835000	1815000	1801000		
取水量(c.m./d)	MWSI					797000	741000	718000	707000	691000
	MWCI					440000	584000	645000	706000	758000
新規接続数	MWSI	487328	488747	518399	571282	602434	443245			
	MWCI	325527	340037	390950	408894	427755	604814			
取率(%)	MWSI	37	40	32	34.3	34	31	31	31	32
	MWCI	37	44.6	47	49	48	46	49.3	58.6	64.5
一接続一日給水量(c.m./con/d)	MWSI					1.38	1.23	1.19	1.14	1.06
	MWCI					2.13	1.78	1.53	1.49	1.36
1000接続当り職員数(人/1000con)	MWSI	6.8				4.2	4.2	4.1	4	3.8
	MWCI	6.3				4.4	4.2	4	3.7	3.4

Revenue water rate

### <Change of Water Tariff>



## Lesson learned

- **Foreign currency debt shall be manageable level**

~ *Verification toward Success* ~

### Trial Case 1

Change of foreign debt 9:1 ⇒ 6:4  
(6:4 is the proportion of actual served population )

⇒ **failure.....**

### Trial Case 2

Foreign debt 6:4 + Same revenue water rate as MWCI

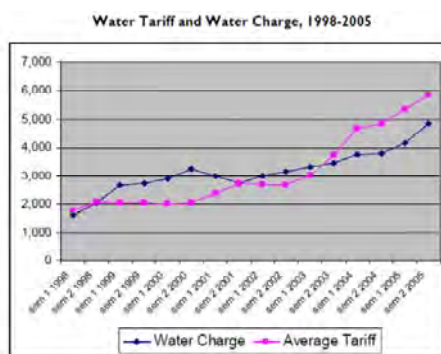
⇒ **Current-account Surplus !!!!**

## Case of Jakarta

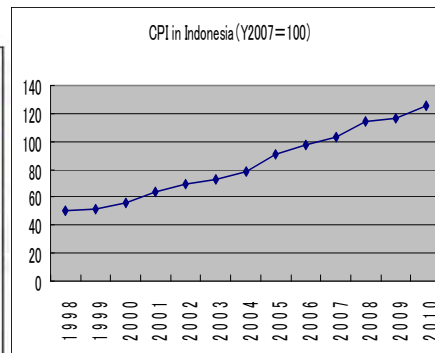
1. *Failure of Water Service Privatization*
2. *CPI hike far beyond Tariff increase*
3. *MWSI vs. MWCI (Point of Failure or Success)*
5. *Negative cycle toward Bankruptcy*
6. *Revenue water flow rate*
7. *Lesson learned*
  - ~ *Verification toward Success* ~

### Reasons for the failure of water service privatization

- 2 concessionaires of operating water service in DKI Jakarta had heavy debt burden in foreign currency caused by plunge of the local currency rate in the Asian currency crisis.
- Automatic tariff adjustment every 6 months (ATA) brought about frequent tariff increases, mainly backed by CPI rise of Indonesia.
- But, tariff increases had been restrained below CPI rises.
- Tariff change had been political issue. 2 concessionaires had asked for tariff increase to Governor of DKI Jakarta.
- JWSRB (regulatory body) didn't have right for determination of tariff change. Governor of DKI Jakarta had it.
- Consequently, 2 concessionaires couldn't invest necessary capital expenditure timely for fulfillment of technical targets.  
(Coverage Ratio, Volume sold, UfW, ...)

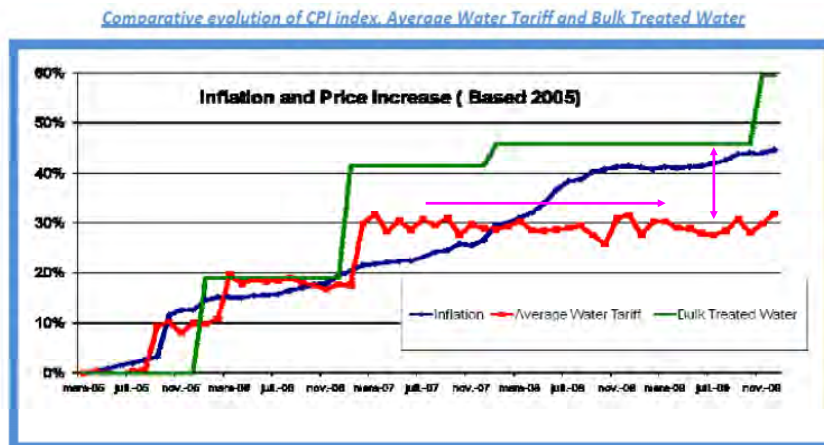


(Source: CURRENT SITUATION OF JAKARTA WATER PRIVATIZATION)



(Source: Drawing up by IMF Data and Statistics)

- Tariff increased since privatization by 18% in 1998, 35% in 2001 and **40% in 2003**)
- CPI increased **by 156%**



NB: Bulk Water increased by 34% during the period in which the Water Tariff has remained unchanged

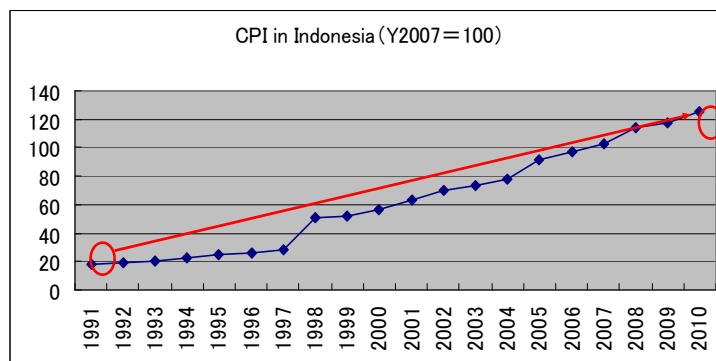
- Without enough tariff, Project is no longer feasible!

(Source: PT Palyja's comments on KRuHA statements in its submission to the UN Independent Expert on the Right to Water and Sanitation that concern the Water concession contract for the West Zone of Jakarta)



- They cannot introduce appropriate Tariff Decision System even now.
  - Water service do not have any symptom of improvement.
- ⇒ **Nothing about Sewage Works !**

For that period: Available land gone, Construction cost higher & higher



(Source: Drawing up by IMF Data and Statistics)



## Lesson learned

- *To avoid political interest*  
**Tariff Decision by neutral Regulatory Body**
- *To avoid revenue & expenditure gap*  
**Proper Tariff Adjustment Mechanism**
- *To avoid construction cost hike*  
*& easy Land Acquisition*  
**Construction as early as possible**

## Proposal through the Study

- **Immediate Construction & Sustainability 1 = Funds**  
⇒ Maximizing Advantage of **JICA PSIF**  
through Private together with **ODA Loan**

Pipe Network	Wastewater Treatment Plant + Sludge Recycling Facility
Public	PPP
162 million US\$	291 million US\$

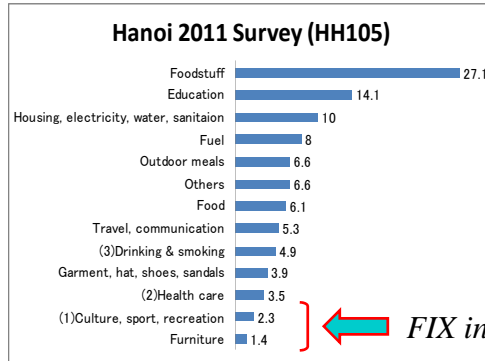
  

308 million US\$	146 million US\$
Subsidy (ODA)	SPC
(50%)	(50%)
	<i>Private PSIF</i>
	Rate: 7~8%

- ⇒ **The ratio bw. 2 Funds**  
**to be decided by Tariff Level**  
**& Availability of Ordinal Account of HPC**

## Proposal through the Study

- **Immediate Construction & Sustainability 2 = Tariff**
- ⇒ **Affordability** for people is most important!

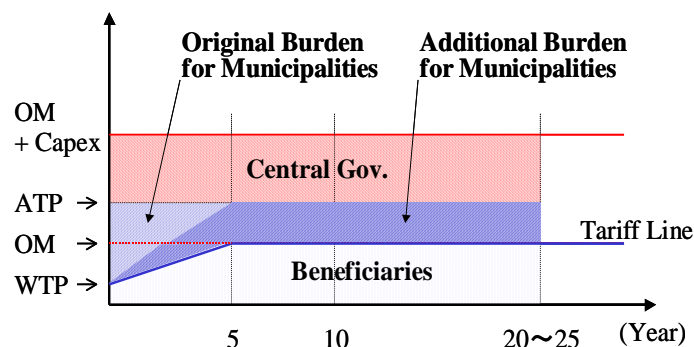


- ⇒ **For Water & Sewerage: Ceiling 5% for HH Exp.**
- Setting up in HH Exp. Map:**
- Avoid Gap against CPI hike & Easy Understanding**

## Proposal through the Study

- **Immediate Construction & Sustainability 3 = Cost Sharing**
- ⇒ **Central Gov shall subsidy Excessive Part.**

(Payment & Tariff)



- ⇒ **People should pay up to ATP (around 2% of HH Exp.)**
- Municipality's burden depends on Ordinary Account**

*Thank you for your attention!!*



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*13 July 2011*

**PPP – Work Shop Document**

**3) Institutions & Finance of Sewerage Works**

**Các thể chế và tài chính của các Công trình**

**thoát nước thải**

**The Introduction of Yokohama PPP Project**

**Giới thiệu về Dự án PPP Yokohama**

**JICA Study Team**

**(Study B)**



## **HANOI CITY: PPP Work Shop**

- **Institutions & Finance of Sewerage Works**

- **JICA Study Team**

- Y. Inoue, Nippon Koei Co., Ltd.

- **July 13<sup>th</sup>, 2011**

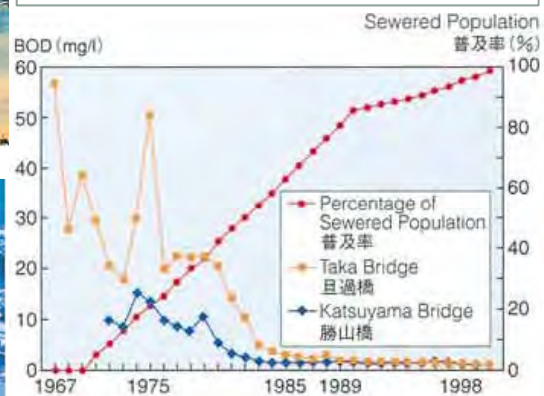
- Part 1: Overview of individual features on finance & institutions
- Part 2: Learned from finance/management capacity development
- Part 3: Recent activities in sewerage works

# Part 1 : Overview of individual features on finance & institutions

## Role of Sewerage System (1)

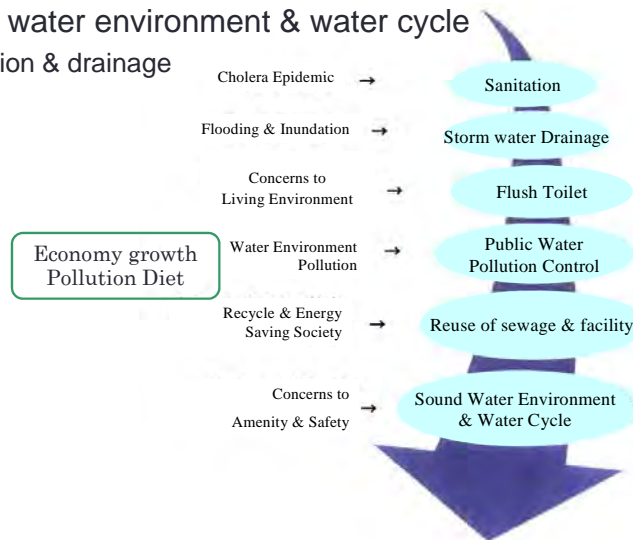


Sewerage system development & pollution control contribute to water environment restoration

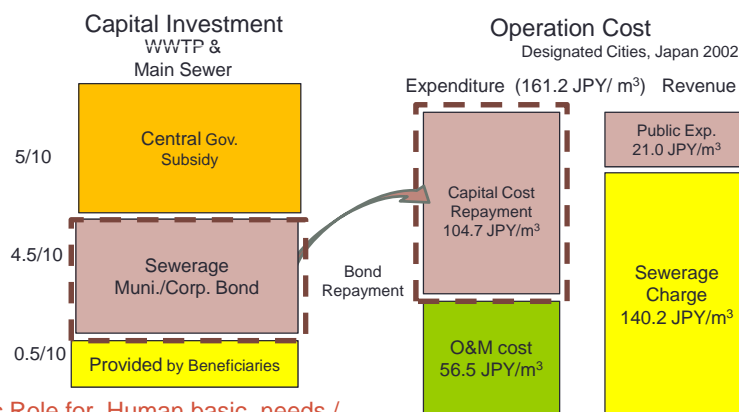


## Role of Sewerage System (2)

- Change to water environment & water cycle from sanitation & drainage



## Finance : Capital and O&M Cost Resources



Public Role for Human basic needs / Infrastructure

Central Gov. (Subsidy) + Municipal Gov.

Private Role for housing environment

Tax(City Planning & Beneficiary + Sewerage charge

Sewerage project is operated as an independent cooperate account of municipality government.

## Finance: US-EPA (1) in wastewater management

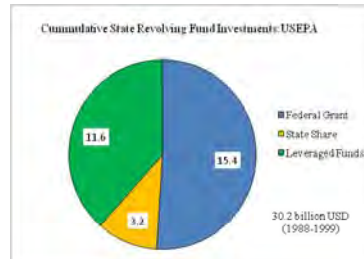
- 1956 Water Pollution Control Act Amendment
- 1972 Federal Water Pollution Control Act
- 1987 Clean Water Act

### Subsidy rate

- 55%(1956) – 75%(1972) – 55%(1981)
- Driving force of WWTP installation**

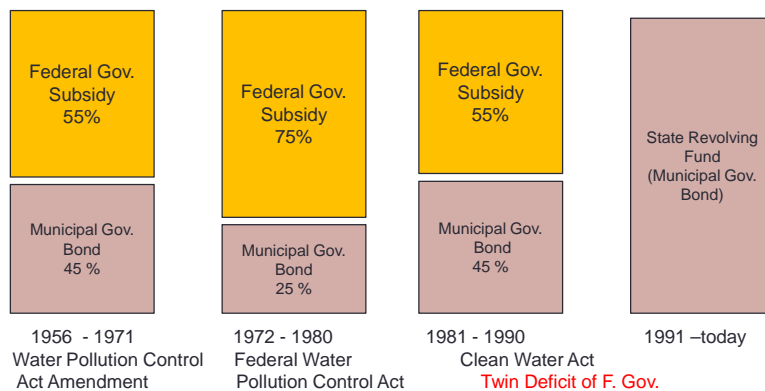
### Clean Water State Revolving Fund

- 1991-1998 USD 30 billion(States 16.6 %, Federal 83.3%)
  - FY2000 USD 1.325 billion
  - Interest rate 0 – market rate(Ave.3%) Repayment period 20 years
- Financial self-independence (SRF replaced form subsidy)**



## Finance: US-EPA (2)

### Change of Financial Support of Federal Gov.



## PPP Projects in Japan (1)

For cost reduction through technology & know-how of PPP

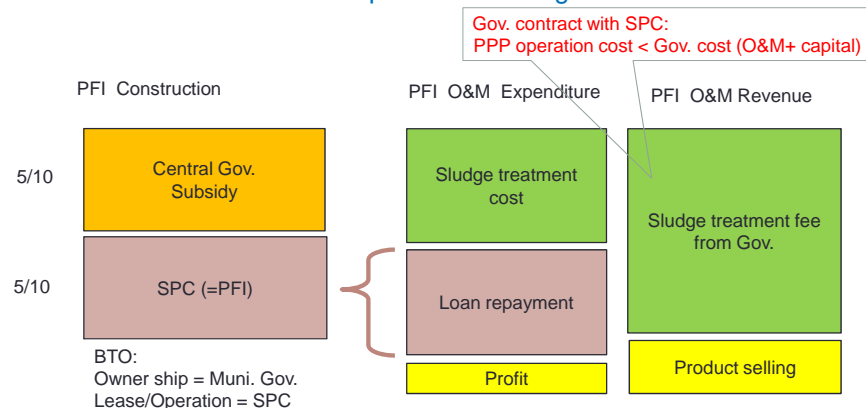
- Bio-gas reuse and electricity & heat supply
- Sewage sludge reuse for fuel

7 operations  
7 constructions & bidding

No.	Project	Business	Product	User	Operation starts	Contract Term year
1	Yokohma City South WWTP	Excavated soil reuse plant	Back-filling soil	Construction project	2004	10
2	Tokyo Morigasaki WWTP	Bio-gas reuse	Heat & electricity	WWTP	2004	20
3	Osaka Tumori WWTP	Bio-gas reuse	Heat & electricity	WWTP	2007	20
4	Tokyo East WWTP	Sludge fuel	Carbonized	coal power	2007	20
5	Yokohama City North WWTP	Bio-gas reuse	Heat & electricity	WWTP	2009	20
6	Miyagi Lower Abukumagawa WWTP	Sludge fuel	Dried pellet	Pulp & paper	2009	
7	Kurobe City WWTP	Sludge fuel	Dried pellet	bio-mass boiler	2010	15
8	Hiroshima West WWTP	Sludge fuel	Carbonized	coal power	2012	20
9	Kinuura East WWTP	Sludge fuel	Carbonized	coal power	2012	20
10	Kumamoto South WWTP	Sludge fuel	Carbonized	coal power	2012	20
11	Osakashi Hirano WWTP	Sludge fuel	Carbonized	coal power	2014	20
12	Chibaken Teganuma WWTP	Sludge fuel	Carbonized	coal power	2015	20
13	Saitamaken Arakawaagan WWTP	Sludge fuel	Carbonized	coal power	2015	20
14	Yokohama City South WWTP	Sludge fuel		coal power	2016	20

## PPP Projects in Japan (2)

Financial resources Japanese Sewerage PPP = BTO



Local Gov. off-set s capital investment into SPC “out of debt”  
Central Gov. Subsidies for cost reduction of public service  
SPC provides capital cost and know-how for construction & OM

## PPP Projects in Japan (3)

### Public Sector Responsibility

Law approval ----- Role of facility ownership

- Land Acquisition & Stake-holder approval
- Sewerage Law
- Supporting to Building Law Approval
- Supporting to other relevant laws

Application of **Subsidy** to Central Government

- Aim is to decline service cost on public

Monitoring of operation

- Sustainability of public service

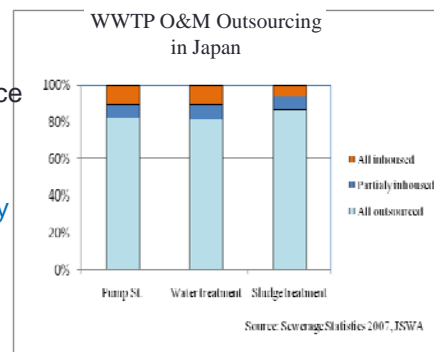
Sharing “Responsibility of public service” & “Cost reduction” with SPC

## O&M outsourcing of Wastewater Treatment Plant

Out-sourcing is prevalent in whole filed.

In-house staff focuses to

- Water quality management
- Storm water pumping station
- Monitoring outsource performance
- Business wastewater monitoring
- Customer information & tariff levy



## Back ground of O&M Out-sourcing

Facilities and O&M staffs increased  
as result of sewerage system development

- Restriction on establishing **new** public organization
- Private sectors' capacity development  
with introducing private sector know-how
- Man power cost increased and low performance  
due to personnel **immobility** in public sector

Local Gov. focuses on services with regulatory power,  
as Customer information, Water quality monitoring, tariff collection, etc.

Part 2:

Learned from finance/management  
capacity development

## Learned from Capacity Development (1)

- Oosaka City in 1930s
  - Urbanization & Needs of sewerage development
    - ⇒ Financial shortage of construction & O&M
    - ⇒ “Finance of Sewerage” introduces Beneficiary Tax of City Planning Act and Sewerage User Charge

- Activated Sludge WWTPs started operation

Tokyo, Nagoya, Toyohashi  
Gifu, Kyoto, Osaka



Blackish water & forming in 1960s

- Beneficiaries Tax

Charge to area of property (m<sup>2</sup>)

Levied at public notice of treatment area (one time)

## Learned from Capacity Development (2)

- Economic growth in 1960s Tokyo Olympic Game 1964
- Pollution Diet 1970 for Institutional Reform
  - “Rapid increase urban population and lack of adequate legal system” are improved to modern sewerage Institution System.
- Environmental Pollution Control Law & EWQ Standards
- Emergency Measures Law for Construction of Sewerage Systems & 5-years Sewerage Development Program
- Sewerage Act Amendment for Comprehensive Basin-wide Planning Sewerage Systems and Regional Sewerage System
- Central Gov. Subsidy Rate increased
- Japan Sewage Works Agency (Sewage Works Center) as project implementation, technical development, training



## Conclusion on financing and institutions

Beginning [stage](#) of Sewerage Works [until 1960s](#)

- Municipality Gov. financed sewerage project.
- In-house O&M staffing started due to public service.

Urbanization & industrialization brought serious water pollution and storm water inundation issues.

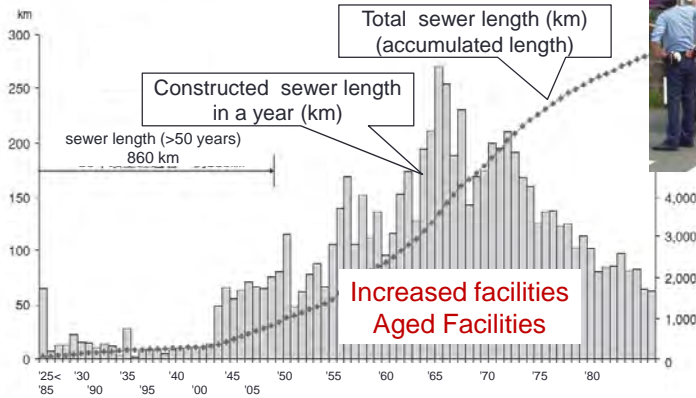
Modified to Present Sewerage Works

- Water pollution control is designated to national policy matter
- Sewerage system admitted as national basic infrastructure
- Financially enforced through high economic growth [in 1960s](#)
- Private sector built capacity

Part 3:  
Recent activities in sewerage works

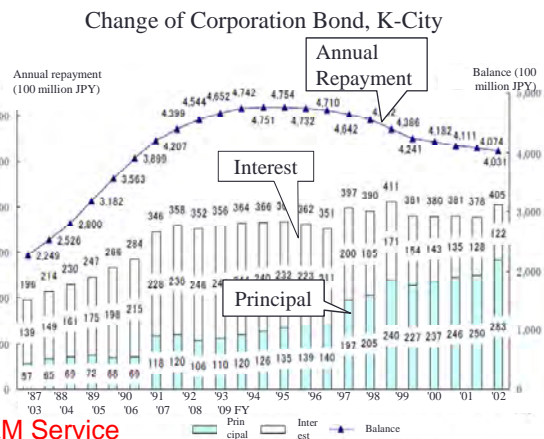
# Facility Management

Accumulated facilities requires OM cost & management  
 Ordinal OM to prevent serious accident



# Financial Reform of Sewerage Works

- Financial Perspective
- Sustaining service level
- Enhancing performance
  - Cost reduction
  - Human development
  - PI(Performance Indicator)
- Public relation
- External resources:
  - Regional management
  - PPP & Comprehensive O&M Service



## Public Relation

### Objectives

- Understanding role of sewerage system & water environment
- Awareness for financing sewerage works

### Activities

- Seminar & site visit
- Recommendation to Gov.



## PI (Performance Indicator)

### Aims

- Management tool to evaluate the efficiency of performance
- Quantitative comparative assessment of performance.

### International Water Association (IWA)

- "Performance Indicator for Water Supply Services" in 2000
- "Performance Indicator for Wastewater Services" in 2003

### Japan Sewage Works Association

- "Guideline for Improving O&M of Wastewater Systems", 2007

## PI (Performance Indicator)

### Context of Information

- Understanding characteristics: Project outline, Staff number, Total budget, etc.
- Project characteristics: Service area, served population, Wastewater flow rate, etc.
- District characteristics: Climate, Receiving water criteria, etc.

### PI : 5 Categories & 56 Items

- 1 Operation (sewer) 7: Aging ratio, Inspection ratio, OM cost per m, etc.
- 2 Operation (WWTP) 12: Aging ratio, Electricity consumed ratio, etc.
- 3 User service 17: WQ compliance, Sewer accident, Claim, etc.
- 4 Management 13: : Unit revenue water, Balance, Wastewater treatment cost,
- 5 Environment 7: BOD load reduction ratio, Sludge recycle ratio, CO<sub>2</sub> reduction

## PI (Performance Indicator)

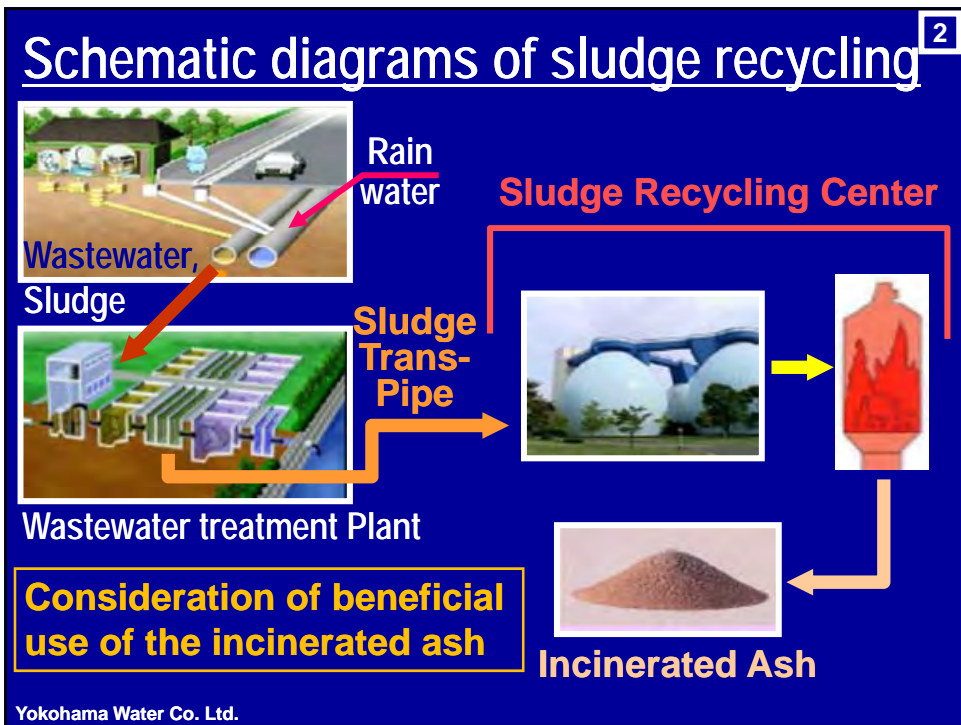
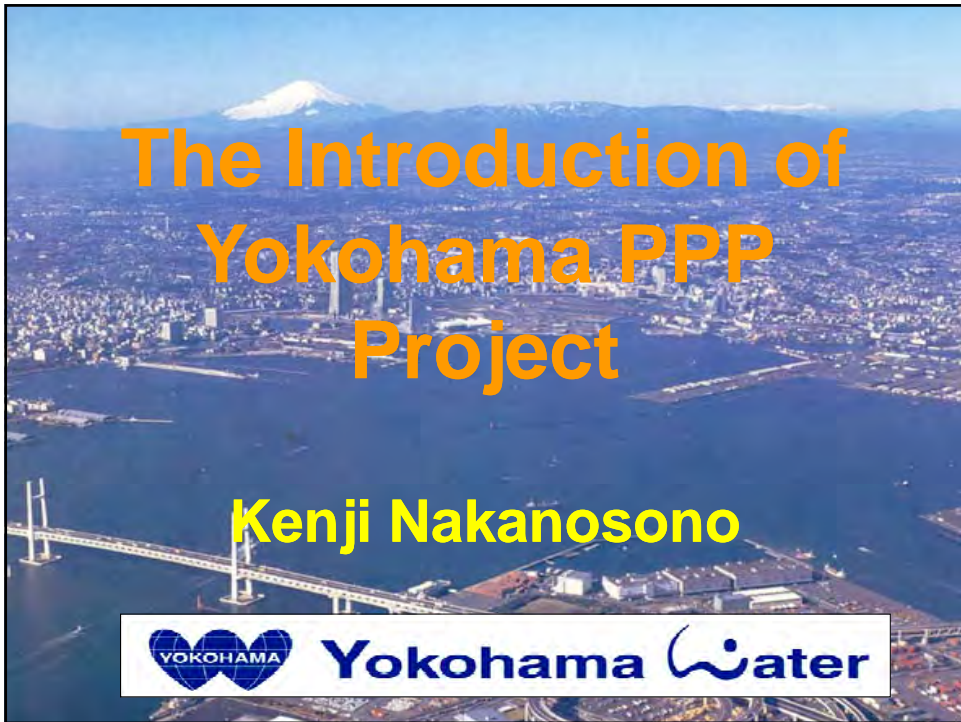
Category	Performance Indicator (PI)	Calculation Formula	Improvement
<b>4. Management (13 items)</b>			
M10	Unit revenue water per person per day	(Annual revenue water / number of days) / Served population	↑
M20	Accounted-for water	Annual accounted-for water / Total treated wastewater x 100	↑
M30	Current balance	Gross earning / Total	
M40	Transfer ratio (profitable earning)	Transfer / Profitable e	
M50	Transfer ratio (capital earning)	Transfer / Capital ear	
M60	Unit revenue	Total revenue / Total	
M70	Unit wastewater treatment cost	Wastewater treatment water	↓
M80	Unit wastewater treatment cost (O&M)	Wastewater treatment cost (O&M) / Total accounted-for water	↓
M90	Unit wastewater treatment cost (capital)	Wastewater treatment cost (capital) / Total accounted-for water	↓
M100	Cost covering ratio	Service charge revenue / Wastewater treatment cost x 100	↑
M110	Cost covering ratio (O&M)	Service charge revenue / Wastewater treatment cost (O&M) x 100	↑
M120	Cost covering ratio (capital cost)	Service charge revenue / Wastewater treatment cost (capital) x 100	↑
M130	Working accidents (per 1 million m <sup>3</sup> treated wastewater)	Number of accidents which caused 4 days of absence or more / Total wastewater treated x 1,000,000	↓

Ex. of PI  
M10: Unit revenue water per person  
M30: Current balance  
M70: Unit wastewater treatment cost  
M100: Cost covering ratio

## Conclusion

- Responsibility of Public Sector
- Capacity Building on Wastewater Management
- PPP contributes to best practice

*Thank you*



# Effective Use of Ash

3

## Incinerated Ash

19,594 DS-t/year  
(DS-t: Dry Solids - tonne)



Landfill

600 DS-t  
(3 %)

### Purpose of Use



Improved Soil  
7,000 DS-t (36 %)



Brick Block  
400 DS-t (2 %)



Cement material  
11,600 DS-t (59 %)

Yokohama Water Co. Ltd.

# Effective Use of Improved soil

4

Displaced soil  
at construction



Improved  
Soil Plant



Sludge Re-  
cycling Center



Soil

### Example of Use

Incinerated ash



Backfilling



Road



Subway

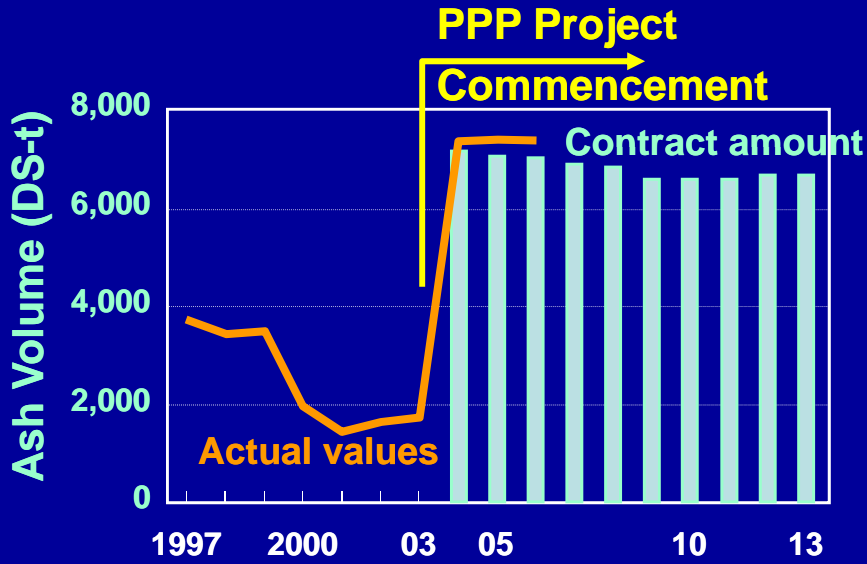


Land  
development

Yokohama Water Co. Ltd.

## Usage of Incinerated Ash

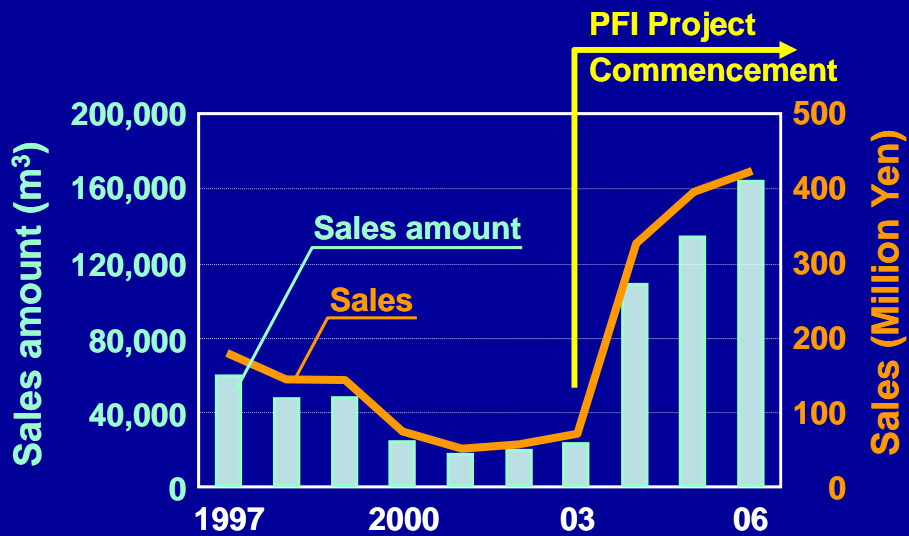
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## Sales of Improved Soil

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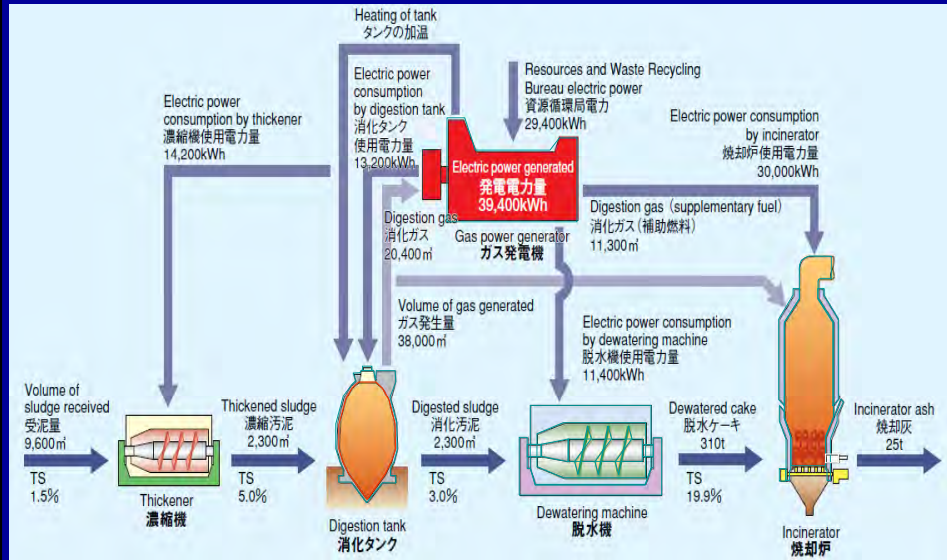


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# Treatment Flow in Plant

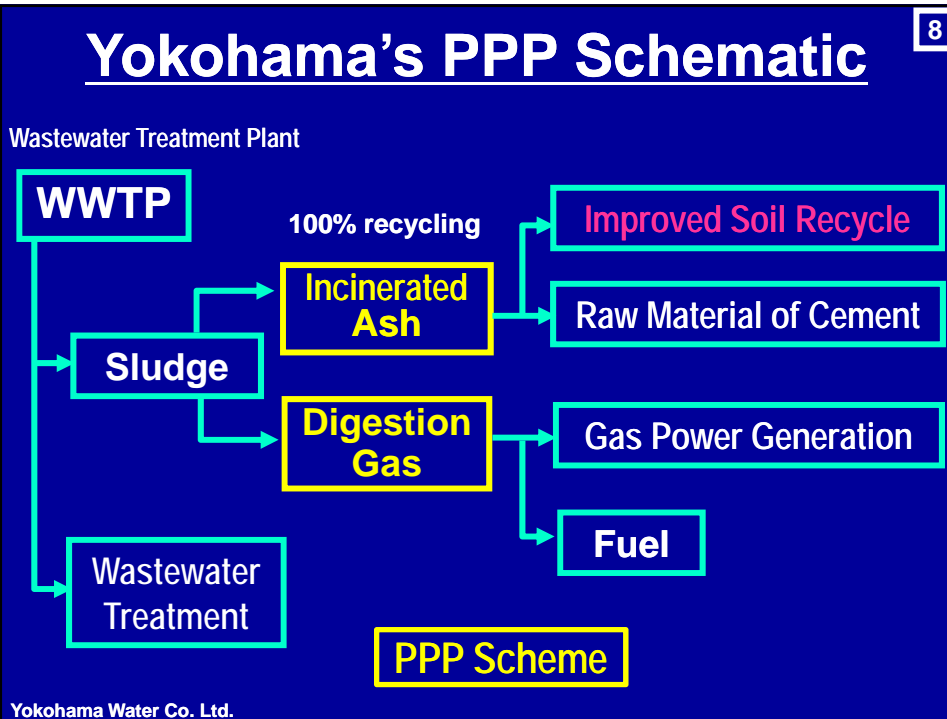
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# Yokohama's PPP Schematic

8



Yokohama Water Co. Ltd.

## **APPENDIX-D**

**PPP 事業の提案書（案）**  
**エンサ下水処理場整備事業**  
**（2011年7月提出）**

Draft Proposal of PPP Scheme  
for  
Project of Yen Xa Wastewater Treatment Plant

July 2011

NIPPON KOEI CO., LTD  
ORIX CORPORATION  
NIHON HELS CORPORATION  
PRICEWATERHOUSECOOPERS CO., LTD  
YOKOHAMA WATER CO., LTD

**(1) Summary**

**Outline Project**

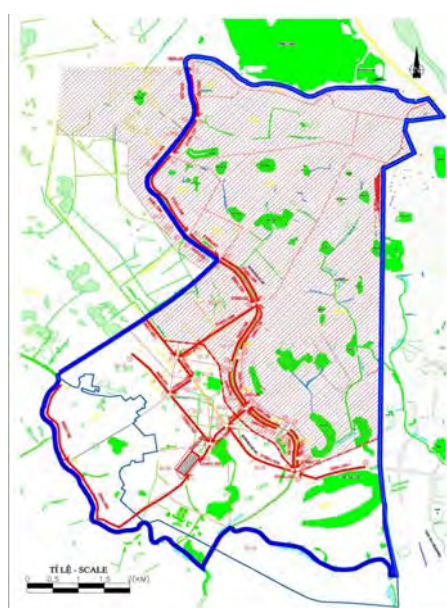
The outline of the Project is as below;

**Table 1-1 Design Condition of the Project**

Service Population	900,000
Service Area	Around 4,900 ha
Wastewater Treatment Capacity	270,000 m <sup>3</sup> /day
Wastewater Treatment Process	Conventional Activated Sludge Process
Sludge Treatment Process	Thickening followed by Dewatering
Sludge Recycle Process	Solar Drying + Mechanical Drying
Treatment Capacity	270,000 m <sup>3</sup> /day



Image of Yen Xa Wastewater Treatment Plant



Service Area

**Table 1-2 Preliminary Cost Estimate of the Project**

(million US\$)

	EPC	Contingency (10%)	VAT	Total
<b>1) Pipe Network</b>	184.2	18.4	20.3	<b>222.9</b>
<b>2) Wastewater Treatment Plant</b>	233.8	23.4	25.7	<b>282.9</b>
<b>3) Sludge Recycling Facility</b>	32.6	3.3	3.6	<b>39.5</b>
<b>Total</b>	<b>450.6</b>	<b>45.1</b>	<b>49.6</b>	<b><u>545.3</u></b>

(The attachement-1 shows the details of cost estimate)

**Summary of Proposal in the Progress of the Study**

The summary of the proposal in the progress report is as below;

- 1) Private sector (SPC) would be responsible for construction and management of Yen Xa wastewater treatment plant and sludge recycling facility. Around 50 % of the fund for the investment cost would be provided from Japanese ODA Loan as the central government subsidy, and the remaining fund will be provided by SPC. JICA PSIF is planned to provide 70 % of the remaining fund with remarkably low interest to SPC. (refer to Figure S1 and S2)
  
- 2) Public Sector would be responsible for construction and management of pipe network. Private company, which may be SPC, would be in charge of the construction under supervision of Public sector. Around 80 % of the investment cost would be provided from Japanese ODA Loan as the central government subsidy. (refer to Figure S1 and S2)
  
- 3) The sewerage tariff shall be increased up to 0.245US\$/m<sup>3</sup> (5,150VND/m<sup>3</sup>), which could cover the operation and maintenance cost (including replacement of mechanical and electrical equipments in 20 years). The tariff would be increased gradually over 10 years since the commencement of the operation of Yen So Treatment Plan (by 5 years after completion of the construction works of Yen Xa). The proposed tariff level is around 10 times of current sewerage tariff, which is same as current water tariff level. As shown in Figure S1, required expenditure from HPC general account is estimated at around 25.8 million US\$/year (542 billion VND/year) after the increase of tariff, which is 2.6 % of HPC ordinary account budget in 2011: 1,000 million US\$/year (21,400 billion VND/year). (refer to Figure S2)

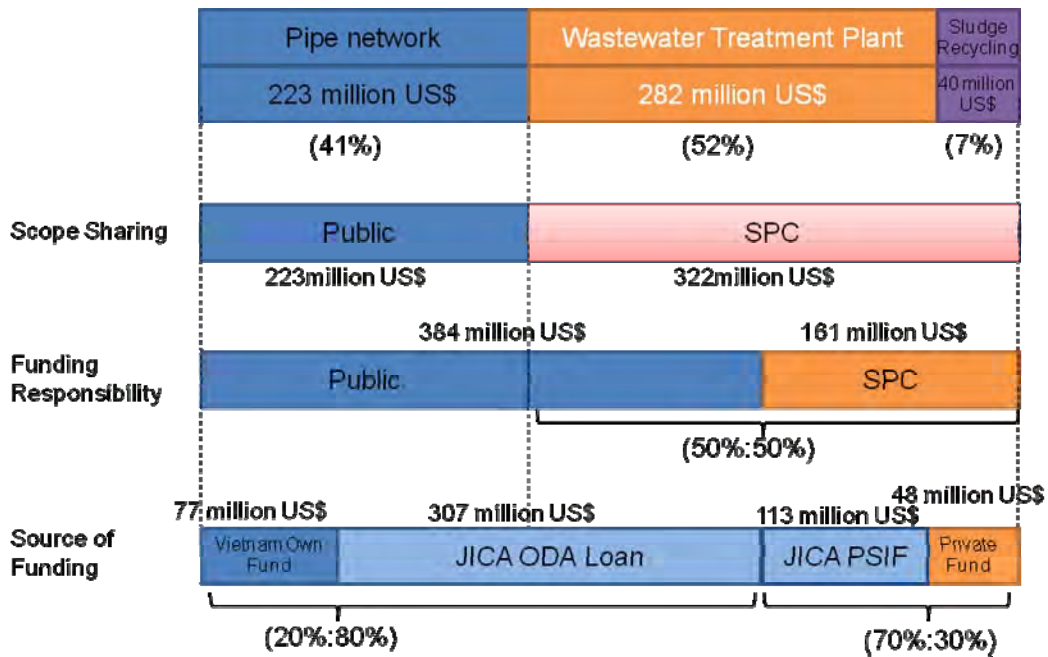


Figure S1 Scope Sharing and Funding Sources of the Project

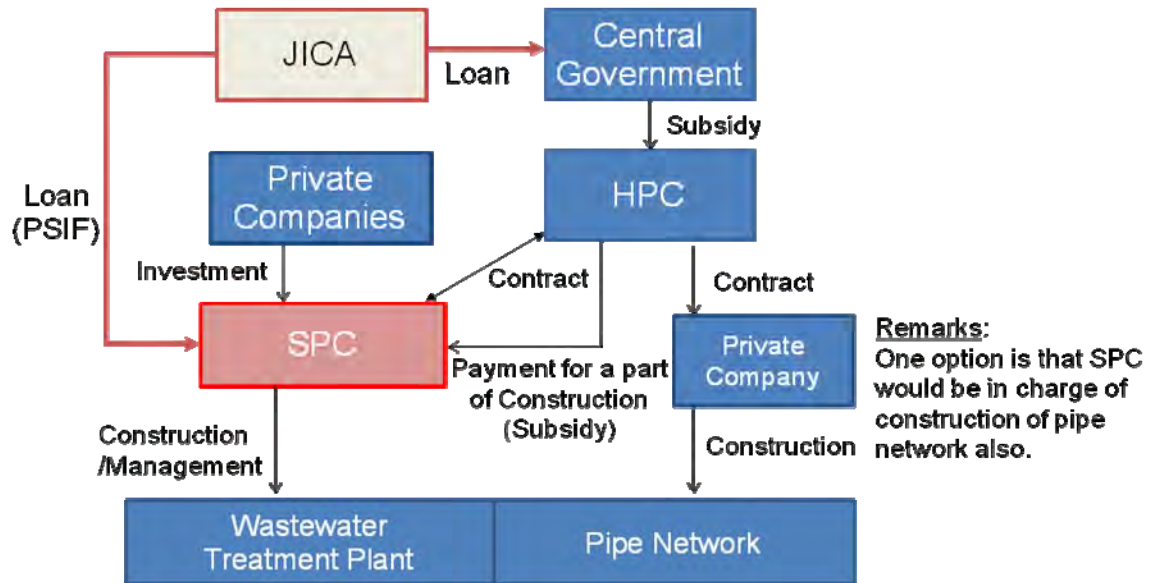


Figure S2 Draft Organization Chart of PPP Scheme for Construction of Yen Xa WWTP

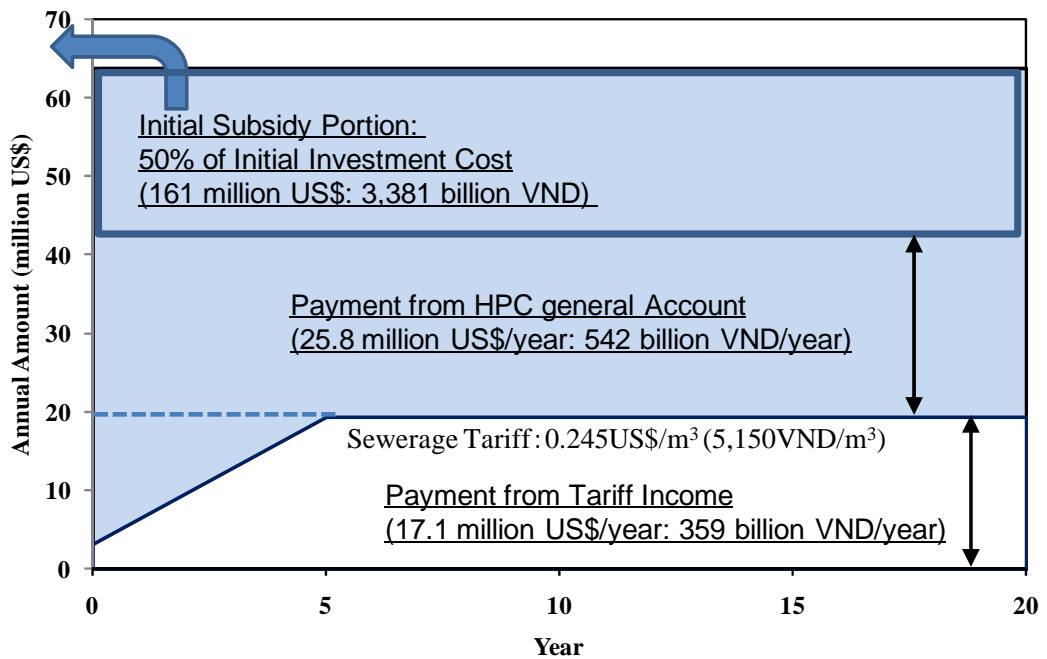


Figure S3 Allocation of Required Cost to Each Source for Yen Xa WWTP

The Study Team prepared the proposal above by following steps of consideration on the appropriate role and cost sharing among sewerage users, the municipality, and the central government, which is described below.

1st Step: Consideration to the suitable tariff level for sewerage users

The suitable sewerage tariff is tentatively proposed at 0.245US\$/m<sup>3</sup> (5,150VND/m<sup>3</sup>), which could cover the operation and maintenance cost (including replacement of mechanical and electrical equipments in 20 years).

2nd Step: Consideration to the affordable financial expenditure for the municipality

The affordable level is tentatively proposed around 25.8 million US\$/year (542 billion VND/year), which is 2.6 % of HPC ordinary account budget in 2011: 1,000 million US\$/year (21,400 billion VND/year)

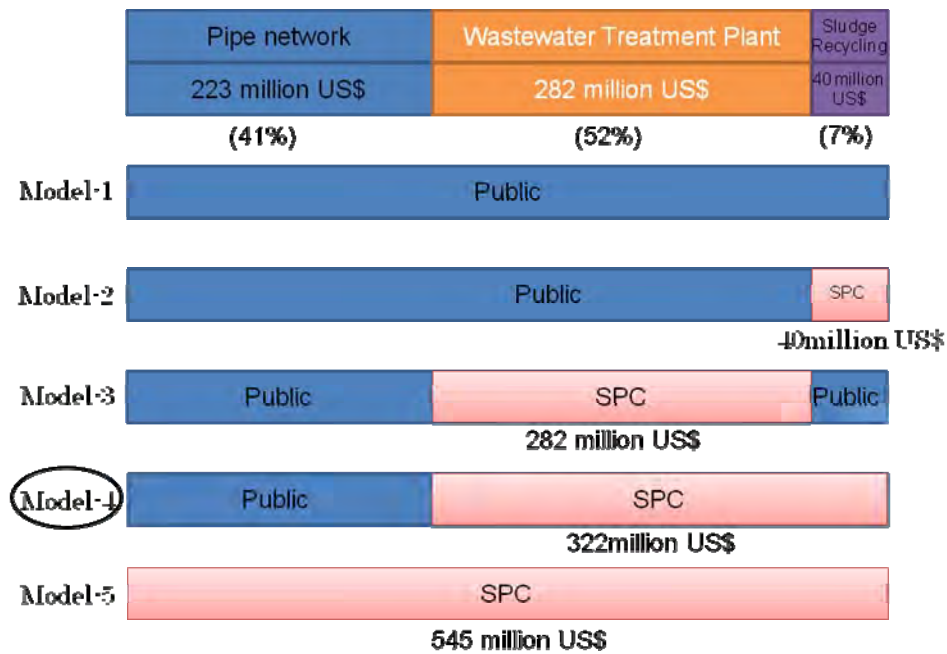
3rd Step: The central government shall subsidy the remaining cost after the fulfillment of burden sharing by sewerage users and the municipality

As the conclusion, it is proposed to provide 100% subsidy for pipe network construction and 50 % subsidy for construction cost of wastewater treatment plant and sludge recycling facility, of which total cost is estimated around 384 million US\$ (8,064 billion VND).

In case that the sewerage tariff level and/or the HPC yearly expenditure proposed above have to be lower, required subsidy should be increased. In order to fix above each step, internal discussions of HPC are required.

## (2) PPP 5 Models

The Project is divided into three portions, "Pipe Network", "Wastewater Treatment Plant" and "Sludge Recycling Facility". JICA Study Team provided PPP 5 Models for alternative study to select portions to be carried out by private sector.



**Figure 2-1 Scope Sharing and Costs of PPP 5 Models**

In the progress of the Study, The Study Team proposed Model-4 as the best option for the PPP scheme of the Project, because of the following reasons;

- 1) The policy of Vietnamese Government does not prefer to use public funds for all of the initial investment cost of the Project. In order to reduce amount of public debts, and introduce effective management of private sector, it is preferred to use certain amount of private fund for the initial investment.
- 2) The construction and management of pipe network portion is not suitable for private sector. The pipe network has not only function of wastewater collection, but also has function of rainwater drainage for keeping safety life in Hanoi. In addition, private sector can hardly to control road traffic and road condition during construction stage, and can hardly utilize their know-how and technologies during operation period in the field.
- 3) On the other hand, effectiveness of wastewater treatment is highly depending on technology and know-how to be applied, private sector is expected to contribute effective construction and management. It is expected to reduce total life cycle cost and safety operation by using competent private companies for construction and management.
- 4) HPC hopes private participation in the field of construction and management of sludge recycling facility by using high technology and know-how with long term experience, particularly in Japan.

(3) Alternatives of Sources of Initial Investment Cost

Table 3-1 shows alternatives of funding source for initial investment cost of sewerage system development in Hanoi. As shown in Figure 2-1, a huge amount of investment cost is required for implementation of the Project. It supposed to use some of sources for the project implementation.



**Table 3-1 Alternatives of Sources of Initial Investment Cost**

<b>Funding Source for Initial Investment</b>		<b>Interest (US\$ basis)</b>
<b>Public Funding Source</b>		
1	Central Government Subsidy (including Funding by ODA Loan: 2.75-3.50%)	-
2	HPC Development and Investment Budget *18,249 billion VND ( 871 million US\$) in 2011	-
3	Municipality Bond	7-10%
4	Loan from Central Government	No data
<b>Private Funding Source</b>		
1	Private Investment (including benefit and risk hedge cost)	12-18%
2	Private Investment with JICA PSIF Loan (Private Sector Investment Fund: 4-5%)	5-10%

Major sewerage and drainage projects in Hanoi have been constructed by using the central government subsidy. The central government provided grant for all of initial investment cost of the major projects to HPC. However, it is generally discussed that the central government won't provide 100 % grant in the field of sewerage in future. The Study Team intends to propose new funding model for sewerage system development in Hanoi by using PPP scheme and JICA funds.

- 1) In order to reduce future HPC expenditure for repayment of investment cost, it is recommended that HPC would pay a part of initial investment cost by using central government subsidy and/or HPC general account. However, in this Study, HPC general account was not considered as a funding source for the initial investment, because of low possibility.
- 2) As other of public funding sources, issue of municipality bond and loan from central government are considerable. However, it is said that municipality bond with long repayment period could hardly be issued by HPC at the present. If so, the municipality bond is not suitable for long term funding for infrastructure development. As for the loan from central government, information is not available so far. In progress of the Study, both funding sources have not been considered. (In USA/Japan, the central government established funds for providing low interest loan to municipalities for sewerage system development. So far, this type of fund is not established nor considered in Vietnam.)
- 3) It seems so difficult to provide enough public funding sources to cover all of the initial investment cost of the Project. The Study Team considered that utilization of private finding source is indispensable for implementation of the Project.
- 4) In private investment scheme, financing cost shall include cost of risk hedge and benefit of private company. Financing cost in private investment is therefore higher than the cost of public funding. The Study Team considers using JICA PSIF and Japanese ODA loan for the Project.
- 5) The idea is that HPC would provide a part of initial investment cost (construction cost) of the Project by using Japanese ODA loan and central government subsidy. The remaining investment

cost would be provided by private sector (SPC) using private investment fund and JICA PSIF. SPC would manage, operate and maintain Yen Xa WWTP in 20 years, and recover his expenditure for the investment cost by service charge that HPC would pay to SPC.

(4) Consideration of Ratio of Subsidy for Investment Cost

Figure 4-1 shows 5 alternatives of subsidy ratio for initial investment cost in case of PPP Model-4. In the Decision 71, it is stipulated that “State participation portion” (subsidy) shall not exceed 30 % of total investment cost. However, the Study Team intends to study on various possibilities, because sewerage project is supposed to be applicable to exceptional sectors of the decision.

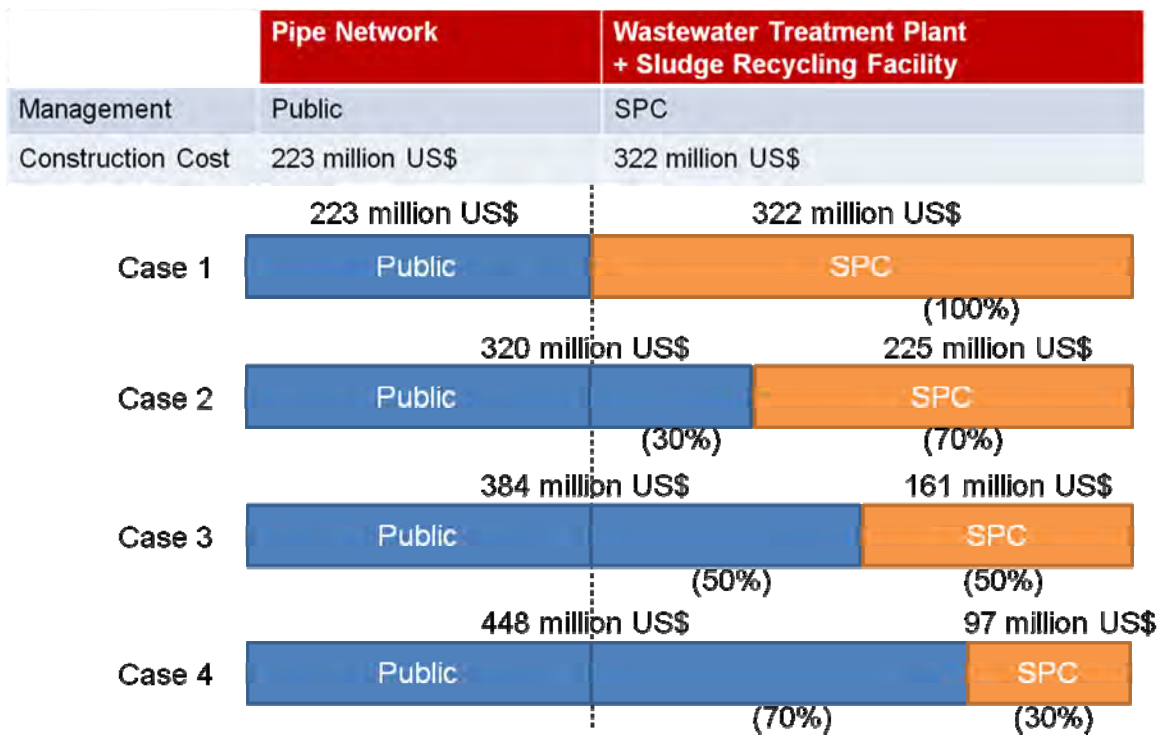


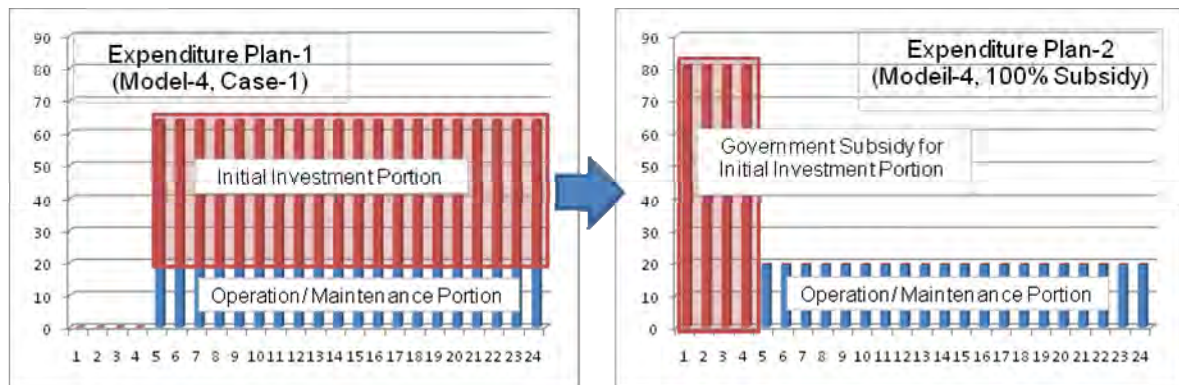
Figure 4-1 Alternatives of Subsidy Ratio for Initial Investment Cost

The plans of expenditure for the Project are prepared in the following two conditions;

Expenditure Plan-1 (Case-1): SPC construct WWTP by using funds SPC provide. HPC doesn't pay for the investment cost during construction stage. During 20 years operation period, HPC pay for service charge, of which amount SPC could recover his expenditure for the initial investment cost (including interest, benefit and risk hedge cost) and OM cost.

Expenditure Plan-2 (100% Subsidy): HPC (or central government) provide full amount of investment cost at construction stage without loan. During construction, HPC pay for only OM cost.

Figure 4-2 shows two expenditure plans in 4 years construction period and 20 years of operation period. If government subsidy can be spent for full initial investment cost at initial stage, yearly required payment during operation period can be reduced drastically. The Study Team intends to propose suitable subsidy ratio, through financial analysis.



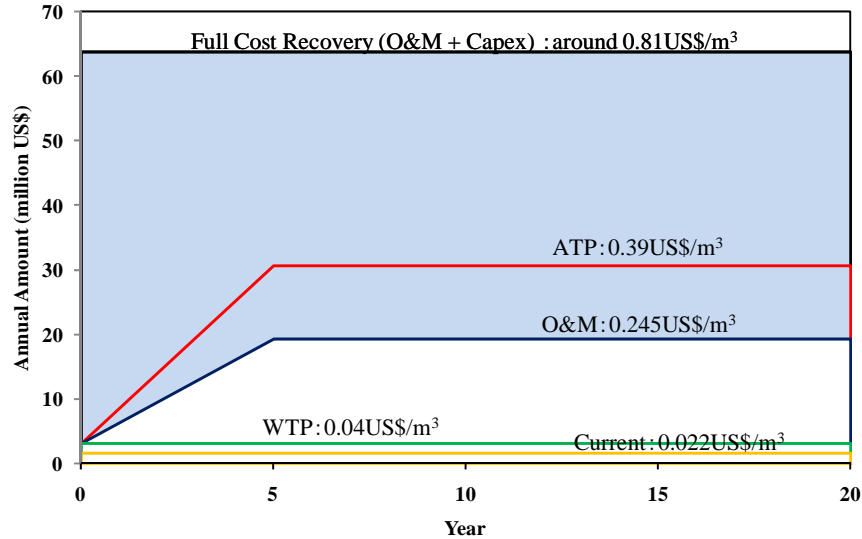
**Figure 4-2 Expenditure Plans with/without Government Subsidy**

#### (5) Financial Analysis

For sources of repayment and operation/ maintenance cost of sewerage system in Hanoi, only “sewerage tariff income” and “HPC general account” are valid. It means that a part of the initial investment cost would be paid by central government subsidy and the remaining would be paid by private finance at the initial stage, and repayment to the private finance and operation and maintenance cost shall be prepared by using “sewerage tariff income” and “HPC general account” during operation period.

In order to establish PPP scheme of the project, it is important to study on balance of “Subsidy ration of initial investment cost”, “Amount of sewerage tariff income with suitable tariff level” and “Possible expenditure from HPC general account”. The Study Team is carrying out a financial analysis as described below.

In case of Model-4 with Expenditure Plan-1 as shown in Figure 4-2, HPC shall provide around 63 million US\$/year for the repayment and operation and maintenance to SPC. If the financial source is only tariff income in service area of Yen Xa WWTP, sewerage tariff should be 0.81 US\$/m<sup>3</sup> (17,000 VND/m<sup>3</sup>). It is equivalent of around 40 times of current sewerage tariff level, or around 4 times of current water tariff level. The average monthly household income is around 365US\$ (7,641,000 VND), and the average monthly water consumption is estimated at around 17 m<sup>3</sup>/day. The expenditure of sewerage tariff from household is estimated at 14US\$/month (294,000 VND/month), which is around 3.8% of the household income. Generally, total expenditure of water and sewerage tariff could not be more than 3-4%. It is almost impossible that sewerage tariff come to 3% level.



**Figure5-1 Alternatives of Sewerage tariff level and Required Annual Payment**

The financial analysis of PPP Model-4 is carried out by 12 cases (3 patterns of sewerage tariff x 4 types of subsidy ratio). Figure 4-1 shows 4 types of subsidy ratio, and 3 patterns of sewerage tariff are explained as below;

Sewerage Tariff Level (3 Patterns)

- 1) Willingness-To-Pay Level: 0.04 US\$/m<sup>3</sup> (840 VND/m<sup>3</sup>)  
Average Monthly Charge to Household : 0.68 US\$/month (14,300 VND/month), which is equivalent to 0.19% of the average household income in Hanoi
- 2) Operation and Maintenance Cost Recovery Level: 0.245 US\$/m<sup>3</sup> (5,150 VND/m<sup>3</sup>)  
Average Monthly Charge to Household: 4.2 US\$/month (87,600 VND/month), which is equivalent to 1.16% of the average household income in Hanoi
- 3) Affordable-to Pay Level : 0.39 US\$/m<sup>3</sup> (8,190 VND/m<sup>3</sup>)  
Average Monthly Charge to Household : 6.6 US\$/month (138,600 VND/month), , which is equivalent to 1.80% of the average household income in Hanoi

**Table 5-1 Basic Assumption for Water Tariff Setting in the Study**

Items	Assumption
Average Household Income	91.7 million VND/year (7.64 million VND/month) 4,378 US\$/year (365 US\$/month)
Average Persons per Family	3.94
Average Water Consumption	17 m <sup>3</sup> /family/month (143 L/p/day)

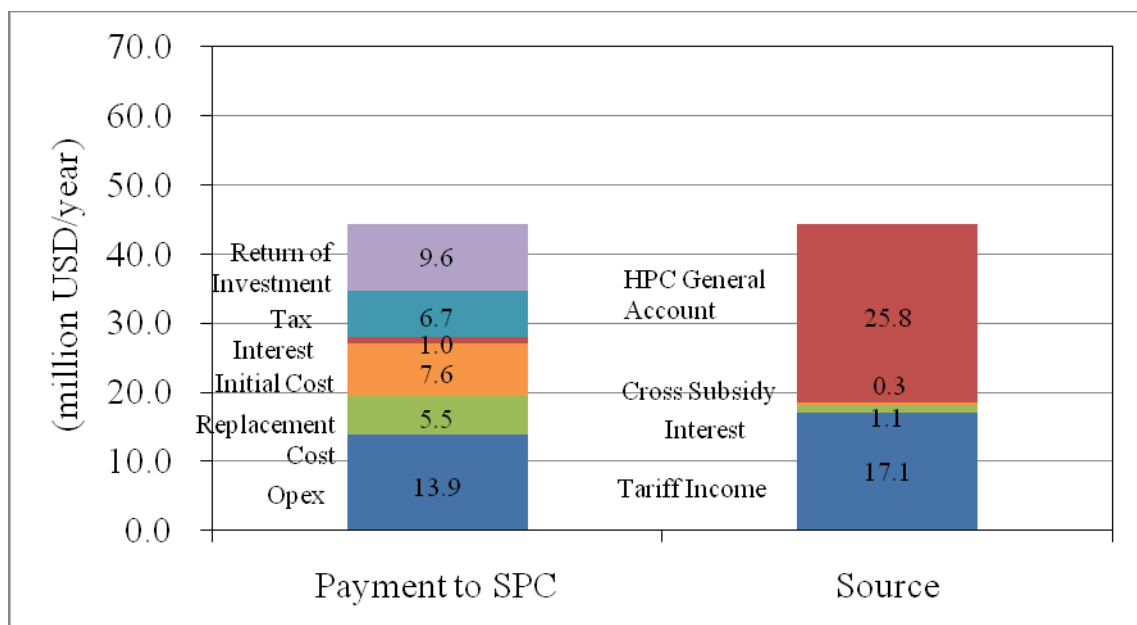
Basic conditions of financial analysis are shown in Table 5-2.

**Table 5-2 Basic Conditions of Financial Analysis**

Items	Assumptions
Currency for Calculation	US \$
Period of Analysis	Construction Period: 4 years Operation Period: 20 years
Loan Repayment Period (PSIF)	The same as "Operation Period"
Loan Interest Rate (PSIF)	5%
Equity Return Rate (IRR)	15%
Income Tax Rate*	25 %
Value Added Tax Rate*	10 %
Debt to Equity Ratio*	Debt (PSIF) 70%, Equity 30%
Government Subsidy	No repayment/ no interest
Sewerage Tariff	Target Tariff: 0.04 US\$ /m <sup>3</sup> , 0.245 US\$ /m <sup>3</sup> , 0.39 US\$ /m <sup>3</sup> Increasing up to target tariff level from 0.04 US\$ /m <sup>3</sup> (840 VND /m <sup>3</sup> ) in 5 years

The results of the financial analysis on 12 cases are shown in Attachment-1

The result of Subsidy 50% and Sewerage Tariff 0.245 US\$/m<sup>3</sup> (5,150 VND/m<sup>3</sup>) is shown in Figure 5-2



**Figure 5-2 Result of Financial Analysis (PPP Model-4, Case-3 with Tariff 0.245 US\$/m<sup>3</sup>)**

Table 5-3 explain output items of the financial analysis.

**Table 5-3 Output Items of Financial Analysis**

<b>Items</b>	<b>Assumptions</b>
<b>Payment to SPC</b>	
1) Return of investment	The sum of the dividend to be paid to the equity investors. This includes the return portion only and does not include principal (i.e., originally invested) portion of the investment.
2) Tax	The sum of income tax and value added tax to be paid by SPC during operation period.
3) Interest	The sum of the interest expenses to be paid by SPC for PSIF loan. The amount does not include the principal portion of the PSIF.
4) Initial Cost	Repayment of Initial construction cost and related expenses to be paid by SPC during construction period.
5) Replacement Cost	Replacement cost (i.e., additional capital expenditure) to be paid by SPC during operation period.
6) Opex	Operating expenses to be paid by SPC during operation period.
<b>Financial Source</b>	
1) HPC General Account	Annual expenditure by HPC to SPC to compensate for the shortfall of revenue items "Tariff Income", "Interest" and "Cross Subsidy", to provide the payment amount to SPC above. This is assumed to be paid during the operation period.
2) Cross Subsidy	Cross subsidy from other territories in Hanoi. If sewerage Tariff of 0.245 US\$/m <sup>3</sup> is materialized, some WWTPs in charge of other territories could generate excess cash flow. Such excess cash flow is assumed to be paid to this project as a kind of "territorial" cross subsidy.
3) Interest	Interest income from the deposit of SPC in banks.
4) Tariff Income	SPC's Income which corresponds with the amount assumed to be paid by citizens to use Yen Xa WWTP as sewage tariff.

Table 5-4 shows rough estimate of required yearly expenditure from HPC general account for each case

Table 5-4 Required Yearly Expenditure from HPC General Account for Each Case

	Subsidy: 0%	Subsidy: 30%	Subsidy: 50%	Subsidy: 70%
VND 840 /m <sup>3</sup> (US\$ 0.04/ m <sup>3</sup> ) Willingness-to-Pay (0.2% of household Income)	59.4 (1,247)	47.8 (1,004)	40.0 (840)	32.1 (671)
VND 5,150 / m <sup>3</sup> (US\$ 0.245/ m <sup>3</sup> ) Management Cost Recovery (1.1% of household Income)	45.2 (949)	33.6 (706)	25.8 (542)	18.0 (378)
VND 8,190 / m <sup>3</sup> (US\$ 0.39/ m <sup>3</sup> ) Affordable-to-Pay (1.8% of household Income)	38.8 (814)	27.2 (571)	19.3 (405)	11.5 (241)
				(million US\$/year) (billion VND/year)

#### (6) Conclusion and Recommendation in Progress Stage

As the progress report, the Study Team recommends Model-4 Case-3 as the best option.

- 1) Private sector (SPC) would be responsible for construction and management of Yen Xa wastewater treatment plant and sludge recycling facility. Around 50 % of the fund for the investment cost would be provided from Japanese ODA Loan as the central government subsidy, and the remaining fund would be provided by SPC. JICA PSIF is planned to provide 70 % of the remaining fund with remarkably low interest to SPC. (refer to Table 7-1)
- 2) Public Sector would be responsible for construction and management of pipe network. Private company, which may be SPC, would be in charge of the construction under supervision of Public sector. Around 80 % of the investment cost would be provided from Japanese ODA Loan as the central government subsidy. (refer to Table 7-1)
- 3) The sewerage tariff shall be increased up to 0.245US\$/m<sup>3</sup> (5,150VND/m<sup>3</sup>), which could cover the operation and maintenance cost (including replacement of mechanical and electrical equipments in 20 years). The tariff will be increased gradually over 10 years since the commencement of the operation of Yen So Treatment Plan (by 5 years after completion of the construction works of Yen Xa). The proposed tariff level is around 10 times of current sewerage tariff, which is same as current water tariff level. As shown in Figure S1, required expenditure from HPC general account is estimated at around 25.8 million US\$/year (542 billion VND/year) after the increase of tariff, which is 2.6 % of HPC ordinary account budget in 2011: 1,000 million US\$/year (21,400 billion VND/year).

Figure 6-1 shows allocation of required expenditure for the Project to each source. Figure 6-2 shows yearly expenditure plan of HPC in Model-4, case-3.

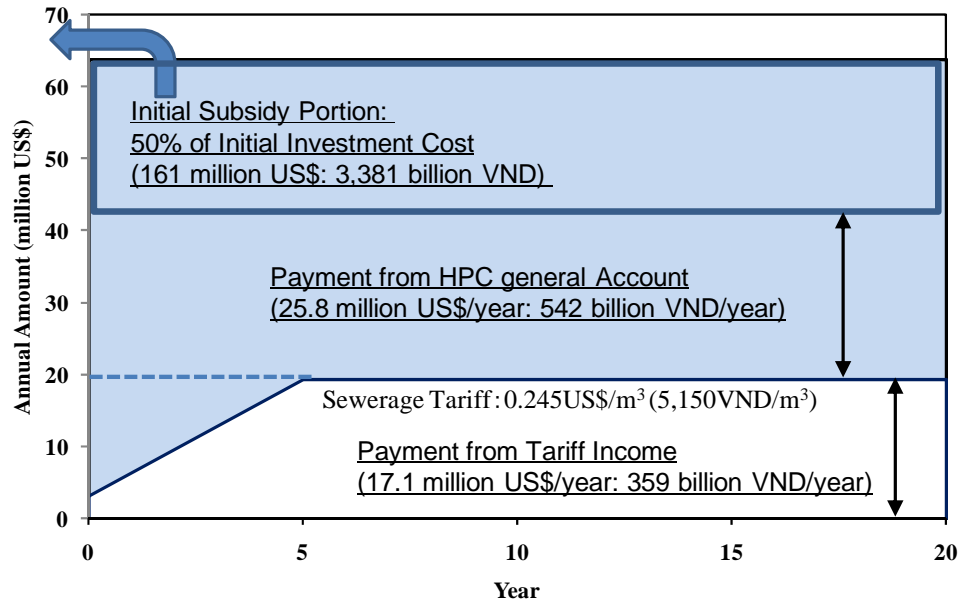


Figure 6-1 Allocation of Required Cost to Each Source for Yen Xa WWTP

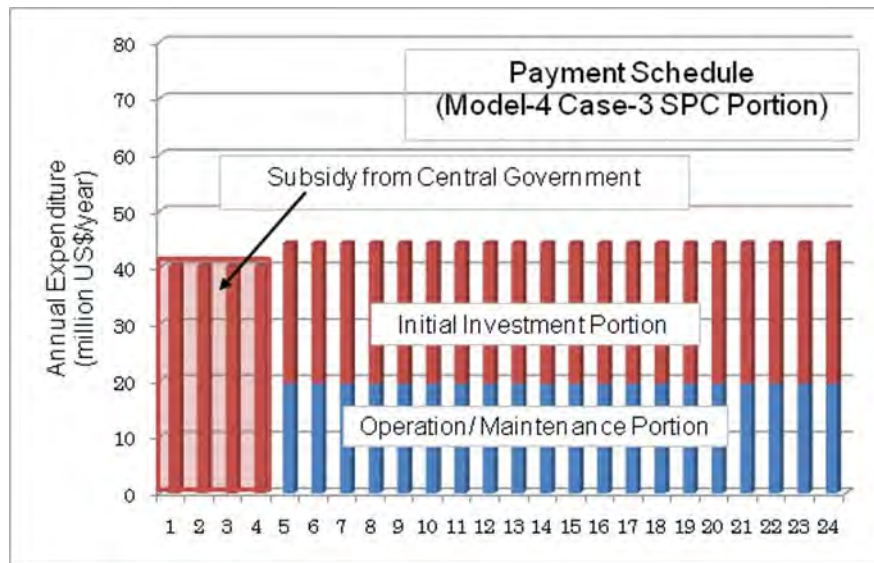


Figure 6-2 Expenditure Plan of HPC (Model-4 case-3)

(7) Draft Proposal of Hanoi PPP Model and Funding Source

There are many project examples in China, Korean, Taiwan and Mexico, that private sector (SPC) has constructed and managed WWTP by using private funds under the contract with a municipality. Figure 7-1 shows the image of organization chart of PPP scheme of construction of WWTP. In all cases, SPC has received service charges from municipality (not from end users) under the contract.



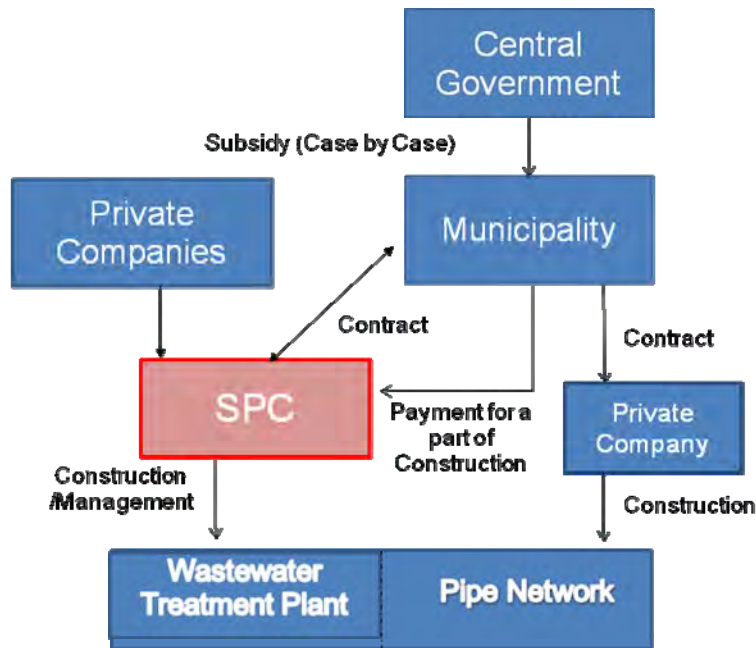


Figure 7-1 Sample of Organization Chart of PPP Scheme for Construction of WWTP

Figure 7-2 shows the draft organization chart of PPP scheme for the project of Yen Xa WWTP. In order to reduce financing cost of the Project, it is proposed that JICA ODA loan would be provided to the central government for source of public funding for the public portion and SPC portion of the Project, and JICA PSIF would be provided to SPC. Table 7-1 shows rough estimate of funding amount from each source for the initial investment of the Project..

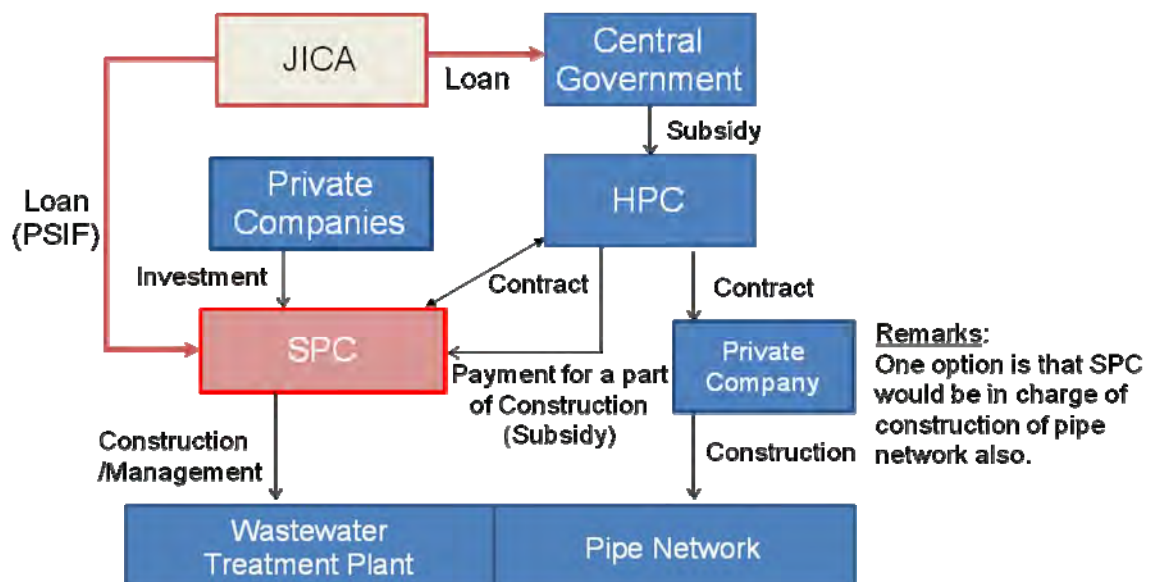


Figure 7-2 Draft Organization Chart of PPP scheme for construction of Yen Xa WWTP

Table 7-1 shows the draft proposal of funding source and required amount for overall the Project

**Table 7-1 Draft Proposal of Funding Source for Overall Project  
(PPP Model-4, Case-3)**

(million US\$)

	Public Fund (Central Government Subsidy)		Private Fund		Total
	Vietnam Own Fund (20%)	JICA ODA Loan to Central Government (80%)	JICA PSIF to SPC (70%)	Private Investment (30%)	
<b>Public Portion</b> (Pipe Network)	44.6	178.3	-	-	<b>222.9</b>
<b>SPC Portion</b> (Wastewater Treatment Plant, and Sludge Recycling Facility)	32.2	129.0	112.8	48.4	<b>322.4</b>
		← 161.2 (50%) →	← 161.2 (50%) →		
<b>Total</b>	<b>76.8</b>	<b>307.3</b>	<b>112.8</b>	<b>48.4</b>	<b>545.3</b>

Remarks: It is assumed that JICA ODA loan would provide 80 % of public fund for the Project.

## *Attachment-1 Cost Estimation of Initial Investment Cost*

### **1.1 Procedure of Initial Investment Cost Estimate for the Project**

The initial investment cost of the Project is estimated in as shown in Table 1.1.

**Table 1.1 Summary of Preliminary Cost Estimate**

(million US\$)

	EPC	Contingency (10%)	VAT	Total
<b>1) Pipe Network</b>	184.2	18.4	20.3	<b>222.9</b>
<b>2) Wastewater Treatment Plant</b>	233.8	23.4	25.7	<b>282.9</b>
<b>3) Sludge Recycling Facility</b>	32.6	3.3	3.6	<b>39.5</b>
<b>Total</b>	<b>450.6</b>	<b>45.1</b>	<b>49.6</b>	<b><u>545.3</u></b>

The cost estimate is carried out by using cost estimate data in “Feasibility Study for the Construction Project of Central Large-scaled Wastewater Treatment Plants for Hanoi Environmental Improvement” (2008). The procedure of the cost estimate followed steps as shown below;

- Step 1: Picking up construction cost estimate data in the F/S report (2008)
- Step 2: Price adjustment from 2008 price to 2011 price (including exchange ratio)
- Step 3: Adding cost of additional facilities (including a sludge recycling facility and an integrated control system)
- Step 4: Consideration of cost reduction by introduction of PPP scheme. (around 20 % cost reduction on construction cost of wastewater treatment plant)
- Step 5: Adding engineering cost to estimate cost of EPC (Engineering Procurement and Construction)

Table 1.2 shows the results of calculation at each step.

<b>Table 1.2 Procuder of Cost Estimate</b>														
Items	Construction Cost												EPC Cost of PPP Project (Step 5) (million US\$)	
	F/S Report, 2008 (Step 1)			Modified with 2011 Price (Step 2)			Modified for PPP Project (Step 3&4)			Exchange to US\$ (million US\$)				
	Foreign Portion (million JPY)	Local Portion (million VND)	Total (million JPY)	Foreign Portion (million JPY)	Local Portion (million VND)	Total (million JPY)	Foreign Portion (million JPY)	Local Portion (million VND)	Total (million JPY)					
Sewer Collection System	Civil Works	10,095	687,308	14,391	10,095	963,606	13,921	10,095	963,606	13,921	10,095	963,606	167.4	184.2
	Mechanical, Electrical	0	0	0	0	0	0	0	0	0	0	0	0	
WWTP (wastewater treatment + sludge thickening, dewatering)	Civil Works	1,831	863,530	7,228	1,831	1,210,669	6,637	1,465	968,535	5,310	1,465	968,535	63.9	233.8
	Mechanical, Electrical	14,293	124,679	15,072	14,293	174,800	14,987	11,434	139,840	11,990	11,434	139,840	144.2	
Sludge Recycle Center (Solar Drying + Mechanical Drying)	Civil Works	-	-	-	-	-	-	-	-	-	-	-	5.1	32.6
	Mechanical, Electrical	-	-	-	-	-	-	-	-	-	-	-	24.6	
Integrated Control System	Civil Works	-	-	-	-	-	-	-	-	-	-	-	0	-
	Mechanical, Electrical	-	-	-	-	-	-	-	-	-	-	-	4.5	
Total				36,691			35,545			34,060			409.6	450.6

Remarks: The cost of the integrated control system is added to the cost of WWPT in EPC column.

Table 1.3 shows summary of the project cost estimate in the F/S report (2008) with Japanese Yen and Vietnamese Dong. The cost is estimated around 45,564 million JPY, which is equivalent to 451 million US\$ or 733.6 billion VND in 2008 price and exchange ratio. (excluding VAT and price contingency)

**Table 1.3 Project Cost Estimate in the F/S Report (2008)**

		Foreign Portion (mil. JPY)	Local Portion (mil. VND)	Total (mil. JPY)
1) Construction Cost				
Sewer Collection System	Civil Works	10,095	687,308	14,391
	Mechanical, Electrical	0	0	0
WWTP (wastewater treatment + sludge thickening, dewatering)	Civil Works	1,831	863,530	7,228
	Mechanical, Electrical	14,293	124,679	15,072
Sub-Total		26,219	1,675,517	36,691
2) Engineering Cost		2,622	167,552	3,669
3) Land Acquisition Cost			40,591	254
4) Administration Cost	2% of 1) + 2)	577	36,861	807
5) Physical Contingency	10% of 1), 2), 3) & 4)	2,942	192,052	4,142
Total		32,360	2,112,573	45,564

The cost was estimated based on the price level and the exchange rate of April 2008. The exchange rate of that time is as follow.

US\$ 1.00 = 16,100 VND、 US\$ 1.00 = 101 JPY、 1 JPY = 160 VND

## 1.2 Method of Cost Estimate

The method of cost estimate is as mentioned below.

### 1) Demarcation of Work Scope between Public and Private

The project of Yen Xa WWTP in the F/S report (2008) consists of 1) Wastewater Collection Pipe Network and 2) WWTP (wastewater treatment facilities, sludge thickening and dewatering facilities). Additionally, 3) Sludge recycling facility and 4) Integrated control system are proposed in the PPP Project. The cost shall be added. (The cost of the integrated control system is added to the cost of WWPT.)

The scope sharing between public and private for the Project is shown in Table 1.4. Only the wastewater collection pipe network is proposed in public portion and the others are proposed in SPC portion. As for the structures in the SPC portion, SPC would be responsible for the works from EPC to operation/ maintenance stage consistently.

**Table 1.4 Demarcation of Public and Private for each Facility**

Facilities	Sewer Collection System	WWTP	Sludge Recycle Center	Integrated Control System
Demarcation	Public	Private	Private	Private

## 2) Consideration of Price Discount in SPC Portion

In the F/S report (2008), the WWTP was planned to be constructed by using fund from JICA ODA Loan, and the construction and management would be under public sector. However, in the Study, WWTP is proposed to be constructed and managed on private sector (SPC) responsibility under supervision of public sector. SPC would implement from EPC to O&M consistently and consider effective construction and management method in order to minimize life cycle cost of the Project by using his technology and know-how. Based on above consideration, the construction/procurement cost of WWTP is tentatively estimated around 20% lower than the estimate in the F/S report (2008).

## 3) Consideration of Price Escalation

The cost estimate in the F/S report is based on the price in April, 2008. For price adjustment from April 2008 price to April 2011 price, Vietnamese consumer price index (CPI) from April 2008 to April 2011 are confirmed as shown in Table 1.5.

**Table 1.5 Vietnamese CPI in each April from 2008 to 2011 (vs. April a year ago)**

Period	April 2008	April 2009	April 2010	April 2011
CPI (vs. April a year ago)	—	109.23	109.23	117.51

(Source : <http://www.gso.gov.vn/>)

From Table 1.5, the inflation rate from April 2011 to April 2008 is estimated as below.

$$(109.23/100 * 109.23/100 * 117.51/100) * 100 = 140.20 \%$$

For the estimate in 2011, local portion of the estimate cost in the F/S report (2008) is multiplied by 140.20%. As for CPI in Japan, there is less than 0.3% difference between April 2008 and 2011. The foreign portion (JPY) of the cost estimate is used for the estimate in 2011 without adjustment.

## 4) Exchange Rate

In this cost re-estimation, the foreign exchange rates of 2011 April 1<sup>st</sup> are used.

US\$ 1.00 = 20,944 VND、 US\$ 1.00 = 83.15 JPY、 1 VND = 0.00397 JPY

(Source: Bank of Tokyo-Mitsubishi UFJ, Financial Times)

## 5) Others

Other conditions are shown as below;

- Engineering Cost: 10% of construction/procurement cost
- Land Acquisition Cost: It is assumed to be provided by HPC, and be out of cost estimate in the Study
- Administration Cost: It is considered in operation and maintenance cost
- Physical Contingency: 10% of EPC cost
- VAT: 10%

## 6) Calculation Method

The calculation method is shown in Table 1.4.

**Table 1.4 Calculation of Cast Estimate**

Facilities	Foreign Portion	Local Portion		Sub-Total (JPY)	Modified Construction Cost *1,*2		EPC Cost (US\$)
	Existing F/S (JPY)	Existing F/S (VND)	Price Escalation (VND)		(JPY)	Exchange to US\$ (US\$)	
Sewer Collection System	A <sub>1</sub>	B <sub>1</sub>	C <sub>1</sub> (=1.402*B <sub>1</sub> )	D <sub>1</sub> (=A <sub>1</sub> + C <sub>1</sub> /0.00397)	E <sub>1</sub> (=D <sub>1</sub> )	F <sub>1</sub> (=E <sub>1</sub> /83.15)	G <sub>1</sub> (=1.1*F <sub>1</sub> )
WWTP	A <sub>2</sub>	B <sub>2</sub>	C <sub>2</sub> (=1.402*B <sub>2</sub> )	D <sub>2</sub> (=A <sub>2</sub> + C <sub>2</sub> /0.00397)	E <sub>2</sub> (=0.8D <sub>2</sub> )	F <sub>2</sub> (=E <sub>2</sub> /83.15)	G <sub>2</sub> (=1.1*F <sub>2</sub> )
Sludge Recycle System	-	-	-	-	E <sub>3</sub>	F <sub>3</sub> (=E <sub>3</sub> /83.15)	G <sub>3</sub> (=1.1*F <sub>3</sub> )
Integrated Control System	-	-	-	-	E <sub>4</sub>	F <sub>4</sub> (=E <sub>4</sub> /83.15)	G <sub>4</sub> (=1.1*F <sub>4</sub> )

\*1 the cost of WWTP is to be reduced by 20% from the estimate in the F/S report (2008)

\*2 the costs of the sludge recycling facility and the integrated control system are newly estimated in this Study.

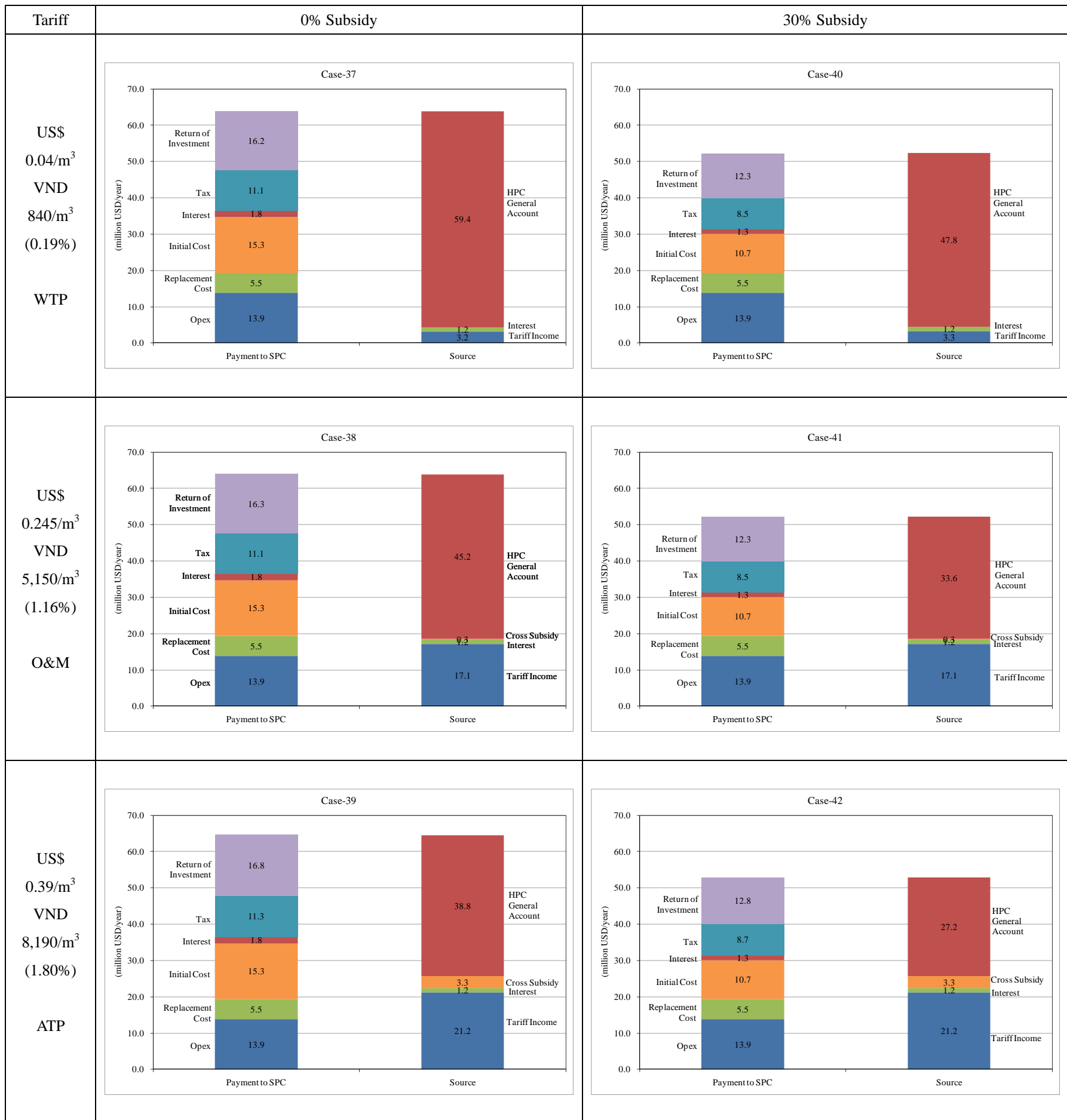
\*3 the initial project cost = construction cost + engineering cost + contingency + tax

## Appendix-2: Results of Financial Analysis (Model-4)

Model

Pipe	WWTP	Sludge Recycle
Public	SPC	SPC

Cash Flow (US\$MM) 2011 Price





Tariff	50% Subsidy	70% Subsidy																																																
US\$ 0.04/m <sup>3</sup> VND 840/m <sup>3</sup> (0.19%)  WTP	<p style="text-align: center;">Case-43</p> <table border="1"> <caption>Case-43 Data</caption> <thead> <tr> <th>Category</th> <th>Value (million USD/year)</th> </tr> </thead> <tbody> <tr><td>Opex</td><td>13.9</td></tr> <tr><td>Replacement Cost</td><td>5.5</td></tr> <tr><td>Initial Cost</td><td>7.6</td></tr> <tr><td>Interest</td><td>1.0</td></tr> <tr><td>Tax</td><td>6.7</td></tr> <tr><td>Return of Investment</td><td>9.6</td></tr> <tr><td><b>Total Payment to SPC</b></td><td><b>44.3</b></td></tr> <tr><td>Tariff Income</td><td>3.2</td></tr> <tr><td>Interest</td><td>1.1</td></tr> <tr><td><b>Total Source</b></td><td><b>40.0</b></td></tr> <tr><td>HPC General Account</td><td>36.8</td></tr> </tbody> </table>	Category	Value (million USD/year)	Opex	13.9	Replacement Cost	5.5	Initial Cost	7.6	Interest	1.0	Tax	6.7	Return of Investment	9.6	<b>Total Payment to SPC</b>	<b>44.3</b>	Tariff Income	3.2	Interest	1.1	<b>Total Source</b>	<b>40.0</b>	HPC General Account	36.8	<p style="text-align: center;">Case-46</p> <table border="1"> <caption>Case-46 Data</caption> <thead> <tr> <th>Category</th> <th>Value (million USD/year)</th> </tr> </thead> <tbody> <tr><td>Opex</td><td>13.9</td></tr> <tr><td>Replacement Cost</td><td>5.5</td></tr> <tr><td>Initial Cost</td><td>4.6</td></tr> <tr><td>Interest</td><td>0.6</td></tr> <tr><td>Tax</td><td>5.0</td></tr> <tr><td>Return of Investment</td><td>6.9</td></tr> <tr><td><b>Total Payment to SPC</b></td><td><b>36.5</b></td></tr> <tr><td>Tariff Income</td><td>3.2</td></tr> <tr><td>Interest</td><td>1.1</td></tr> <tr><td><b>Total Source</b></td><td><b>32.1</b></td></tr> <tr><td>HPC General Account</td><td>28.9</td></tr> </tbody> </table>	Category	Value (million USD/year)	Opex	13.9	Replacement Cost	5.5	Initial Cost	4.6	Interest	0.6	Tax	5.0	Return of Investment	6.9	<b>Total Payment to SPC</b>	<b>36.5</b>	Tariff Income	3.2	Interest	1.1	<b>Total Source</b>	<b>32.1</b>	HPC General Account	28.9
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US\$ 0.245/m <sup>3</sup> VND 5,150/m <sup>3</sup> (1.16%)  O&M	<p style="text-align: center;">Case-44</p> <table border="1"> <caption>Case-44 Data</caption> <thead> <tr> <th>Category</th> <th>Value (million USD/year)</th> </tr> </thead> <tbody> <tr><td>Opex</td><td>13.9</td></tr> <tr><td>Replacement Cost</td><td>5.5</td></tr> <tr><td>Initial Cost</td><td>7.6</td></tr> <tr><td>Interest</td><td>1.0</td></tr> <tr><td>Tax</td><td>6.7</td></tr> <tr><td>Return of Investment</td><td>9.6</td></tr> <tr><td><b>Total Payment to SPC</b></td><td><b>44.3</b></td></tr> <tr><td>Tariff Income</td><td>17.1</td></tr> <tr><td>Cross Subsidy Interest</td><td>0.7</td></tr> <tr><td><b>Total Source</b></td><td><b>25.8</b></td></tr> <tr><td>HPC General Account</td><td>25.1</td></tr> </tbody> </table>	Category	Value (million USD/year)	Opex	13.9	Replacement Cost	5.5	Initial Cost	7.6	Interest	1.0	Tax	6.7	Return of Investment	9.6	<b>Total Payment to SPC</b>	<b>44.3</b>	Tariff Income	17.1	Cross Subsidy Interest	0.7	<b>Total Source</b>	<b>25.8</b>	HPC General Account	25.1	<p style="text-align: center;">Case-47</p> <table border="1"> <caption>Case-47 Data</caption> <thead> <tr> <th>Category</th> <th>Value (million USD/year)</th> </tr> </thead> <tbody> <tr><td>Opex</td><td>13.9</td></tr> <tr><td>Replacement Cost</td><td>5.5</td></tr> <tr><td>Initial Cost</td><td>4.6</td></tr> <tr><td>Interest</td><td>0.6</td></tr> <tr><td>Tax</td><td>5.0</td></tr> <tr><td>Return of Investment</td><td>6.9</td></tr> <tr><td><b>Total Payment to SPC</b></td><td><b>36.5</b></td></tr> <tr><td>Tariff Income</td><td>17.1</td></tr> <tr><td>Cross Subsidy Interest</td><td>0.7</td></tr> <tr><td><b>Total Source</b></td><td><b>18.0</b></td></tr> <tr><td>HPC General Account</td><td>17.3</td></tr> </tbody> </table>	Category	Value (million USD/year)	Opex	13.9	Replacement Cost	5.5	Initial Cost	4.6	Interest	0.6	Tax	5.0	Return of Investment	6.9	<b>Total Payment to SPC</b>	<b>36.5</b>	Tariff Income	17.1	Cross Subsidy Interest	0.7	<b>Total Source</b>	<b>18.0</b>	HPC General Account	17.3
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# **APPENDIX-E**

## 本邦研修報告書

平成 24 年 2 月 20 日

ベトナム国ハノイ市エンサ下水処理場整備事業  
準備調査（PPP インフラ事業）にかかる  
研修報告書

幹部研修：2011 年 9 月 28 日～2011 年 10 月 7 日

実務者研修：2011 年 10 月 12 日～2011 年 10 月 25 日

横浜ウォーター株式会社

## 打合簿

平成24年2月20日

監督職員  
業務主任者 永井康敏

案件名: ハノイ市エンサ下水処理場整備事業準備調査(PPPインフラ事業)

打合項目	打合内容及び結果
研修員受入業務完了の確認及び支出金額の報告について	<p>平成23年3月17日に締結した業務委託契約書[付属書Ⅱ]特記仕様書第6条-(2)-キに定める招聘の実施については、受注者がこれを適切に履行したことを両者で確認した。</p> <p>なお、当該業務にかかる経費については、全体業務の契約金額精算報告書提出後に、別途JICAによる精算確定を受けることとする。(当該業務にかかる経費の一部は別添の通り)</p> <p style="text-align: center;">記</p> <ol style="list-style-type: none"><li>1. 研修実施内容及び同行者の有無 別添「研修実績報告書」及び「研修工程実績表」のとおり</li><li>2. 講義、見学、各種検討会の実施実績 別添「研修工程実績表」のとおり</li><li>3. 研修教材用の原稿執筆実績 別添「契約に含まれる国別研修【別紙1】および【別紙2】」のとおり</li><li>4. 同行者、講師、検討会参加者に係る旅費・交通費の明細 別添「契約に含まれる国別研修【別紙1】および【別紙2】」のとおり</li></ol> <p style="text-align: center;">別添:研修実績報告書 研修工程実績表 契約に含まれる国別研修</p>

# 研修実績報告書

平成24年2月17日

独立行政法人国際協力機構  
契約担当役 小寺清 殿

受託機関 横浜ウォーター株式会社  
代表者 代表取締役  
五十川 健郎 印

## 1 案件の概要

- (1) 案件名 (和文/英文): ハノイ市エンサ下水処理場にかかる幹部研修  
Training of Sewerage Management for Hanoi People Committee (Executive Class)
- (2) 研修期間: 2011年9月28日から2011年10月7日まで
- (3) 研修員人数: 6名

## 2 研修内容

### (1) 研修全体概念図

ハノイ市において始まったばかりの下水道事業に関し、我が国の優れた下水道技術、事業経営手法を導入し、ハノイ市エンサ下水処理場のPPP事業のためのアクションプランが策定される。



1. ハノイ市と横浜市環境創造局(本研修を弊社と連携して実施している団体)とがハノイ市の抱える問題点についてディスカッションをおこない、双方が理解する。
2. 我が国の自治体の有する下水道運営・管理ノウハウ(水質管理、浸水対策、下水道料金制度を含む)等を学ぶことを通じて、研修員の課題解決に向けた考察、討議等を行う。
3. 我が国の自治体の有する下水道運営、管理ノウハウ(水質管理、浸水対策、下水道料金制度を含む)等に関して、講義のみならず下水道施設等の視察を通して実際の取り組み状況を効果的に学び、研修員の課題に向けた考察を行う。
4. 研修を通して習得した技術等と自国技術等の比較分析により、自国の現状と課題について把握することにより、自国の社会資本への導入・応用が可能となるよう理解を深める



議論した改善策に基づき、ハノイ市の下水道運営改善に向けた政策の提言などの取り組みが開始される。

### (2) 日程表

別添資料-1の通り

### (3) カリキュラム構成

別添資料-1の通り

## 3 案件目標の達成度

### (1) 案件目標

- 案件目標: ハノイ市において始まったばかりの下水道事業に関し、我が国の優れた下水道技術、事業経営手法を導入し、ハノイ市エンサ下水処理場のPPP事業のためのアクションプランが策定される。
- 指標: 研修実施後の期待充足度では5点評価中4点以上と評価している。
- 達成度: 研修員6名中全員が4点以上と評価しており、目標は達成された。

	← ← 達成			未達成 → →		無回答	平均点
	5点	4点	3点	2点	1点		
期待充足度	4人	2人	0人	0人	0人	0人	4.7

## (2) 達成度測定結果

### ア. クエスチョネア集計結果

	←十分達成できている			達成していない→		無回答	平均点
	5点	4点	3点	2点	1点		
研修実施前	0人	2人	2人	0人	0人	2人	3.5
研修実施後	4人	2人	0人	0人	0人	0人	4.7

### イ. ディスカッション

#### (ア)キックオフ・ディスカッション

研修員と環境創造局職員、水道局職員及び横浜ウォーター職員が参加してディスカッションを行い、双方の下水道事業の状況確認を行った。確認項目は、事業概要、公共用水域の水質の状況、分合流方式の採用状況、使用料徴収方法、PR等である。

上記確認事項を基に横浜市側からハノイ市が抱える現状の問題点に関しアドバイスをを行った。アドバイスをを行った主な項目は下記の通りである。

- ・下水道に求められる役割の歴史的変遷について
- ・合流式下水道の改善について
- ・下水処理方式の選定について  
特に標準法、回分法の選定について
- ・高度処理について
- ・汚泥の集約処理及び有効利用について
- ・浸水対策について
- ・下水道の経営について
- ・下水道使用料の徴収について

#### (イ)ファイナル・ディスカッション

今回の研修の成果について、研修員と環境創造局職員、水道局職員及び横浜ウォーター職員が参加してディスカッションを行った。研修員から下記のような感想、意見があった。

- ・日本の下水処理技術が高度に発達していることを理解した。
- ・日本では幼い頃から環境教育に取り組んでおり、環境に対する意識が高い。  
自国でも下水道を始めゴミ処理などの環境に対する啓蒙活動に取り組みたい。
- ・日本では事業が計画的に実施されている。
- ・日本ではエネルギーの相互利用、汚泥のリサイクルなどの技術が進んでいる。
- ・今回の研修で修得したことを、自国の政策に取り組むよう提言していきたい。

## 4 研修案件に対する所見

### (1) 研修デザイン

研修員がハノイ市の幹部であることから、我が国及び横浜市下水道事業の全体像を把握できるよう一週間の研修期間を設定した。研修期間に対する研修員の評価は4.2であり、研修員の期待に添った期間設定ができたと考えられる。

### (2) 研修内容

今回の研修は、我が国及び横浜市下水道事業の全体像の把握を主眼に設定した。評価会において研修員からももう少し具体的な話、例えば下水処理場建設計画時の課題、資金調達、財源の確保、運営トラブル対応などについて聞きたかったとの意見があった。これらの点については次年度以降改善に取り組むたい。

### (3) 研修の効果を高める工夫

横浜市を始め、札幌市、苫小牧市の下水道処理施設を視察した。これらの視察では横浜市では行っていない汚泥のコンポスト施設などを視察した。これにより研修員は幅広く下水道処理技術に関する知見を修得できたと考える。

横浜市北部下水道センターでは、水処理施設および汚泥処理施設に加えて隣接する資源循環局鶴見工場で廃棄物焼却施設を見学し、汚泥処理施設や廃棄物焼却施設で発生する熱や電気を水処理施設で利用するとともに、下水道処理水を相互に機械の運転や事務所の清掃に再利用している状況を確認した。こうすることにより、研修員は下水道技術に対する知見を深めるばかりでなく、環境負荷削減に対する認識をより深めることができたと考える。

#### (4) 研修運営体制

横浜市環境創造局に主たる講義を依頼し研修を行った。同局は下水汚泥焼却灰の有効利用で我が国初のPFI事業に取り組むなど、先進的な事業を行っており、ハノイ市の下水道事業展開に向け有意義な講義をすることができたと考える。

### 5 次年度へ向けた改善点及び提案

#### (1) 評価会における要望事項

下水道処理場建設計画時の課題、資金調達、財源の確保、運営トラブル対応、環境教育の実施内容などをカリキュラムに加えてほしいとの要望があった。これらの要望については、環境創造局と調整の上、可能なものから取り入れるようにしたい。

#### 添付資料

(1) 研修日程

別添資料-1

(2) 研修員リスト

別添資料-2

(3) テキストリスト

別添資料-3

(4) クエスチョネア集計票

別添資料-4

研修写真集 (1/2)



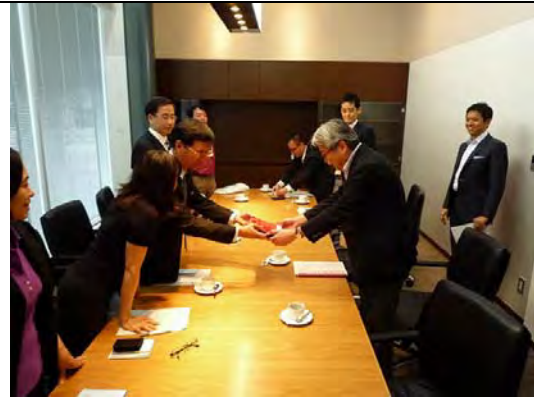
環境創造局政策調整部長挨拶 (9/29)



横浜市の下水道事業について (9/29)



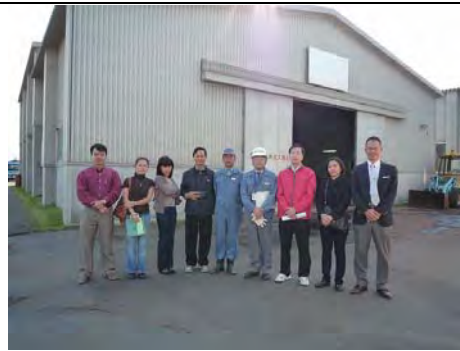
日本&横浜の下水道事業概要 (9/30)



JICA 表敬訪問(9/30)



札幌市創成川処理場視察 (10/3)



苫小牧市コンポスト工場視察 (10/4)



北部水再生・汚泥資源センター視察 (10/5)



北部水再生・汚泥資源化センター視察 (10/5)



研修写真集 (2/2)



北部水再生・汚泥資源化センター視察(10/5)



改良土センター視察 (10/5)



資源循環局鶴見工場視察(10/5)



資源循環局鶴見工場視察(10/5)



ファイナルディスカッション (10/5)



終了式集合写真(10/5)

研修工程実績表 ハノイ市エンサ下水処理場 整備事業準備調査 経営者研修コース

月日	曜日	時刻			形態	研修内容	講師又は見学先担当者等		研修場所・移動行程	講義内容	備考
							氏名(敬称略)	所属先及び職位			
9月28日	水					来日					
9月29日	木	09:30	~	12:00	講義	オリエンテーション		JICA	JICA横浜		
		13:30	~	16:00	討議	横浜市の下水道事業について意見交換会 (横浜市のパFI事業をメインテーマに)	政策課 大狭間誠 下水道設備課 芦澤補佐 下水道設備課 佐光職員	政策課 下水道事業調整課 下水道設備課 下水道施設管理課	関内中央ビル 3B協議室	意見交換小テーマ ○横浜市について、横浜市の財政について ○業務委託、PFI手法による能力増強	
9月30日	金	09:30	~	10:50	講義	日本の下水道及び横浜市下水道事業の概要	大狭間誠	政策課	関内中央ビル 3B協議室		
		11:00	~	12:00	講義	横浜市下水道経営	増田潤	下水道事業推進課	関内中央ビル 3B協議室		
		13:30	~	16:00	訪問	JICA表敬訪問		JICA	JICA横浜		
10月1日	土				休日						
10月2日	日				移動日						
10月3日	月	09:00	~	13:00	視察	札幌市創成川処理場・水再生プラザ視察	原 洋隆				
10月4日	火	09:30	~	12:00	視察	苫小牧市西町下水処理センター視察	徳光和男				
10月4日	火	13:00	~	15:50	視察	苫小牧市勇払下水処理センターコンポスト工場視察	山下 実				
10月5日	水	09:00	~	10:30	視察	北部第二水再生センター	前田賢二	北部下水道センター(水再生)	北部第二水再生センター	適切なリン・窒素の除去=高度処理の運転管理、水質改善、光ファイバーによる遠隔監視、中央監視システムの実施、上部利用について	
		10:40	~	12:00	視察	北部汚泥資源化センター	及川隆仁	北部下水道センター(汚泥)	北部汚泥資源化センター	転・維持管理、マニュアルについて、下水道資源の有効利用	
		13:30	~	15:00	視察	資源循環局 鶴見工場	福田裕	資源循環局鶴見工場	資源循環局鶴見工場	処理水、汚泥との資源利用、ふれーゆへの熱量利用	
10月6日	木	09:30	~	12:00		研修評価会準備		JICA	JICA横浜		
		13:30	~	16:00	討議	下水道事業運営について意見交換	大狭間誠 増田潤 古川聡	政策課 下水道事業推進課 経理経営課	JICA横浜		
10月7日	金				離日						

ハノイ市エンサ下水処理場整備事業準備調査(PPPインフラ事業)にかかる研修テキストリスト  
経営者研修コース

資料番号	資料名
1	横浜市の下水道
2	下水汚泥は資源の宝庫
3	下水道事業中期経営計画2011概要版
4	北部汚泥資源化センター 消化ガス発電設備整備事業
5	改良土プラント PFI事業 パンフレット
6	日本の下水道及び横浜市の下水道概要
7	下水道事業の経営

クエスチョネア集計 / Questionnaire

研修コース名	ハノイ市エンサ下水処理場にかかる幹部研修
受入期間	2011/9/28 ~ 2011/10/7
対象人数	6名

I. 研修コース評価 Evaluation of the training course

1. 設定された到達目標とニーズの適合について

Did you find the course objectives appropriate according to the needs of your country or organization?

← appropriate			inappropriate →		X
5	4	3	2	1	
3	3	0	0	0	0

回答が1、2の場合、改善を要す点 If your answer is 1 or 2, what kind of improvement should be

2. カリキュラム評価 Evaluation of the curriculum

(1) 研修プログラムで最も有益であった研修項目

Please name the most beneficial subject in the training program.

- ・各下水処理場や横浜環境創造局での視察と質疑応答 (Ms.トゥアン) (Ms.ヒエン) (Mr.ナム)
- ・汚泥集中処理場での視察。(Mr.ミン)
- ・横浜環境創造局での視察と質疑応答や各下水処理場での視察、札幌市の下水道科学館での視察。(Mr.クオン)
- ・水再生技術や高度処理技術/汚泥処理技術や排出資源の有効活用 (Ms.オアン)

(2) 今後追加すべき研修項目

Please write the subject that should be added to the training program.

- ・下水処理場の計画過程や計画的な運営内容/下水処理場整備の計画・投資・建設過程における課題等/下水使用量徴収の課題/環境教育の実施内容 (Mr.クオン)

(3) 今後削除すべき研修項目

Please write the subject that should be eliminated from the training program.

3. 研修期間について Did you find the duration of the program appropriate?

← appropriate					inappropriate →	X
5	4	3	2	1		
2	3	1	0	0	0	

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

4. 講師の講義プレゼンテーションについて

What is your evaluation of the presentation by the lecturers in the program?

← good					poor →	X
5	4	3	2	1		
3	3	0	0	0	0	

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

5. テキスト、研修機材、講義施設について

What is your evaluation of the textbooks, training equipment, and lecture facilities of the program?

	← good					poor →	X
	5	4	3	2	1		
テキスト/ textbooks	3	3	0	0	0	0	
研修機材/ training equipment	5	0	0	0	0	1	
講義施設/ lecture facilities	5	0	0	0	0	1	

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

6. 研修運営管理について

What is your evaluation of the general administration and management of the training program?

	← good					poor →	X
	5	4	3	2	1		
JICA	4	2	0	0	0	0	
受入機関/ training institution	4	2	0	0	0	0	
コーディネーター/ coordinator	5	1	0	0	0	0	

7. 期待充足度 Did the training meet your expectations?

← satisfied					unsatisfied →	X
5	4	3	2	1		
4	2	0	0	0	0	

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

8. 到達目標達成度 Evaluation of level of objective accomplishment

(1) 到達目標1 Objective 1

ハノイ市の適正な下水処理の促進

到達目標1の達成度 Did you achieve objective 1?

	← 十分達成できている fully achieved			達成していない → unachieved		X
	5	4	3	2	1	
研修実施前/ before the training	0	2	2	0	0	2
研修実施後/ after the training	4	2	0	0	0	0

回答が3、4、5の場合、今回の研修で得た情報・知識は、業務に活用可能か。

If your answer is 3,4,or, 5, do you find the information and knowledge obtained through the training program useful to your job in your country?

	← 十分活用できる very useful			活用できない → not useful		X
	5	4	3	2	1	
	5	1	0	0	0	0

回答が4、5の場合、業務における具体的な活用内容及び方法

If your answer is 4 or 5, please describe how it applies to your job.

- ・ハノイ市の下水処理整備に適切な投資を選定する業務に活用。(Ms.トゥアン)
- ・エンサ処理場整備事業や将来には集中汚泥処理場整備事業に応用したい。(Ms.ヒエン)
- ・下水処理場の運営業務や汚泥処理研究に応用したい。(Mr.ミン)
- ・エンサ処理場整備事業の促進。具体的には財源確保の方策作り。(Mr.クオン)
- ・本研修で汚泥の処理方法や排出資源の有効活用方法を修得できた。ハノイ市の汚泥処理における政策提言に活用したい。(Ms.オアン)
- ・ハノイ市の大規模な下水処理場整備事業の促進に活用したい。(Mr.ナム)

回答が1、2の場合、その理由 If your answer is 1 or 2, Please describe the reasons.

## II. その他 Others

1. JICAのブリーフィングについて What is your evaluation of JICA's briefing?

← good		poor →			X
5	4	3	2	1	
3	2	1	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

2. ジェネラルオリエンテーションについて What is your evaluation of the general orientation?

← good		poor →			X
5	4	3	2	1	
2	3	0	0	0	1

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

3. 日本の印象 What kind of impression of Japan did you get through your stay here?

← good		poor →			X
5	4	3	2	1	
6	0	0	0	0	0

(1) 回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

(2) 回答が4、5の場合、その理由 If your answer is 4 or 5, please describe the reasons.

- ・環境保護意識や排水・ごみ資源の活用振り。(Ms.トゥアン)
- ・関係機関・個人の熱心的な対応で良いインパクトが残る。また、日本人の環境保護意識の高さに感心した。(Ms.ヒエン)
- ・先端的な技術が導入されていること。日本人は意志が高く、ベトナム人に親近的である。(Mr.ミン)
- ・日本や日本人に非常に良い印象を覚えている。本研修の関係者も非常に親切であった。日本は近代的な工業先進国でありながら環境保護政策も充実している。(Ms.オアン)
- ・日本人の仕事に対する姿勢 (Mr.ナム)

4. その他コメント Any other comments

- ・ベトナムのリーダーは環境保全の意識を向上し、政策・予算・人材育成等の計画立案に適切に対応すべき。(Ms.トゥアン)
- ・合理的で切実な要望を応えた今回の研修を調整していただいた関係機関に感謝し、研修中に同行していただいた各個人にもお礼を申し上げます。ハノイ市にとって下水処理分野は新しい領域であるため、日本の豊富な経験を学ぶ本研修は非常に有益だった。今後ともこのような研修を引き続き継続していただきたい。(Ms.ヒエン)

# 研修実績報告書

平成24年2月17日

独立行政法人国際協力機構  
契約担当役 小寺清 殿

受託機関 横浜ウォーター株式会社  
代表者 代表取締役  
五十川 健郎 印

## 1 コース概要

(1) 案件名 (和文/英文): ハノイ市エンサ下水処理場にかかる実務者研修  
Training of Sewerage Management for Hanoi People Committee (Engineer Class)

(2) 研修期間: 2011年10月12日から2011年10月25日まで

(3) 研修員人数: 7名

## 2 研修内容

### (a) 研修全体概念図

ハノイ市において始まったばかりの下水道事業に関し、我が国の優れた下水道技術、事業経営手法を導入し、ハノイ市エンサ下水処理場のPPP事業のためのアクションプランが策定される。



1. ハノイ市と横浜市環境創造局(本研修を弊社と連携して実施している団体)とがハノイ市の抱える問題点についてディスカッションをおこない、双方が理解する。
2. 我が国の自治体の有する下水道運営・管理ノウハウ(水質管理、浸水対策、下水道料金制度を含む)等を学ぶことを通じて、研修員の課題解決に向けた考察、討議等を行う。
3. 我が国の自治体の有する下水道運営、管理ノウハウ(水質管理、浸水対策、下水道料金制度を含む)等に関して、講義のみならず下水道施設等の視察を通して実際の取り組み状況を効果的に学び、研修員の課題に向けた考察を行う。
4. 研修を通して習得した技術等と自国技術等の比較分析により、自国の現状と課題について把握することにより、自国の社会資本への導入・応用が可能となるよう理解を深める



議論した改善策に基づき、ハノイ市の下水道運営改善に向けた具体的な取り組みが開始される。

### (b) 日程表

別添資料-1の通り

### (c) カリキュラム構成

別添資料-1の通り

## 3 研修コースに対する所見

### (a-1) 講義

横浜市環境創造局に主たる講義を依頼し研修を行った。同局は下水汚泥焼却灰の有効利用で我が国初のPFI事業に取り組むなど、先進的な事業を行っており、ハノイ市の下水道事業展開に向け有意義な講義をすることができたと考える。

— 案件目標: ハノイ市において始まったばかりの下水道事業に関し、我が国の優れた下水道技術、事業経営手法を導入し、ハノイ市エンサ下水処理場のPPP事業のためのアクションプランが策定される。

— 指標: 研修実施後の期待充足度では全員が5点と評価している。

— 達成度: 研修員7名中全員が5点と評価しており、目標は達成された。

	← ← 達成			未達成 → →		無回答	平均点
	5点	4点	3点	2点	1点		
期待充足度	7人	0人	0人	0人	0人	0人	5



(a-2) 達成度測定結果

ア. クエスチョネア集計結果

	←十分達成できている			達成していない→		無回答	平均点
	5点	4点	3点	2点	1点		
研修実施前	1人	3人	0人	3人	0人	0人	3.3
研修実施後	5人	2人	0人	0人	0人	0人	4.7

(b) 討論・実習・演習・発表

(ア) キックオフ・ディスカッション

研修員と環境創造局職員、水道局職員及び横浜ウォーター職員が参加してディスカッションを行い、双方の下水道事業の状況確認を行った。確認項目は、事業概要、公共用水域の水質の状況、分合流方式の採用状況、使用料徴収方法、PR等である。

上記確認事項を基に横浜市側からハノイ市が抱える現状の問題点に関しアドバイスをを行った。アドバイスをを行った主な項目は下記の通りである。

- ・下水道に求められる役割の歴史的変遷について
- ・合流式下水道の改善について
- ・下水処理方式の選定について  
特に標準法、回分法の選定について
- ・高度処理について
- ・汚泥の集約処理及び有効利用について
- ・浸水対策について
- ・下水道の経営について
- ・下水道使用料の徴収について

(イ) ファイナル・ディスカッション

今回の研修の成果について、研修員と環境創造局職員、水道局職員及び横浜ウォーター職員が参加してディスカッションを行った。研修員から下記のような感想、意見があった。

- ・日本の下水処理技術が高度に発達していることを理解した。特に、高度処理、汚泥処理が参考になった。
- ・日本では環境に対する意識を高める工夫が行われている。ハノイでも参考にしたい。
- ・日本では汚泥処理、下水処理が段階的に技術の応用がされていて参考になった。
- ・日本ではエネルギーの活用、汚泥のリサイクルなどの技術が進んでいる。
- ・ハノイは標高が低い。ポンプ場を設置しないと雨水排水が難しい。日本の技術をどのように導入すればよいか研究したい。

(c) 見学

横浜市を始め、京都市、大阪市の下水道処理施設を視察した。京都、大阪では横浜市の処理方法と異なる処理法(3W法など)を採用している施設を視察した。研修員は幅広く下水処理技術に関する知見を修得できたと考える。

(d) 研修期間・配列・密度

① 研修期間

研修員がハノイ市の下水道実務技術者であることから、我が国及び横浜市下水道事業の具体的事例を把握できるよう二週間の研修期間を設定した。研修期間に対する研修員の評価は4.9であり、研修員の期待に添った期間設定ができたと考える。

② 研修内容・密度

今回の研修は、我が国及び横浜市下水道事業の具体的事例の把握を主眼に設定した。評価会において研修員から下記のような要望があった。

- ・運転の実務に関わる職員から経験談などを聞く機会を設けてほしかった。

・PPPの枠組みなどについての講義をしてほしかった。  
これらの点については次年度以降改善に取り組みたい。

#### 4 研修員

##### (a) 研修参加への意欲・受講態度

自国の下水道をよりよくしようとする態度がうかがわれ、日本の下水道技術・制度などを熱心に吸収しようとしていた。受講態度は良好であった。

なお、研修員から以下のような指摘があった。

- ①今回の研修の内容は現状のベトナムに導入するには難しいものもあった。
- ②実際の運転実務に関わる職員からの経験談などを聞く機会を設けてほしかった
- ③PPPの枠組みなどについての講義をしてほしかった

また、研修員は下水道使用料金徴収方法、下水処理の効果のPR方法、市民の環境意識を高める工夫などに関する関心が高かった。

これらの指摘や関心の高い事項について環境創造局と調整を図り、取り組みのできる事項から順次研修に取り入れていきたい。

#### 5 研修成果の活用

##### (a) 研修で得られた成果について

横浜市環境創造局に主たる講義を依頼し研修を行った。同局は下水汚泥焼却灰の有効利用で我が国初のPFI事業に取り組むなど、先進的な事業を行っており、研修員は下水道技術・制度など広範囲に知見を修得したと考える。

##### (b) 成果の活用方法について

研修から得られた知見に基づき、ハノイ市の下水道運営改善に向けた具体的な取り組みが開始されるものと考ええる。

ファイナル・ディスカッションでは、研修員から日本の下水道技術を高く評価する発言が多くあった。今後も継続的に研修を実施することによりさらに日本の下水道技術・制度の活用が広まると考えられる。

#### 6 研修環境

別添資料－1の通り

添付資料

(1) 研修日程

別添資料-1

(2) 研修員リスト

別添資料-2

(3) テキストリスト

別添資料-3

(4) クエスチョネア集計票

別添資料-4

(5) 研修員評価表

別添資料-5

研修写真集 (1/3)



環境創造局課長挨拶(10/13)



キックオフ・ディスカッション(10/13)



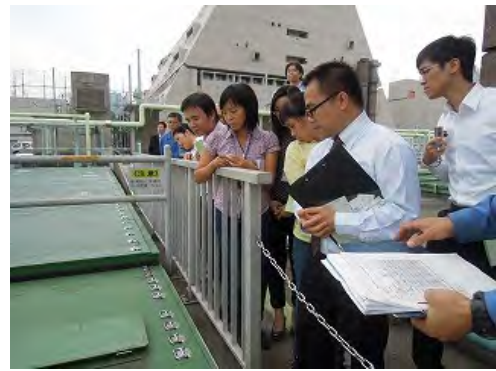
キックオフディスカッション(10/13)



日本及び横浜の下水道概要講義(10/14)



神奈川水再生センター視察(10/14)



神奈川水再生センター(10/14)



1. 京都市鳥羽水環境保全センター視察(10/17)



琵琶湖疏水視察(10/17)

研修写真集 (2/3)



大阪市津守下水処理場視察 3W 講義(10/18)



大阪市津守下水処理場視察(10/18)



北部第二水再生センター視察 (10/19)



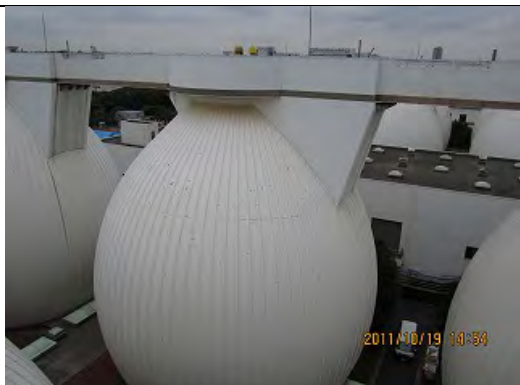
北部第二水再生センター視察(10/19)



北部汚泥資源化センター視察(10/19)



北部汚泥資源化センター視察(10/19)



北部汚泥資源化センター視察(10/19)



高度処理について講義(10/20)

研修写真集 (3/3)



管渠の維持管理について講義(10/20)



新羽末広幹線建設現場視察(10/21)



平戸永谷川調整池視察(10/21)



ファイナル・ディスカッション (10/24)



閉講式(終了証授与) (10/24)



閉講式:修了証授与 (10/24)

研修工程実績表 ハノイ市エンサ下水処理場 整備事業準備調査 実務者研修

月日	曜日	時刻			形態	研修内容	講師又は見学先担当者等		研修場所・移動行程	講義内容	備考
							氏名(敬称略)	所属先及び職位			
10月12日	水					来日					
10月13日	木	09:30	～	12:00	講義	オリエンテーション		JICA	JICA横浜		
		13:30	～	16:00	討議	横浜市下水道事業について意見交換会 (下水道管きよの維持管理をメインテーマに)	高瀬行廣 川島清隆 高橋浩二 城間菊次 大狭間誠	政策課 管路保全課 管路整備課	関内中央ビル 3B協議室	意見交換小テーマ ○公共下水道管きよの改良、修繕、清掃等の維持管理(管路保全課) ○公共下水道台帳の作成(日常及び将来の保守・補修)	
10月14日	金	09:30	～	10:50	講義	日本の下水道及び横浜市下水道事業の概要	大狭間誠	政策課	関内中央ビル 3B協議室		
		11:00	～	12:00	講義	横浜市下水道経営	増田 潤	下水道事業推進課	関内中央ビル 3B協議室		
		13:30	～	16:00	視察	神奈川水再生センターにおける運転維持管理	鈴木延吉	神奈川水再生センター	神奈川水再生センター	下水処理区域、水処理の仕組み、運転に費やす職員や勤務体制、運転維持管理の方法について、対応マニュアルについて、流入水量や水質特性、管理状況把握に必要なデータの取得について	
10月15日	土				休日						
10月16日	日					移動					
10月17日	月				視察	京都市鳥羽水環境保全センター視察・琵琶湖疏水視察	片山博王				
10月18日	火				視察	大阪市津守下水処理場視察	白井久順				
10月19日	水	09:30	～	12:00	視察	北部第二水再生センター	前田賢二	北部下水道センター(水再生)	北部第二水再生センター	適切なリン・窒素の除去=高度処理の運転管理、水質改善、光ファイバーによる遠隔監視、中央監視システムの実施、上部利用について、運転維持管理の方法について、マニュアルについて	
		13:30	～	16:00	視察	北部汚泥資源化センター	及川隆仁	北部下水道センター(汚泥)	北部汚泥資源化センター	運転・維持管理、マニュアルについて、下水道資源の有効利用	
10月20日	木	09:30	～	12:00	講義	横浜市の高度処理について	中村英二	下水道水質課	JICA横浜		
		13:30	～	16:00	講義	下水道管きよの維持管理基準について	川島清孝	管路保全課	JICA横浜	公共下水道管きよの改良、修繕、清掃等の維持管理に係る計画・調査等	
10月21日	金	09:30	～	12:00	講・視	新羽末広幹線における浸水対策について	城間菊次	管路整備課 北部下水道建設事務所	北部建設事務所・新羽末広幹線	横浜市の浸水被害対策(全体講義) 新羽末広幹線視察	
		13:30	～	16:00	講・視	今井川調整池における洪水対策、河川管理、河川監視について	岩山剛	道路局 河川計画課	今井川調整池	治水・洪水環境保全対策	
10月22日	土					休日					
10月23日	日					休日					
10月24日	月	09:30	～	12:00		研修評価会準備		JICA	JICA横浜		
		13:30	～	16:00	討議	下水処理施設の運転・維持管理について意見交換	政策課 大狭間誠 下水道設備課 吉見補佐 下水道設備課 土屋職員	政策課 下水道施設管理課 下水道設備課	関内中央ビル 3B協議室		
10月25日	火					離日					

ハノイ市エンサ下水処理場整備事業準備調査(PPPインフラ事業)にかかる研修テキストリスト  
実務者研修コース

資料番号	資料名
1	横浜市の下水道
2	下水汚泥は資源の宝庫
3	下水道事業中期経営計画2011概要版
4	管路の維持管理
5	全国の処理方式
6	日本の下水道及び横浜市の下水道概要
7	下水道事業の経営
8	神奈川水再生センターの概要
9	横浜市の高度処理
10	新羽末広幹線について
11	横浜市の河川事業
12	横浜市河川事業の概要
13	横浜市の水事事業

クエスチョネア集計 / Questionnaire

研修コース名	ハノイ市エンサ下水処理場にかかる実務者研修
受入期間	2011/10/12 ~ 2011/10/24
対象人数	7名

I. 研修コース評価 Evaluation of the training course

1. 設定された到達目標とニーズの適合について

Did you find the course objectives appropriate according to the needs of your country or organization?

← appropriate		inappropriate →			X
5	4	3	2	1	
4	3	0	0	0	0

回答が1、2の場合、改善を要す点 If your answer is 1 or 2, what kind of improvement should be r

2. カリキュラム評価 Evaluation of the curriculum

(1) 研修プログラムで最も有益であった研修項目

Please name the most beneficial subject in the training program.

- ・高度処理技術講義 / 下水処理所・汚泥集中処理場での視察。(Ms. トウイ) (Mr. ヒュー) (Ms. フォン)
- ・汚泥処理技術 / 資源再利用技術。(Mr. チュン)
- ・日本の各下水処理場の運転技術。(Ms. アン)
- ・高度処理技術。(Ms. タイ)
- ・鳥羽水環境保全センターでの視察。(Ms. タム)

(2) 今後追加すべき研修項目

Please write the subject that should be added to the training program.

- ・設備機器の維持管理工程。(Mr. チュン)
- ・下水処理に関連する環境教育。(Ms. アン)
- ・日本よりインフラ整備が遅れている国に対して、下水処理技術の選択肢を提案する。(Ms. タイ)

(3) 今後削除すべき研修項目

Please write the subject that should be eliminated from the training program.



3. 研修期間について Did you find the duration of the program appropriate?

← appropriate		inappropriate →			Σ
5	4	3	2	1	
6	1	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

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4. 講師の講義プレゼンテーションについて

What is your evaluation of the presentation by the lecturers in the program?

← good		poor →			Σ
5	4	3	2	1	
5	2	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

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5. テキスト、研修機材、講義施設について

What is your evaluation of the textbooks, training equipment, and lecture facilities of the program?

	← good		poor →			Σ
	5	4	3	2	1	
テキスト/ textbooks	5	2	0	0	0	0
研修機材/ training equipment	6	1	0	0	0	0
講義施設/ lecture facilities	6	1	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

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6. 研修運営管理について

What is your evaluation of the general administration and management of the training program?

	← good					poor →	Σ
	5	4	3	2	1		
JICA	6	1	0	0	0	0	0
受入機関/ training institution	6	1	0	0	0	0	0
コーディネーター/ coordinator	7	0	0	0	0	0	0

7. 期待充足度 Did the training meet your expectations?

← satisfied		unsatisfied →			Σ
5	4	3	2	1	
7	0	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

8. 到達目標達成度 Evaluation of level of objective accomplishment

(1) 到達目標1 Objective 1

ハノイ市の適正な下水処理の促進

到達目標1の達成度 Did you achieve objective 1?

	← 十分達成できている fully achieved		達成していない → unachieved			X
	5	4	3	2	1	
研修実施前/ before the training	1	3	0	3	0	0
研修実施後/ after the training	5	2	0	0	0	0

回答が3、4、5の場合、今回の研修で得た情報・知識は、業務に活用可能か。

If your answer is 3,4,or, 5, do you find the information and knowledge obtained through the training program useful to your job in your country?

	← 十分活用できる very useful		活用できない → not useful			X
	5	4	3	2	1	
	5	2	0	0	0	0

回答が4、5の場合、業務における具体的な活用内容及び方法

If your answer is 4 or 5, please describe how it applies to your job.

- ・ハノイ市の下水処理業務に活用する。(Ms.トウイ)
- ・ハノイ市の下水処理場の処理技術を向上する。(Mr.チュン)
- ・下水処理場の新人教育に模型を使った教育手法。高度処理の導入研究。(Ms.アン)
- ・ハノイ市の下水処理場計画や建設業務に活用する。(Mr.ヒュー) (Ms.フォン)
- ・下水処理の専門を深める。(Ms.フォン)
- ・ハノイ市の下水処理事業における諮問業務に適切な判断ができる。(Ms.タイ)
- ・下水処理場の管理業務の専門性・効率性を高める。/3W技術や有機炭素増加技術の研究。(Ms.タム)

回答が1、2の場合、その理由 If your answer is 1 or 2, Please describe the reasons.

## II. その他 Others

1. JICAのブリーフィングについて What is your evaluation of JICA's briefing?

← good		poor →			X
5	4	3	2	1	
4	3	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

2. ジェネラルオリエンテーションについて What is your evaluation of the general orientation?

← good		poor →			X
5	4	3	2	1	
4	3	0	0	0	0

回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

3. 日本の印象 What kind of impression of Japan did you get through your stay here?

← good		poor →			X
5	4	3	2	1	
6	1	0	0	0	0

(1) 回答が1、2の場合、その理由 If your answer is 1 or 2, please describe the reasons.

(2) 回答が4、5の場合、その理由 If your answer is 4 or 5, please describe the reasons.

- ・日本は平和的で親近感が溢れて、近代的である。(Ms.トウイ)
- ・日本の環境は非常に清潔である。国や国民の環境対策はとて優れて、資源の再利用は効率的である。(Mr.チュン)
- ・清潔な環境。便利な交通システム。日本人はマナーが良い。(Ms.アン)
- ・日本の下水処理システムはとて近代的で清潔な環境を確保している。(Mr.ヒュー)
- ・すばらしい国である。(人々、インフラ整備、交通網、下水処理排水システム等)(Ms.フォン)
- ・日本は環境に対して非常に配慮している。日本人はとて丁寧で外国人、とりわけベトナム

4. その他コメント Any other comments

・日本の下水処理・排水分野における技術を是非学習したい。(Ms.フォン)