APPENDIX-A1

Checklist for Establishment of Joint Company

CHECKLIST FOR ESTABLISHMENT OF O&M JOINT COMPANY IN HANOI, VIETNAM

※ Currency exchange rate is USD 1 = VND 20,848 (as of 7/2)

I. INFORMATION ABOUT INVESTORS

(For each Vietnamese and foreign party)

1. For investor being an organization

a) HANOI SEWERAGE AND DRAINAGE COMPANY

b) ORIX CORPORATION

c) WATERAGENCY INC (WAC)

II. THE JOINT VENTURE COMPANY TO BE ESTABLISHED:

1. Name of the company: Not yet decided

2. Head office address: Not yet decided

3. Planned term of the company's operations: 50 years

4. Planned term of the investment project : 24 years

5. Main targets and line of business of the Company.
First phase (i) O&M service (including large replacement works), (ii) spare parts and material supply, Second phase (iii) Training service for O&M in sewerage sector for other municipalities, (iv) Engineering service in sewerage sector for other municipalities, and (v) Construction works.

III. INVESTMENT CAPITAL:

(The precondition for below description is that the service charge will be paid in advance, before the O&M service)

1. Total estimated investment capital of the investment project: 54,205 million VND, including

Total estimated investment capital of the investment project: 54,205 million VND equivalent to US$ 2.6 million, including

- Fixed capital : VND 9,568 million equivalent to US$ 0.46 million including :
  - Factory/Workshops : None
  - Office : US$ 48,000
  - Equipment and machinery : US$ 139,000
  - Other fixed capital : US$ 273,000
- Working capital : VND 44,512 million equivalent to US$ 2.14 million

2. Capital sources:

Total capital: VND 54,205 million equivalent to US$2.6 million, of which:

- Charter capital (contributed capital): VND 54,205 million equivalent to US$ 2.6 million
- Loans : VND 0 equivalent to US$ 0

IV. CHARTER CAPITAL:

1. Charter capital (contributed capital) of the Company:
VND 54,205 million, equivalent to US$2.6 million

2. Contributed capital from each Party

2.1 Contributed capital from the Vietnamese Party: (35%)

VND 18,972 million equivalent to US$ 910,000.

2.2 Contributed capital from the Japanese Party: (65%)

VND 35,233 equivalent to US$ 1,690,000

Remark:

・Japanese and Vietnamese parties will contribute full equity in cash.

3. Charter Capital contributions schedule

Item 3, Article 6 of Decree No.102/2010/ND-CP stipulates that legal capital shall be contributed within 36 months from establishment. However, (1) if any party doesn't contribute capital, share percentage of each party will change, (2) JC needs fund after establishment until commencement of operation, (3) Overseas remittance is complicated, therefore, each party shall contribute fully within one month after establishment.

4. Cost advance for the establishment of the Company

- Which Party shall advance the costs relative to the establishment of the Company?

Basically, each investor will bear the cost for his own activities for the establishment of the JC. The details will be discussed later.

5. Increases and reductions of Charter Capital

The increases and reductions of Charter Capital shall be approved by the Members' Council with a number of votes representing at least 65% of the capital of the attending members.

6. Capital withdraw

The capital withdraw by a Company's member under the form of the transfer of its capital to the Company can be only accepted in limited cases provided for in Article 43 of the Law on Enterprises 2005.
(The risk associated with Article 43 shall be analyzed together with lawyer, later)

V. MEMBERS' COUNCIL AND BOARD OF DIRECTORS:

1. Which Party shall have the right to nominate the Chairman of the Members' Council (herein after referred to as MC)?

Each company has the right to nominate one member of MC. The member nominated by HSDC will be the chairman of MC.

2. Composition of Standing Committee of Business Operation;

The Standing Committee (SC) shall be established to discuss and exchange opinions on various matters between Japanese party and Vietnamese party, although decision of the SC is not legally binding due to the form of limited liability company. The members are the following:

Management and Administration Staff of Joint Company

	Nationality	Status	Origin
[MC]			
Chairman (HSDC)	Vietnamese	Full-time	HSDC
Representative of ORIX	Japanese	Part-time	ORIX
Representative of Water Agency	Japanese	Part-time	WAC
[Headquarters]			
General Directors	Japanese	Full-time	ORIX
Deputy General Director/Chief of financial affairs	Japanese	Full-time	ORIX
Deputy General Director/Chief of general and personnel affairs	Vietnamese	Full-time	HSDC
Chief Accountant	Vietnamese	Full-time	HSDC
Chief of Technical Affairs	Japanese	Full-time	WAC
General Staff (General and personnel affairs)	Vietnamese	Full-time	Recruitment
General Staff (Financial and technical affairs)	Vietnamese	Full-time	Recruitment
General Staff(Secretary & Interpreter)	Vietnamese	Full-time	Recruitment

3. Which Party shall have the right to nominate the General Director and other members of the SC?

The key staffs of the company are nominated by each company as shown in above table, and MC has power to appoint and remove the General Director.

4. Powers and obligations of the General Director and other managers of the Company.

Position	Tasks
Chairman (to be provided by HSDC)	· Planning, schedule arrangement, other preparation works (including document preparation), convocation, and chairing of the MC, and other meetings to exchange opinions of the members of the MC. · Supervision of execution of issues resolved by the MC · Signing on issues resolved by the MC, as the representative of the company · Other works stipulated in the Law on Enterprise and the Charter

General Director (to be provided by ORIX)	<u>Daily Works</u> - Supervision of all activities of the company - Execution of issues resolved by the MC - Execution of business plan and investment plan - Signing on business documents/ contract documents, as the representative of the company - Decision of appointment and dismissal of major positions in the company - Decision of salary of company staff - Decision of employment of company staff <u>Preparation of Document for MC</u> · Proposal of internal administrative rule of the company staff · Proposal of organization structure of the company
Deputy General Director/ Chief of Financial Affairs (to be provided by ORIX)	<u>Daily Works</u> · Management works of the financial department · Supervision and Execution of works of financial and accounting matters, and approval <u>Preparation of Document</u> · Preparation of rules/ regulations of audit · Preparation of company's regulations/ rules on financial and accounting issues · Proposal of share of profit and writing off as a loss · Proposal of a business plan and an investment plan · Preparation of annual financial statements and tax payment declaration forms
Deputy General Director/ Chief of General and Personnel Affairs (to be provided by HSDC)	<u>Daily Works</u> · Labor management (salary, working environment and working time), based on the company's regulations on general and personnel affaires · Procurement and management of materials and equipment · Arrangement for acceptance of technical transfer program · Supervision of performance carried out under the license contract · Risk management and emergency response, in cooperation with "Chief Technical Affairs" · Negotiation and coordination with relevant Vietnamese organizations <u>Preparation of Document</u> · Preparation of document on personnel appraisal and personnel change · Preparation of company's regulations/ rules on general affairs and personnel affaires · Preparation of rules for disaster and manuals for risk management · Preparation of regulations/ rules of organization policies, division of duties and administrative authorities
Chief of Technical Affairs (to be provided by WAC)	<u>Daily Works</u> · Supervision of O&M service of the company, and monitoring activities of operation of the facilities (checking based on IP) · Supervision of performance of technical staff in the company · Supervision of technical transfer for O&M of facilities · Management of hazardous materials

	· To study on solutions of troubles in operation, and to take necessary actions Education/Training and Planning · Preparation of the plan of O&M, repair and replacement of the facilities, and preparation of specs of materials and equipment for the O&M, repair and replacement works · Preparation of manuals of operation, monitoring, risk management, and safety and sanitation control · Instruction/training for local technical staff at an initial operation stage of the facilities, in cooperation with contractor · Preparation of a long term plan of education and training for local technical staff, and execution of the training ·
Chief Accountant (to be provided by HSDC)	Daily Works · General accounting works Preparation of Document · Preparation of necessary documents for annual financial statements

VI. PASSING OF MEMBERS COUNCIL'S RESOLUTIONS

The issues that must be approved in unanimous vote include: None.

The issues that must be approved by the number of votes representing at least **75%** of the aggregate capital of the attending members include ;

- Approval on sales of assets more than 50% of total assets value
- Amendment of Charter
- Decision of reorganizing
- Dissolution of the company or declaration of bankruptcy
- Increase or replacement of the investors
- Approval of the middle and long term strategy and yearly business plan

The issues that must be approved by the number of votes representing at least **65%** of the aggregate capital of the attending members include:

- Decision of increase or decrease of legal capital, funding source, and timing
- Decision on investment project more than 50% of total assets value and investment measure
- Decision on market expansion, marketing and technology transfer
- Decision on appointment and remove of the Chairman, General Director, Deputy General Directors, Chief of Financial Affairs and Chief of General and Technical Affairs (to be stipulated in the Charter)
- Decision on remuneration and benefit of chairman, general director and other managerial positions stipulated in the Charter
- Approval on profit distribution and loss treatment

- Approval on annual financial statements
- Decision of company structure
- Decision on establishment of office, branch and representative office
- Other power and duty stipulated in the Law on Enterprise and Charter

The issues that must be approved by the number of votes representing at least **51%** of the aggregate capital of the attending members include: None

VII. ASSIGNMENT OF SHARES OF CAPITAL CONTRIBUTION

The Law on Enterprises 2005 provides as follows:

A member of a limited liability company with two or more members shall have the right to assign a part or its entire share of capital contribution to other persons in accordance with the following provisions:

1. *[A member wishing to assign a part or its entire share of capital contribution] must offer to sell such share of capital contribution to all other members in proportion to their shares of capital contribution in the company on the same terms;*

2. *Assignment to non-members shall only be permitted where the other members of the company do not purchase or do not purchase in full within thirty (30) days from the offering date.*

VIII. OBLIGATIONS AND RESPONSIBILITIES OF EACH PARTY:

1. Obligations and Responsibilities of the Vietnamese Party:

i. To provide 35 % of the total capital

ii. To provide suitable staff to requirement of the following positions
- Chairman of the Member of Council
- The Deputy General Director/ Chief of General and Personnel Affairs
- Three key Staff in each WWTP, which are Director of Site Office, Vice Director/ Manager of Wastewater Treatment, Manager of General Issue

iii. Not establish any JV or co-operation to provide waste water treatment plant operation and maintenance service in Hanoi with any companies other than the Foreign Party without the Foreign Party's consent.

iv. To liaise with HPC and relevant authorities and make the JC provide operation and maintenance service of waste water treatment plants in Hanoi, including but not limited to, Yen So, Yen Xa, Bay Mau, Ho Tay, and Phu Do, under the acceptable fee for the both parties.

2. Obligations and Responsibilities of the Foreign Party:

i. To provide 65 % of the total capital

ii. To provide suitable staff to requirement of the following positions
- Two members of the Member of Council
- The General Director and the Deputy General Director/ Chief of Financial Affairs
- The Chief of Technical Affairs

iii. Provide training to Vietnamese employees of the JC for the efficient operation of waste water treatment plant operation and maintenance and provide training to Vietnamese employees to replace expatriates to the extent appropriate to the objectives and policies of the JC. Such training may be conducted in the form of practical on-the-job training in Vietnam to the extent the training does not jeopardize the daily operation of the Company.

iv. Make sure technology transfer to the JC.

v. Not establish any JC or co-operation to provide waste water treatment plant operation and maintenance service with any companies other than the Vietnamese Party without the Vietnamese Party's consent in Hanoi city.

IX. PRODUCTS, SERVICES AND MARKET:

1. Products and services description.
   Services for O&M, Replacement of equipment, and Spare parts supply

2. Expected markets for products, customers, percentage planned of export products.
   Expected markets for products: None
   Customers: HPC and Other municipalities
   Percentage planned of export products: None

X. TECHNOLOGY, EQUIPMENT, MACHINERY AND ENVIRONMENT:

1. Technology:

The tasks of JC are O&M for:

1) Yen So WWTP (Sequencing Batch Reactor Process)
2) Ho Tay WWTP (Conventional Activated Sludge Process)
3) Bay Mau WWTP (Conventional Activated Sludge Process)
4) Phu Do WWTP (Conventional Activated Sludge Process)
5) Yen Xa WWTP (Conventional Activated Sludge Process)
6) Yen So Bio-solids Processing Center (Hybrid Type Sludge Drying (Solar Drying & Heat Pumping Type Drying)

2. List of necessary special equipment and machinery in response to the Company's activities.

(1) Transportation

1) Mini Van	2units
2) Pickup Truck	1 unit
3) Arm Truck	1 unit
4) Passenger Car	6 units

(2) Wastewater treatment

1) Sampler for water Quality Analysis	1 units
2) Automatic Water Quality Analytical Equipment (portable)	5 units
3) Cart	25 units
4) Crane	1 unit
5) Forklift	1 unit

6) Spare Parts, Consumables (Belt, Seal Material, Diffuser, Equipments for Water Quality Analysis and Sludge Analysis) L.S.
7) Small Truck, Cart, Forklift 5 units
8) Truck for Sludge Transfer 14 units
9) Weighing Machine 1 unit

(3) Administration
1) PC 27 units
2) Mobile phone 41 units
3) Land line 10 units
4) Fax machine 6 units
5) Office Equipment L.S.
6) Work clothes & Equipment for safety 195 units
7) Equipment for Cleaning and Mowing 15 units
8) Daily commodities 34 units

3. Environment:

WWTPs and Sludge bio-solids processing center, to be operated by JC are to work for environmental protection and pollution reduction, so that no serious environmental impact is expected.

XI. DEMANDS FOR BUSINESS'S ACTIVITY:

1. Demand for machinery, equipment and raw material

List (types)	First year (2014)	Second year (2015)	Year of stable production
1.Purchase			
(1)Transportation			
1)Mini Van	2 units	2 units	2 units
2)Pickup truck	1 units	1 units	1 units
(2)Wastewater Treatment			
1)Sampler for water quality analysis	1 units	1 units	1 units
2)Automatic water quality analytical equipment	3 units	3 units	5 units
3)Cart	15 units	15 units	25 units
(3)Administration			
1)PC	18 units	18 units	27 units
2)Mobile phone	26 units	26 units	41 units
3)Land line	7 units	7 units	10 units
4)Fax machine	4 units	4 units	6 units
5)Office Equipment	L.S.	L.S.	L.S.
6)Work clothes & Equipment for safety	115 units	115 units	195 units
7)Equipment for Cleaning and Mowing	9 units	9 units	15 units
8)Daily commodities	26 units	26 units	34 units
2.Rental			
1)Passenger car	3 units	3 units	6 unit
2)Arm truck	0	0	1 unit
3)Crane	0	0	1 unit
4)Forklift	0	0	1 unit
3.Provided by HPC			
1)Spare parts, consumables	L.S.	L.S.	L.S.

2. Demand for fuel, energy, water, services and list of suppliers

List (types)	First year 2013	Second year 2014	Third year 2015	Year of stable production
Electricity	0 kWh 0 US$	22,536,000kWh 1,297,000 US$	29,952,000kWh 1,724,000 US$	80,590,000kWh 4,884,000 US$
Fuel	0 L 0 US$	349,954 L 405,000 US$	466,605 L 539,000 US$	482,505 L 602,000 US$
Chemicals	0 kg 0 US$	1,471,406 kg 1,460,000 US$	1,989,660 kg 1,943,000 US$	4,562,178 kg 4,608,000 US$
Contract for Technical Transfer	424,500 US$	566,000 US$	566,000 US$	566,000 US$
Management Contract	462,000 US$	616,000 US$	616,000 US$	616,000 US$

* Projected measures of satisfying demands in term of power and water for project.

3. Demand for employees in year of stable production

Kinds of employees	Vietnamese citizens	Foreigners	Total
1. Management staff	11	5	16
2. Technical-Supervising staff	21	2	23
3. Skilled workers	124		124
4. Non-skilled workers	24		24
5. Office staff	3		3

XII. SITE - CONSTRUCTION - ARCHITECTURE:

1. Site and project's land area:

* Address (commune, district, province) boundaries or geographical coordinates of site.

* Existing conditions of floor space and infrastructure system (roads, bridges, power, water, drainage, communications...)

* Land area to be used for project and rental rate.

Notice:

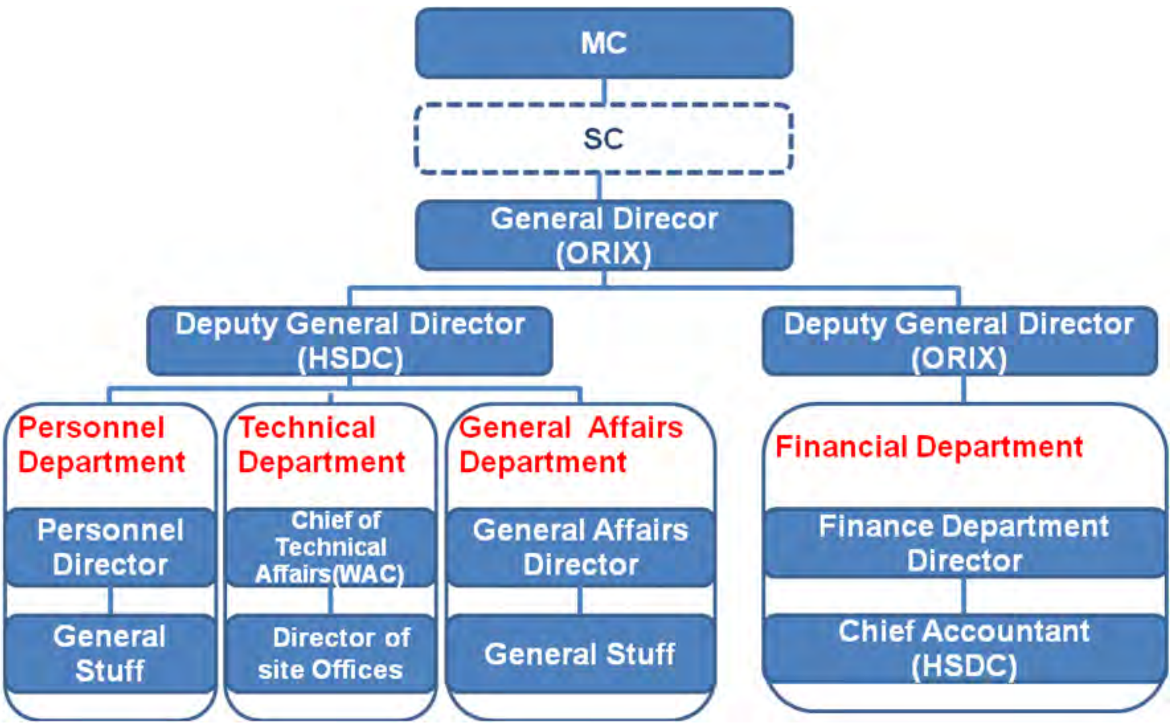
- *For establishment of joint venture company, it's indispensable to present the implementation site of the project.*
- *In case that the joint venture company must clear the land area to be used for the project, the cost for compensation and relocation must be estimated, based on agreement with the People's Committee of the province.*

2. Constructions and Architecture

No construction and no architecture in the service.

XIII. ORGANIZATIONAL STRUCTURE, PERSONNEL AND SALARIES:

1. Organizational chart of company



Remarks: 1) Decision of Standing Committee (SC) does not have any legal power, but it is proposed for well communications and discussions between Vietnamese and Japanese sides.
2) One Deputy General Director will hold the positions of heads of the Personnel Department and the General Affairs Department, concurrently.
3) Another Deputy General Director will hold the position of head of the Financial Department, concurrently.
4) The head of Financial Department is the final decision maker for purchase and payment.

2. Annual salary funds

(unit: US$)

	Ⅰ	Ⅱ	Ⅲ	Year of stable production
	2013	2014	2015	
1. Expatriate staff				
General Directors	36,000	48,000	48,000	48,000
Deputy GD	27,000	36,000	36,000	36,000
Chief Technical Affairs	18,000	24,000	24,000	24,000
Technical Experts				0
Total salary fund (I)	81,000	108,000	108,000	108,000
2. Vietnamese staff				
Deputy GD	18,000	24,000	24,000	24,000
Chief Accountant	9,000	12,000	12,000	12,000
General Staff (1)	9,000	12,000	12,000	12,000
General Staff (2)	9,000	12,000	12,000	12,000
General Staff (3)	9,000	12,000	12,000	12,000
Operation staff	12,800	269,100	358,800	703,200
Total salary fund (II)	66,800	341,100	430,800	775,200
3. Total salary funds (I + II)	147,800	449,100	538,800	883,200

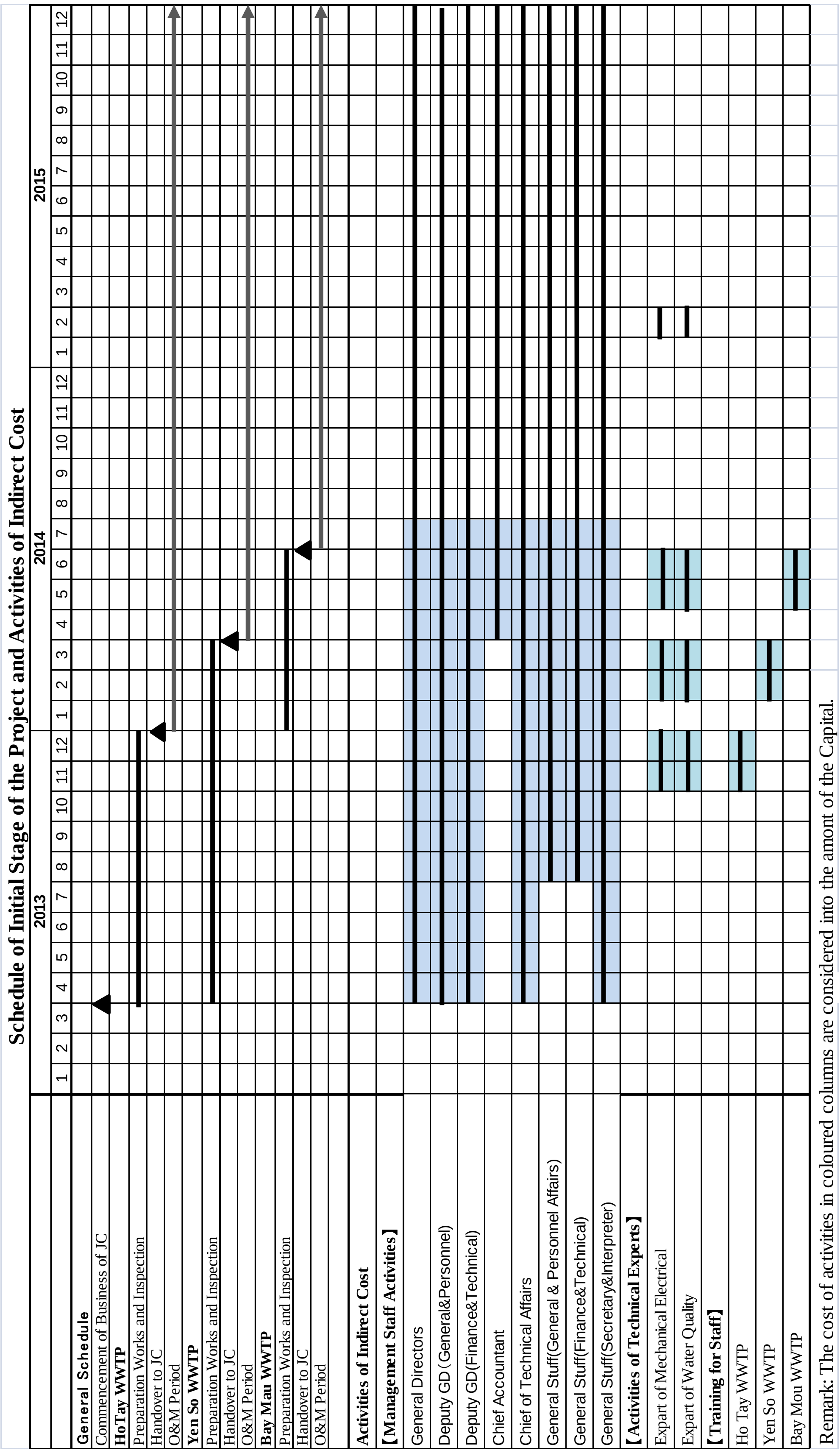
3. Form of employee’s recruitment, training's plan for management and technical personnel (state clearly contents and estimated expenditures).

Form of employee's recruitment :
The Key Staff will be transferred from the both of Vietnamese and Japanese parties, as mentioned in Chapter VIII, and remaining staff will be recruited through advertisement on newspaper and staff dispatching company

Training's plan for technical personnel:
Under the license contract, WAC will dispatch three (3) Technical Staff; “Chief of Technical Affairs” and “Mechanical and Electrical Expert” and “Wastewater Treatment Process Engineer” for achievement of suitable O&M servives of the company, and they will provide On-the-Job-Training (OJT) program for local expert in each WWTP as shown in Table ”Schedule of Initial Stage of the Project and Activities of Initial Cost”.

XIV. SCHEDULE FOR PROJECT IMPLEMENTATION:

The schedule at the initial stage of the Project and activities of indirect cost is shown as below.



Remark: The cost of activities in coloured columns are considered into the amount of the Capital.

XV. STRUCTURE OF INVESTMENT CAPITAL DURING IMPLEMENTATION YEARS:

1. Working capital:

Components	First year	... year	Year of stable production
1. Production capital a) 2. Cash Working capital in total	0 US$2.14 million US$2.14 million		

2. Fixed capital:

(Unit: US$)

Components	First year	... year	Year of stable production
1. Machines & Equipments	139,000		
2. Office rent	48,000		
3. Medication costs	3,000		
4. Insurance expenses	30,000		
5. Overhead	240,000		
Total fixed capital	460,000		

XVI. EVALUATION OF THE PROJECT EFFICIENCY:

1. Financial efficiency

- Term for return of capital
- Theoretical break - even point.
- Capacity to balance foreign currency.

2. Socio - economic efficiency of project

- Number of employees used by the project.

Kinds of employees	Vietnamese	Foreigners	Total
1. Management staff	11	5	16
2. Technical-Supervising staff	21	2	23
3. Skilled workers	124		124
4. Non-skilled workers	24		24
5. Office staff	3		3
Total	183	7	190

- Estimated tax amount paid to State budged

XVII. FINANCE AND ACCOUNTING SYSTEM:

1. Principle of sharing profit.

The profit will be shared to the investors, depending on share of the initial investment amount..

2. The accounting system used by the joint venture company.

Vietnamese accounting system
ORIX is listed in New York Stock Exchange so that USGAAP base financial statements will also be prepared in case the JC is judged as consolidated company of ORIX.

3. Assets depreciation principles.

In accordance with Vietnamese tax regulations.
Straight line method. Production output method (number of operating time base) may be an option.

APPENDIX-A2

Term Sheet of O&M Join Company

Preliminary Draft

For discussion purposes only

Frame Investment Agreement

(TERM SHEET)

Party	Hanoi Sewerage and Drainage Company (“HSDC”) ORIX Corporation (“ORIX”) Water Agency (“WA”, collectively with ORIX, the “Consortium”)
Execution Date	[30/September/2012]
Joint Venture Company (“JVC”)	1. Type of the Company: LLC with more than one or more members. The liabilities of each member of JVC shall be limited to the amount which the member actually invested into JVC. 2. Name: 3. Address: 4. Charter Capital and Contributed Capital from each Party (1) Charter Capital: VND [ ] million (2) Contribution of HSDC: VND [ ] million (3) Contribution of ORIX and WA: VND [ ] million [Note: Please see the spread sheet separately attached describing the assumption of the calculation for the Capital Contribution above.] 5. Shareholding Ratio (1) HSDC: 35% (2) Consortium: 65% 6. Business Lines of JVC (1) Operation and maintenance services for waste water treatment plants, including but not limited to the following conditions: (i) Repair and Replacement works for the waste water treatment plants; (a) Repair means that JVC shall, or cause any third party to, repair any part/component of the equipment/machinery installed in the plants. (b) Replace means that JVC shall, or cause any third party to, replace any equipment/machinery installed into the plants.

	(ii) The necessary permit/license/registration/filings (the “Permits”) should be obtained or completed, if applicable, for wholesale and retail and/or construction and any other Permits for JVC to perform the operation and maintenance services. (2) Training service for O&M services in sewerage sector for other municipalities; (3) Advisory service in sewerage sector for other municipalities; (4) Construction works; and (5) Other business lines to be separately agreed by the Parties
Capital Contribution	1. Capital Contribution Date and Obligation The Capital Contribution Date shall be the date within six (6) months from the issuance date of the investment certificate of JVC or such other date to be separately agreed by the Parties. Further, each of the Parties shall perform its capital contribution in cash at the Capital Contribution Date. 2. Conditions Precedent for the Capital Contribution by the Consortium (1) Execution of the Loan Agreement between JICA and the competent Vietnam Governmental Agency (the “Loan Agreement”); (2) Execution of OM Service Agreement (including repair and replacement work to be made by JVC) for Yen So (the “OM Service Agreement”); (3) Execution of MOU(s) regarding OM Services for Yen Xa, Ho Tay, Bay Mau and Phu Do (collectively, the “Related Facilities”) (“MOU”); (4) Execution of Technology Transfer Agreement between JVC and WA (the “TTA”) ; (5) Execution of Service Agreement between JVC and ORIX (the “Service Agreement”, collectively with the Loan Agreement, the OM Service Agreement, MOU and TTA, the “Related Agreement”); (6) Completion of the due diligence by ORIX on Yen So and Related Facilities;

	(7) Issuance by People's Committee of Hanoi ("HPC") of the Guarantee Letter to guarantee (i) the effectiveness and validity of the put option arrangement under the Frame Investment Agreement [(including commitment by HPC that HPC shall cause HSDC to comply with the terms and conditions on the put option under the Frame Investment Agreement and not to claim and assert the inability and ineffectiveness of the put option thereunder from the Vietnamese or other applicable law perspective)],(ii) effectiveness and validity of the distribution or payment by JVC of the dividend or other profit (if any) to its members in USD and (iii) that, if the corporate structure or legal status of HSDC is changed or all or material parts or functions of HDSC is transferred to, merged with, or divided into other entities or governmental bodies during the term of JVC regardless of the reason therefor, HPC shall cause such transferee organization to abide by all terms and conditions of the JVAs and other transaction documents of which HSDC is the party, and shall also cause such transferee organization to obtain a new investment certificate and necessary modifications on permissions, etc. in connection with the change in the corporate structure; (8) Agreement on (i) internal regulation, rules or agreement regarding the remuneration, salary and allowance to be paid to the directors or other executives (if any) (ii) Internal Labor Rules and Regulations (including details of the salary and allowance to be paid to employees of JVC), (iii) rules on the internal decision-making procedure of JVC, management and operation manual or rules, and (iv) other material internal rules, satisfactory to the Parties; (9) Confirmation Letter from (i) the relevant tax authority on the taxation on the capital amount to be paid by each member of JVC, the profit of JVC, and distribution by JVC to its members, and (ii) the relevant authority on the transferring foreign currencies from [and to] a domestic account; (10) HSDC has obtained the approval of the Board of Management and other relevant governmental agency or

	authority for execution of the Frame Investment Agreement, Joint Venture Agreement, Charter of JVC and other related documents (collectively, the “JVAs”); (11) The terms and conditions of the Investment Certificate issued by the relevant governmental authority shall be satisfactory to the Consortium; (a) the items approved by the Confirmation Letter from the relevant tax authority and other relevant authority shall be specificly stated; and (b) necessary Permits are obtained and reflected in the Certificate. (12) No breach of any of the JVAs or the Related Agreements; (13) No material adverse change; (14) Compliance with applicable laws; (15) Completion of licenses (including licenses for (i) the retail and wholesale of certain goods, (ii) Construction and (iii) others necessary for JVC to perform the OM services (including repair and replacement works) under the OM service agreement), permissions, registration and/or filings procedures; (16) (i) Documents evidencing the satisfaction of items above and (ii) other documents required or necessary to establish JVC; and (17) Other items to be separately agreed by the Parties
Corporate Governance	1. MC (1) Chaireman (HSDC) (2) Representative of ORIX (ORIX) (3) Representative of Water Agency (WA) 2. Headquaters (1) General Director and Legal Representative (ORIX) (2) Deputy General Director in charge of Financial Affairs / Chief of Financial Affairs (ORIX) (3) Deputy General Director in charge of General and Personal Affairs and Techinical Affairs / Chief of General and Personal Affairs (HSDC) (4) Chief Accountant (HSDC)

	(5) Chief of Technical Affiars (WA) (6) General Staff for general and personnel affairs (Recruitment) (7) General Staff for fiancial and technical affairs (Recruitment) (8) General Staff (Secretary & Interpreter) (Recruitment) (9) [TBD] 3. Salary for the Directors, other Executives and Employees [TBD] 4. Inspection Committee [TBD] 5. Standing Committee: JVC shall set up the Standing Committee consisting of the working-level personel of each Parties hereof in order to cultivate a shared understanding and to enhance communication, and the meeting of the Standing Commitee shall be held [ ] per month to discuss about performance and status of the business operation, sales and marketing of JVC and business strategy and policy of JVC. 6. Decision Making Procedure The following items (the “Material Items”) shall be diceded by 75% or more affairmative vote at a MC meeting. (1) Amendment of the Charter; (2) Change of the investors of the JVC; (3) Approval of the middle and long term strategy and annual business plan (excluding funding, financing and distribution of the profit of JVC to Shareholders); (4) Liquidation, termination and winding up of JVC, and declaration of banckraptcy; (5) Approval of the sale of assets more than 50% of the total asset value recorded in the most recent financial statement of JVC; (6) Decision of reorganization of JVC 7. Role of each Executives (1) Chairman (to be designated by HSDC) (a) Planning, schedule arrangement, other preparation works (including document preparation), convocation, and chairing of the MC, and other meetings to exchange opinions of the members of the MC; (b) Supervision of execution of issues resolved by the MC; (c) Signing on issues resolved by the MC (if necessary); and (d) Other works stipulated in the Law on Enterprise and the

Charter.

(2) General Director and Legal Representative (to be designated by ORIX)

(a) Supervision of all activities of the company

(b) Execution of issues resolved by the MC

(c) Execution of business plan and investment plan

(d) Signing on business documents/contract documents, as the representative of the company

(e) Decision of appointment and dismissal of major positions in the company

(f) Decision of salary of company staff

(g) Decision of employment of company staff

(h) Proposal of agenda and detailed items to be determined by MC meeting and preparation of documents necessary for MC

(i) Decision of internal administrative rule of the company staff

(j) Decision of internal organization structure of JVC

(3) Deputy General Director in charge of Financial Affairs/Cheif of Financial Affairs (to be designated by ORIX)

(a) Management works of the financial department

(b) Supervision and Execution of works of financial and accounting matters, and approval

(c) Preparation of rules/regulations of audit

(d) Preparation of company’s regulations/ rules on financial and accounting issues

(e) Proposal of share of profit and writing off as a loss

(f) Proposal of a business plan and an investment plan

(g) Preparation of annual financial statements and tax payment declaration form

(4) Deputy General Director in charge of General and Personal Affairs and Technical Affairs/Cheif of General and Personal Affairs (to be designated by HSDC)

(a) Labor management (salary, working environment and working time), based on the company’s regulations on general and personnel affaires

	(b) Procurement and management of materials and equipment (c) Arrangement for acceptance of technical transfer program (d) Supervision of performance carried out under the license contract (e) Risk management and facility operation, in cooperation with “Chief Technical Affairs” (f) Negotiation and coordination with relevant Vietnamese organizations (g) Preparation of documents on personnel appraisal and personnel change (h) Preparation of internal regulations and rules on general affairs and personnel affaires (i) Preparation of rules for disaster and manuals for risk management (j) Preparation of regulations/ rules of organization policies, division of duties and administrative authorities (5) Cheif of Technical Affairs (to be designated by WA) [TBD] (a) Supervision of O&M service of the company, and monitoring activities of operation of the facilities (checking based on IP) (b) Supervision of performance of technical staff in the company (c) Supervision of technical transfer for O&M of facilities (d) Management of hazardous materials (e) To study on solutions of troubles in operation, and to take necessary actions (f) Preparation of the plan of O&M, repair and replacement of the facilities, and preparation of specs of materials and equipment for the O&M, repair and replacement works (g) Preparation of manuals of operation, monitoring, risk management, and safety and sanitation control (h) Instruction/training for local technical staff at an initial operation stage of the facilities, in cooperation with contractor (i) Preparation of a long term plan of education and training for local technical staff, and execution of the training

	(6) Cheif of Accountant (to be designated by HSDC) (a) General accounting works (b) Preparation of necessary documents for annual financial statements
Rules of Decision-making Authority	[to be discussed]
Operation of the Joint Venture Company	1. Business Plan: The Consortium shall prepare the plan and it shall be attached hereto. 2. Profit Distribution Policy: JVC shall distribute its profit exceeding certain amount to be reserved in accordance with applicable laws and minimum cash reserve necessary for operating the business of JVC to the Parties every year. 3. Finance: JVC shall arrange any financing from any domestic or international financial institutions or other creditors by its own credibility and none of the Parties shall be obligated to (i) make a loan to JVC nor make any additional contribution to JVC or (ii) guarantee the financing for the JVC's creditors. 4. Cash Management: JVC may open accounts of any nature whether denominated in Vietnamese or USD at any credit institutions permitted to operate in Vietnam as the Chief of the Financial Affairs may elect from time to time, and (if necessary, with the approval of the State Agency) with a foreign bank outside Vietnam. USD will be received from HPC as a part of O&M service fees, of which will be appropriate to an invoice from any supplier to be billed in dollars, shall be deposited to such USD account. 5. The Parties agree that JVC may take any available measures to offset the exchange risks. 6. [TBD]
Covenants	1. HSDC (1) Negotiation with any governmental agency including HPC in order to implement this Agreement and the Related Agreements (excluding the Loan Agreement) (2) HSDC shall cause HPC to perform its obligations under the

	OM service agreement in accordance therewith. (3) HSDC shall second and dispatch to JVC the personnel in charge of technical transfer from WA. (4) HSDC shall second and dispatch to JVC the Deputy General Directors and shall cause the Deputy General Directors to perform its assignment and obligations in accordance with applicable laws and the Frame Investment Agreement. (5) HSDC shall select an appropriate and chief of accountant for JVC. (6) Information collection regarding new sewage water projects in Hanoi (mainly BT and/or BOT projects) and negotiation with HPC for the OM service agreement relating to the new projects. (7) HSDC shall procure sufficient employees for Yen So and Related Facilities (including secondement and dispatch of employees from HSDC and hiring new employees therefor). (8) HSDC shall make its best effort to resolve any and all labor disputes with employees of JVC, Yen So and Related Facilities. (9) HSDC shall support JVC, ORIX and WA in procedures relating to (i) import of materials and chemicals necessary for JVC’s business, and (ii) obtaining appropriate visa for the foreign employees to be seconded and dispatched from ORIX and WA. (10) HSDC shall, based upon request by the Consortium, make its best effort to support JVC in (i) obtaining any and all licenses and permits and (ii) completion of all procedures required or necessary for JVC to conduct its business. (11) If the corporate structure or legal status of HSDC is changed or all or material parts or functions of HDSC is transferred to, merged with, or divided to other entities or governmental bodies during the term of JVC regardless of the reason therefor, HSDC shall cause such transferee organization to abide by all terms and conditions of the JVAs and other transaction documents of which HSDC is the party, and shall also cause such transferee organization to obtain a new

	investment certificate and necessary modifications on permissions, etc. in connection with the change in the corporate structure. (12) HSDC shall perform other assignments and obligations to be separately agreed by the Parties (if any). 2. ORIX (1) ORIX shall make its best effort to support HPC and/or other relevant Vietnam Governmental Agency in negotiation with JAICA with respect to the Yen Xa Projects. (2) ORIX shall make its best effort to promote practical cooperation to implementation of Yen So sludge recycling business, such as finding and arranging of the meetings with the prospective Japanese investors. (3) ORIX shall arrange training for the employees of JVC if required by JVC as reasonably necessary. (4) ORIX shall advise and support JVC in further development of JVC's business as reasonably necessary (including business alliance with any third party) (5) ORIX shall second and dispatch to JVC General Director and the Deputy General Directors, and shall cause the General Director and Deputy General Directors to perform its assignment and obligations in accordance with applicable laws and the Frame Investment Agreement. (6) ORIX shall support JVC in executing OM service agreements relating to ODA projects sponsored by JAICA or other Japanese entities in other province. (7) ORIX shall perform other assignments and obligations to be separately agreed by the Parties (if any). 3. WA (1) WA shall procure sufficient amount of chemicals for JVC and sell the same to JVC. For the avoidance of doubt, JVC may purchase such chemicals from any third party if (i) the quality of the chemical provided by the third party is equivalent to that of WA and (ii) the price of the chemical of the third party is less than that of WA. (2) WA shall conduct a due diligence against Yen So and Related

	Facilities and figure out the improvement items thereof. (3) WA shall perform its obligations under TTA in accordance therewith. (4) WA shall second and dispatch to JVC the technical expert, and shall cause the technical expert to perform its assignments and obligations in accordance with applicable laws, the Frame Investment Agreement and TTA. (5) WA shall advise JVC in preparation of management and operation manuals for Yen So and Related Facilities. (6) WA shall perform other assignments and obligations to be separately agreed by the Parties (if any).
Non-Competition	1. HSDC shall not execute any OM service agreements for Yen So and other Related Facilities with any third parties without prior written consent of the Consortium. 2. HSDC shall cause HPC not to assign the replacement work to any third party. 3. HSDC shall not establish any JV or other entity to provide waste water treatment plant operation and maintenance service in Vietnam with any companies other than the Consortium without prior written consent of the Consortium. 4. JVC and HSDC shall not, without obtaining a prior consent of ORIX, expropriate and/or transfer to a third party any of the technology to be transferred by WA to JVC under the TTA. 5. HSDC shall not cause or solicit any employees of JVC, Yen So and Related Facilities to work at other waste water treatment plants or similar facilities for which any OM service agreement is not executed by JVC.
Financial Statements and Audit	1. The Parties agree to cause JVC to prepare financial statements based on US GAAP as well as those based on Vietnamese GAAP. 2. The Parties agree to cause JVC to cooperate with ORIX in audit by the accounting firm retained by ORIX which is required by laws of Japan. For the avoidance of doubt, such audit cost (including fees payable to the accounting firm) shall be borne by ORIX.

Trademark and other Intellectual Properties	1. HSDC shall, or shall cause employees of JVC, not to use any of the trademarks and other intellectual properties owned or used by ORIX and/or WA or register the same with any relevant authority. 2. The Consortium shall, or shall cause employees of JVC, not to use any of the trademarks and other intellectual properties owned or used by HSDC or register the same with any relevant authority.
Representations and Warranties	1. Each Party individually represents and warrants to each other Party that: (a) it is an entity duly organized, validly existing and in good standing under the laws of the jurisdiction of its country of incorporation or establishment. Each Party has all requisite corporate power and authority necessary to enable it to own, lease or otherwise hold its assets and to carry on its business as presently conducted. (b) it satisfies all qualification requirements under the laws of Vietnam or otherwise imposed by the Approval Authority in relation to a Vietnamese or a foreign investor in nature of JVC (as the case may be). (c) each Party has the full power, authority to enter into the JVAs to which it is a party and perform its obligations under such JVAs. (d) each Party has obtained all consents and approvals and taken all actions necessary for it to validly enter into and give effect to the JVAs to which it is a party. (e) the signatory of each Party to the JVAs has the authority to execute them for and on behalf of it, (f) the entry into and delivery of, when executed, and the performance of each JVAs to which the Party is a party will not result in any breach of any of its constitutional document or any of its legal or contractual obligations or result in any claim by a third party against the other Party or JVC. (g) there are no pending or threatened actions or proceedings before any court, judicial body, administrative agency or arbitrator which may materially adversely affect the other Party or this Agreement. 2. In addition to the representations and warranties above, each Party

	shall make further representations and warranties to be separately agreed by the Parties.
Deadlock	In case where HSDC and the Consortium fail to reach an agreement for any of the Material Items, HSDC and ORIX as a representative of the Consortium shall discuss on the solution therefor for [thirty (30) days]. If HSDC and ORIX fail to reach an agreement within the period, both HSDC and ORIX shall respectively appoint one representative and those representatives shall discuss on the same for additional [thirty (30) days]. Further, if the representatives fail to reach an agreement within the period, ORIX may decide the matter without any consent of HSDC.
Equity Transfer	1. Each Party shall not sell, transfer or dispose of the shares of capital contribution without prior written consent of other Parties. 2. Put Option of the Consortium (1) Put Option Events (a) In case where JVC fails to execute any of the OM service agreements for the Related Facilities (b) Failure by HPC to pay any OM service fees and replacement cost in accordance with the OM Service Agreements or other material breach by HPC of the OM Service Agreement. For the avoidance of doubt, after the execution of the OM service agreements for any of the Related Facilities, the failure by HPC to pay any OM service fees and replacement cost in accordance with such OM service agreements or other material breach by HPC of the OM service agreements. (c) In case where HPC assigns any replacement work with respect to Yen So and the Related Facilities to any third party (d) In case where any of the OM Service Agreements for Yen So and the Related Facilities is terminated (e) In case where JVC is being able to operate the business by itself without any support from the Consortium. (f) [TBD]

	(2) Procedures and Price (a) Procedures: [thirty (30) days] prior notice (b) Price: (i) Items (a) to (d) [TBD] (ii) Item (e) Book Value of the Shares of Capital Contribution
IPO	In case where shares or interests of JVC shall be listed on any relevant stock exchange, each Party may transfer its owned shares or interests of JVC to any third party.
Termination and Dissolution	1. Term: [50] years 2. Termination by either Party (no defaulting Party shall have the right to exercise the following rights) (a) The conditions precedent are not satisfied with [one (1) year from execution of the Frame Investment Agreement]. (b) The Party fails to perfume its obligations or breaches any provisions under the JVAs (including JVAs) and Charter of JVC and to cure the same within [thirty (30) days]. (c) Any Party is declared bankrupt or enters into proceedings of bankruptcy, dissolution or liquidation. (d) Only one Party owns the shares of capital contribution. (e) JVC has recorded the deficit for three successive fiscal years. (f) The Investment Certificate of JVC is revoked and terminated regardless of the reason and not replaced with a new investment certificate in form and contents satisfactory to the Parties. (g) The business of JVC shall be suspended by (i) the competent governmental agency without any willful misconduct or negligence of either Party or (ii) any changes of applicable laws. (h) There is any material change in the applicable law that results in a material adverse effect on the business of JVC. (i) HPC fails to perform its obligations under the OM Service Agreements and/or other OM service agreements for the Related Facilities and cure the same within [thirty (30) days]

	(j) [TBD] 3. Termination by the Consortium (a) Any of the Consortium is unable to convert all its profits into foreign exchange or remit all its profits as foreign exchange to overseas as a result of a change in law or banking regulations which did not exist at the time of execution of the Frame Investment Agreement unless such restrictions are imposed due to the member of the Consortium's willful misconduct. (b) [TBD] 4. Termination by mutual agreement The Frame Investment Agreement may be terminated by mutual written agreement by the Parties. 5. Effect of the Termination The termination of the Frame Investment Agreement shall not prejudice any rights of the non-breaching Party or obligations of the breaching Party which shall have accrued as a result of a breach or violation of the Frame Investment Agreement by a Party prior to such termination and shall not destroy or diminish the binding force and effect of any of the provisions of the Frame Investment Agreement which are expressly provided to continue in force after such termination. 6. Dissolution In case where JVC shall be dissolved regardless of the result of the termination of the Frame Investment Agreement and/or Joint Venture Agreement, each Party shall, in proportion to its share of capital contribution, make a capital contribution or other method to be agreed by the Parties to resolve the excessive debt and then cause JVC to be dissolved.
Indemnification	Each Party (the "Indemnifying Party") shall indemnify and hold harmless the other (the "Indemnified Party") from and against all Losses **(**"Losses" means all liabilities, obligations, losses, damages, penalties, claims, actions, suits, judgments or settlements of any kind, whether absolute, accrued, contingent, direct, indirect or otherwise, whether due or to become due, and whether or not resulting from third-party claims (including interest and penalties with respect thereto and out-of-pocket expenses, and reasonable fees and expenses

	for attorneys, accountants, consultants and experts incurred in investigating or defending any of these).**)** suffered or incurred by the Indemnified Party resulting from, arising out of or in connection with, any breach of any obligation under the Frame Investment Agreement of the Indemnifying Party, or any failure or refusal of the Indemnifying Party to observe or perform any of its covenants or obligations under the Frame Investment Agreement.
Governing Law	Laws of Singapore
Arbitration	Arbitration in Singapore. The arbitration shall comprise of three arbitrators. Each of HSDC and the Consortium shall respectively appoint one arbitrator and the two arbitrators appoint one arbitrator. The arbitration shall be conducted in English.
Others	1. Definition 2. Confidentiality: 3. Notice: 4. Cost: Each Party shall pay its own costs for the preparation and execution of the Frame Investment Agreement and any other JVAs. 5. Language and Counterparts: English and three counterparts 6. Priority: Joint Venture Agreement and Charter, contents of which shall be separately agreed by the Parties, shall be attached to the Frame Investment Agreement. In case where there are any inconsistencies between the Frame Investment Agreement and other JVAs (excluding the Frame Investment Agreement), the Frame Investment Agreement prevails against other JVAs. 7. Non-Assignment: The Frame Investment Agreement shall not be assignable or otherwise transferable by any Party without the prior written consent of the other Parties, and any purported assignment or other Transfer without such consent shall be void and

	unenforceable. Further, the transferee must be of sound creditworthiness and have sufficient capability to perform the transferring Party's obligations under the Frame Investment Agreement, and the transferee must not be a competitor of JVC and the other Parties. 8. Amendment: The Frame Investment Agreement may be amended or modified only by a written agreement executed by the Parties and any such amendment or modification shall form an integral part thereof. 9. Severability: If any provision of the Frame Investment Agreement is or is held to be invalid or unenforceable, then so far as it is invalid or unenforceable it has no effect and is deemed not to be included in this Agreement. This shall not invalidate any of the remaining provisions of the Frame Investment Agreement. The parties shall then use all reasonable endeavors to replace the invalid or unenforceable provision by a valid provision the effect of which is as close as possible to the intended effect of the invalid or unenforceable provision. 10. Good Faith Consultation: 11. Other items to be separately agreed by the Parties

APPENDIX-A3

Financial Analysis in relation to Establishment of Joint Company

Preliminary Financial Analysis in relation to the establishment of Joint Company

Table of Contents

Important Notice in relation to the Model

Any model and related documentation ("Model") supplied or referred to herein is prepared in reliance upon information provided by various sources. Any Model is supplied for discussion purposes only and is not appropriate for any other purpose. The Recipients accept and agree that any such Model and its related output do not to any extent substitute for the exercise of professional and business judgment on the Recipients' part and that of the Recipients' employees.

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1 Major Assumptions

This part discusses and illustrates the major assumptions based on which the financial analysis of the Joint Venture Company ("JV") was done.

1.1 Scope of JC's Business

1.1.1 Facilities to Cover

JC is expected to execute O&M contracts with HPC whereby it will provide operation and maintenance services for the wastewater treatment plants ("WWTPs") located in Hanoi urban area and owned by HPC. In addition, it is planned that JC will execute an O&M sub-contract with SPC to be established for the construction and operation of the sludge reuse facility under the BOT scheme.

The WWTPs to be operated by JC have yet to be identified. For the purpose of this analysis, we assumed the following two cases:

Case	Facilities to cover
Case A	Yen Xa WWTP, Yen So WWTP, Bay Mau WWTP, Phu Do WWTP, Ho Tay WWTP, and Sludge reuse facility
Case B	Yen Xa WWTP, Bay Mau WWTP, Phu Do WWTP, Ho Tay WWTP, and Sludge reuse facility (Yen So WWTP is excluded from Case A)

1.1.2 Scope of JC's O&M works

The point of consideration for the scope of JC's O&M works is whether it is to be in charge of long term replacement/refurbishment works of the facilities which it will cover or not.

This has yet to be determined. We assumed the following 3 cases.

Case	Scope of JC's O&M works	
	WWTPs	Sludge Reuse Facilities
Case 1	○	△
Case 2	△	△
Case 3	—	△

○ : JC is responsible for replacements and takes the risk of functional deterioration. JC will do necessary replacement of the facilities with receiving "pre agreed" service charge

△ : JC will do replacement works but does not take the risk of functional deterioration. JC will replace the facilities with the money which it will receive then.

— : JC will not be involved in the replacement works.

1.2 Schedule

1.2.1 Establishment of JC

To start the O&M work from year 2014, it is assumed that JC will be established at the beginning of 2013.

1.2.2 Period of O&M works

It is assumed as follows. The O&M period is assumed to continue until December 31, 2037, which is the 20th anniversary of the operation of the Yen Xa WWTP.

Facilities	From	To	Period
Yen Xa WWTP	January 2018	December 2037	20 Years
Yen So WWTP	March 2014	December 2037	23 Years 9 months
Bay Mau WWTP	July 2014	December 2037	23 Years 6 months
Phu Do WWTP	January 2016	December 2037	22 Years
Ho Tay WWTP	January 2014	December 2037	24 Years
Sludge Reuse facility	January 2016	December 2037	22 Years

* For simplicity, however, each O&M period in the financial model is assumed to start at the beginning of the year as described above.

1.3 Cost related Assumptions

1.3.1 Operational Assumptions of each facility

Maximum Capacity (m^3/day), Capacity Factor(%), Usage(%), and Treatment Volume ('000 m^3 p.a.) of each facility are assumed. For details, please refer to Attachment 1.

1.3.2 O&M cost assumptions

O&M costs which JC incurs are assumed for each facility. For details, please refer to Attachment 2. Please note that the costs indicated in Attachment 2 include JC's profit, which constitutes 5 % of the figures in Attachment 2.

1.3.3 Replacement cost assumptions

Replacement costs for each facility are also assumed. For details, please refer to Attachment 3. Replacement costs are reflected in the financial analysis only in the cases where it is assumed that the replacement works are within JC's scope of work. 5% profit of JC is also included in the figures in Attachment 3.

The figures in Attachment 3 are calculated based on the assumption that JC will take the functional deterioration risk and will provide life-cycle maintenance services of the WWTPs (i.e., "Case i" in section 1.1.2) . If this is not the case (i.e., "Case ii" in section 1.1.2), the figures in Attachment 3 is assumed to increase by 20%, since the life cycle management of the replacement works (particularly in later years) will become less cost effective,

We assumed the number "20%" above (by which replacement cost is assumed to increase if life cycle management of the replacement works is not adopted) based on the following analysis in Japan and UK about the effect of PFIs/PPPs. Under PFI/PPP scheme, life cycle management of the facilities is usually adopted. Therefore, we believe such analysis shall serve as the basis to consider the effect of cost savings under the lifecycle management.

- ✓ Japanese PFI promotion office in Cabinet office analyzed 181 (3.2 trillion yen in total) PFI projects for which winning bidders have been nominated since April 1998 to June 2008. According to the Cabinet office, 19% of the cost savings was obtained by adopting PFIs compared with traditional public procurement scheme. This would mean that if long term lifecycle management had not been adopted, the cost would have been increased by 23.5% (=19% / (100%-19%)).
- ✓ A 2000 report commissioned by the UK Treasury Taskforce found that among a sample of twenty nine PFI projects, of which the PFI project cost and PSC (Public Sector Cost, which is the cost if a PFI project had been done as public sector works) were available for, the average saving due to PFI was closer to 17%. This would mean that if long term lifecycle management had not been adopted, the cost would have been increased by 20.5% (=17%/ (100%-17%)).

1.4 Financial Assumptions

1.4.1 Currency used inflation rate in the financial analysis

USD is used as the currency for the financial analysis. Inflation rate (in USD base, accordingly) is assumed as 3%.

1.4.2 Taxes

- ✓ Value added tax: 10%
- ✓ Property tax: None
- ✓ Corporate income tax: 25% but both of the following 2 tax incentives are assumed to be available.

Reduction of income tax rate	Exemption of income tax
Until 15th year: 10%	Until 4th year: 100% exemption
Thereafter: 20%	From 5th until 9th year: 50% exemption

1.4.3 JC's financing

US$2.1 million of equity is assumed to be in place when JC is established in 2013. No other sources of financing (e.g.: external borrowing) are assumed.

Please note that we have not yet analyzed the lead time of JC's revenue and payments (i.e., accounts receivable and payable). Working capital may arise after such analysis has been conducted.

1.4.4 Dividend

Payment of dividend is forecasted by consideration of large amount of future replacement expenses. In other words, part of free cash flow of JC in early years may be reserved for future replacement needs of the plants.

Considering the above, dividend payment is assumed so as not to lead to future cash shortfall when large replacement cost is paid.

1.5 Revenue Structure

As is usual with this type of long term O&M contracts, the revenue which JC will receive from HPC is assumed to be composed by several sub-charges each of which is intended to cover corresponding cost items. For details, please refer to Attachment 4

2 Results

2.1 Extraction of Cases

Based on the possible options of JC's business scope as discussed in 1.1, we extracted the following 6 cases and made financial analysis.

<table>
<tr><th>Case</th><th>Facilities to cover</th><th>Scope of JC's replacement works for WWTPs</th></tr>
<tr><td>Case A1</td><td rowspan="3">Yen Xa WWTP
Yen So WWTP
Bay Mau WWTP
Phu Do WWTP
Ho Tay WWTP
Sludge reuse facility</td><td>○ : JC is responsible for replacements and takes the risk of functional deterioration. JC will do necessary replacement of the facilities with receiving "pre agreed" service charge</td></tr>
<tr><td>Case A2</td><td>△ : JC will do replacement works but does not take the risk of functional deterioration. JC will replace the facilities with the money which it will receive then.</td></tr>
<tr><td>Case A3</td><td>— : JC will not be involved in the replacement works.</td></tr>
<tr><td>Case B1</td><td rowspan="3">Yen Xa WWTP
Bay Mau WWTP
Phu Do WWTP
Ho Tay WWTP
Sludge reuse facility
(Yen So WWTP is excluded from the above)</td><td>○ : JC is responsible for replacements and takes the risk of functional deterioration. JC will do necessary replacement of the facilities with receiving "pre agreed" service charge</td></tr>
<tr><td>Case B2</td><td>△ : JC will do replacement works but does not take the risk of functional deterioration. JC will replace the facilities with the money which it will receive then.</td></tr>
<tr><td>Case B3</td><td>— : JC will not be involved in the replacement works.</td></tr>
</table>

2.2 Financial analyses for extracted cases

The summary financial analyses of the 9 cases are attached in Attachments 5 to 10. The key financial data can be illustrated as follows.

		Case A1	Case A2	Case A3	Case B1	Case B2	Case B3
Operation Cost (Tariff – US$/m^3, 2011 price)	Yen Xa WWTP	0.243	0.246	0.131	0.247	0.250	0.133
	Yen So WWTP	0.246	0.248	0.125			
	Bay Mau WWTP	0.447	0.454	0.276	0.455	0.461	0.283
	Phu Do WWTP	0.209	0.211	0.155	0.213	0.214	0.159
	Ho Tay WWT	0.403	0.410	0.254	0.410	0.416	0.259
	Sludge reuse facility	91.2	91.2	91.4	91.4	91.3	91.5
JC Financial Result	Total Revenue (US$MM)	1,666	1,783	987	1,047	1,115	675
	Total Income (US$MM)	60	67	39	34	41	26
	Equity Return (%)	33.5%	24.3%	20.9%	12.9%	18.4%	15.9%
	Minumun Cash (US$MM)	0.81	(1.90)	(2.02)	0.81	(3.53)	(3.27)

* Operation Cost for Sludge reuse facility includes JC's cost only, and does not include the cost incurred by SPC.

The above results indicate that cases where JC takes responsibility for replacements (Case A1 and B1) could operate the plants with lower costs compared with the cases where JC does not do so (Cases A2 and B2). This is mainly due to replacement cost reduction obtained by long term life cycle management of the replacement works (particularly in later years). Besides such economic effects, however, by transferring life cycle operation risks to JC, HPC can maximize the use of private sector skills, and can thus focus on the management/monitoring of output and service level of JC for safe and sound operation of the plants.

Regarding comparison between Case A1 and Case B1, the difference is whether the O&M of Yen So WWTP is included or not. The difference is reflected (among others) in the projected revenue of JC. In Case A1 (where operation of Yen So WWTP is included), revenue of JC is projected to reach approximately USD 21 million in 2014 and above USD 50 million in and after 2018, while in Case B1 (where operation of Yen So WWTP is not included), revenue of JC is projected to remain below US$10 million until 2015 (which is the 3rd year from initial investment) and around USD 10 million until 2017 (which is 5th year from initial investment).

From the viewpoint of foreign investors, they usually expect the effect of investment in reasonable (not so long) period of time, say, in 3 years. If this is kept in mind, Case B1 may not attract potential investors, since projected revenues in 3 or 5 years may be regarded "small". (Although minimum amount of "revenue" which investors require may differ, it would not be less than, say, US$10 million.)

Attachment 1: Operational Assumptions of each facility

	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Days		365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365
Yen Sa Wastewater Treatment Plant																									
Maximum Capacity (m^3/day)	5E+06					270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000
Capacity Factor(%)	100.00%					100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	76.50%					40.80%	51.00%	61.20%	71.40%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%
Wastewater Treatment Volume ('000 m^3 p.a.)	2E+06					40,208	50,261	60,478	70,365	80,417	80,417	80,637	80,417	80,417	80,417	80,637	80,417	80,417	80,417	80,637	80,417	80,417	80,417	80,637	80,417
Sludge Reuse Plant (Carbonization)																									
Maximum Capacity (m^3/day)	4061.2			185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Capacity Factor(%)	100.00%			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	96.64%			64.00%	64.00%	98.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Sludge reuse Volume ('000 m^3 p.a.)	1433.5			43	43	66	67	68	67	67	67	68	67	67	67	68	67	67	67	68	67	67	67	68	67
Yen So Wastewater Treatment Plant																									
Maximum Capacity (m^3/day)	4,560,000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000
Capacity Factor(%)	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	98.96%	75.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Wastewater Treatment Volume ('000 m^3 p.a.)	1,648,203	52,013	69,350	69,540	69,350	69,350	69,350	69,540	69,350	69,350	69,350	69,540	69,350	69,350	69,350	69,540	69,350	69,350	69,350	69,540	69,350	69,350	69,350	69,540	69,350
Bay Mou Wastewater Treatment Plant																									
Maximum Capacity (m^3/day)	319,200	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300	13300
Capacity Factor(%)	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	79.90%	40.80%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%
Wastewater Treatment Volume ('000 m^3 p.a.)	93,155	1,981	3,961	3,972	3,961	3,961	3,961	3,972	3,961	3,961	3,961	3,972	3,961	3,961	3,961	3,972	3,961	3,961	3,961	3,972	3,961	3,961	3,961	3,972	3,961
Phu Do Wastewater Treatment Plant																									
Maximum Capacity (m^3/day)	1,848,000			84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000	84000
Capacity Factor(%)	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%
Wastewater Treatment Volume ('000 m^3 p.a.)	550,820			25,087	25,019	25,019	25,019	25,087	25,019	25,019	25,019	25,087	25,019	25,019	25,019	25,087	25,019	25,019	25,019	25,087	25,019	25,019	25,019	25,087	25,019
Ho Tay Wastewater Treatment Plant																									
Maximum Capacity (m^3/day)	360,000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Capacity Factor(%)	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%	81.60%
Wastewater Treatment Volume ('000 m^3 p.a.)	107,296	4,468	4,468	4,480	4,468	4,468	4,468	4,480	4,468	4,468	4,468	4,480	4,468	4,468	4,468	4,480	4,468	4,468	4,468	4,480	4,468	4,468	4,468	4,480	4,468

Attachment 2: O&M cost assumptions

(2011 Price)		year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	year 11	year 12	year 13	year 14	year 15	year 16	year 17	year 18	year 19	year 20	year 21	year 22	year 23	year 24
Maintenance and Operation Unit Cost		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Yen Sa Wastewater Treatment Plant																									
Utility ($/000㎥)	51.96	-	-	-	-	53.57	52.90	52.30	52.13	51.88	51.88	51.74	51.88	51.88	51.88	51.74	51.88	51.88	51.88	51.74	51.88	51.88	51.88	51.74	51.88
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	110018	-	-	-	-	1,730	1,730	2,440	4,109	7,113	2,700	14,175	7,185	2,464	8,435	1,990	4,582	2,227	4,251	21,069	5,303	1,990	2,464	3,520	10,541
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sludge Reuse Plant (Carbonization)																									
Utility ($/000㎥)	13,153	-	-	19,819	19,874	12,979	12,719	12,684	12,719	12,719	12,719	12,684	12,719	12,719	12,719	12,684	12,719	12,719	12,719	12,684	12,719	12,719	12,719	12,684	12,719
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	23562	-	-	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071	1,071
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yen So Wastewater Treatment Plant																									
Utility ($/000㎥)	57.65	76.12	57.09	56.93	57.09	57.09	57.09	56.93	57.09	57.09	57.09	56.93	57.09	57.09	57.09	56.93	57.09	57.09	57.09	56.93	57.09	57.09	57.09	56.93	57.09
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	101846.8	1,558	1,558	2,126	3,453	7,184	2,326	5,516	5,819	2,137	8,157	1,758	3,832	1,947	2,803	16,121	4,313	1,758	2,137	2,982	8,561	3,950	3,950	3,950	3,950
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bay Mou Wastewater Treatment Plant																									
Utility ($/000㎥)	113.52	113.60	113.60	113.29	113.60	113.60	113.60	113.29	113.60	113.60	113.60	113.29	113.60	113.60	113.60	113.29	113.60	113.60	113.60	113.29	113.60	113.60	113.60	113.29	113.60
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	14056.5	273	546	575	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603	603
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phu Do Wastewater Treatment Plant																									
Utility ($/000㎥)	84.0	-	-	83.9	84.1	84.1	84.1	83.9	84.1	84.1	84.1	83.9	84.1	84.1	84.1	83.9	84.1	84.1	84.1	83.9	84.1	84.1	84.1	83.9	84.1
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	35602	-	-	941	941	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686	1,686
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ho Tay Wastewater Treatment Plant																									
Utility ($/000㎥)	107.4	107.4	107.4	107.1	107.4	107.4	107.4	107.1	107.4	107.4	107.4	107.1	107.4	107.4	107.4	107.1	107.4	107.4	107.4	107.1	107.4	107.4	107.4	107.1	107.4
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	14502	552	552	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609	609
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inflation for Costs		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%

Attachment 3: Replacement cost assumptions

(2011 Price)	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	year 11	year 12	year 13	year 14	year 15	year 16	year 17	year 18	year 19	year 20	year 21	year 22	year 23	year 24
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Yen Xa Wastewater Treatment Plant	-	-	-	-	-	-	-	-	-	-	871	5,124	588	7,793	2,760	2,572	9,663	6,184	34,097	31,834	23,009	6,043	2,924	10,842
Sludge Reuse Plant (Carbonization)	-	-	-	-	-	-	-	-	-	-	-	-	10,526	10,526	-	-	-	-	-	-	-	-	-	-
Yen So Wastewater Treatment Plant	-	-	-	-	-	-	871	5,124	588	6,654	2,718	2,679	11,344	7,628	26,327	23,101	13,970	6,274	2,924	11,387	11,531	11,531	11,531	11,531
Bay Mou Wastewater Treatment Plant	-	-	-	-	-	-	15	274	259	456	456	-	-	-	4,027	4,265	238	-	-	1,018	1,269	505	505	505
Phu Do Wastewater Treatment Plant	-	-	-	-	-	-	-	-	61	1,037	-	1,824	-	-	-	-	16,108	952	-	-	-	4,070	1,004	1,004
Ho Tay Wastewater Treatment Plant	-	-	-	-	-	-	30	518	-	912	-	-	-	-	8,054	476	-	-	-	2,035	502	502	502	502
Inflation of Capex	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%

Attachment 4: Revenue Structure

Sub-charge Category		Corresponding O&M Cost	Unit (example)	Example of calculation (Yen So in 2014, assuming 21000 as VDN/USD exchange rate)	Payment condition (example)	Adjustment of unit charge amount during operation period	
						Adjustment by Inflation	Adjustment by Foreign exchange fluctuation
Variable Payment	Foreign Cost Portion	Variable and foreign currency indexed O&M cost (e.g.: imported fuel)	per m^3	0.046419 (USD/m^3) * 190,000 (m^3/day) *365 (days) *75% (Usage) = 2,414 thou USD =50,701 mil VDN	To be paid based on the actual amount (m^3) treated	Yes (Based on the inflation in the country using the indexing currency)	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Cost Portion	Variable and domestic O&M cost (e.g.: utility)	per m^3			Yes (Based on the inflation in Viet Nam)	None

Sub-charge Category		Corresponding O&M Cost	Unit (example)	Example of calculation (Yen So in 2014, assuming 21000 as VDN/USD exchange rate)	Payment condition (example)	Adjustment of unit charge amount during operation period: Adjustment by Inflation	Adjustment of unit charge amount during operation period: Adjustment by Foreign exchange fluctuation
Availability Payment 1	Foreign Cost Portion	Fixed and foreign currency indexed O&M Cost (e.g.: cost for imported spare parts)	per month	5.45661(USD/m3/ month) *190,000 (m^3/day) *12 (month) *100% (Availability) = 12,441 thou USD =261,263 mil VDN	To be paid based on the actual availability of the facility. (e.g.: The amount may be reduced in case of a material accidental shutdown)	Yes (Based on the inflation in the country using the indexing currency)	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Portion	Fixed and domestic O&M cost (e.g.: payroll)	per month			Yes (Based on the inflation in Viet Nam)	None
Availability Payment 2	Foreign Cost Portion	Equity investment, Foreign currency indexed loan	per month			None	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Portion	Domestic currency indexed loan	per month	(Not assumed so far)		None	None

Note that detailed analysis of O&M costs has yet to be done to determine the structure of the Revenue in detail.

Attachment 5: Summary Financial Analysis – Case A1

Summary of Operation and Tarrifs

			Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
			Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational	Operation from		2018	2014	2014	2016	2014	2016		
	Operatiion Period		20 yrs.	24 yrs.	24 yrs.	22 yrs.	24 yrs.	22 yrs.		
	Maximum Capacity ('000 ㎥/day)		270	190	13	84	15	0		
	Capacity Factor(%)		100%	100%	100%	100%	100%	100%		
	Usage(%)		76.5%	99.0%	79.9%	81.6%	81.6%	96.6%		
	Treatment Volume ('000 ㎥/day)		207	188	11	69	12	0		
	JC' Scope of work for Replacement(*)		○	○	○	○	○	△		
Financial	Tarrif (US$/㎥, 2011 price)		0.243	0.246	0.447	0.209	0.403	136.67	91.16	45.51
	Usage	Opex	0.119	0.113	0.251	0.141	0.230	28.11	-	28.11
		Replacement Cost (after reserve account effect)	0.106	0.114	0.163	0.052	0.143	16.38	2.43	13.95
		Other Costs	0.006	0.006	0.011	0.005	0.010	15.82	14.65	1.17
		Tax	(0.011)	0.027	0.004	0.001	0.004	14.17	13.70	0.47
		Return of Investment	0.023	(0.015)	0.019	0.010	0.016	24.67	22.87	1.81
		(Less:Other (Interest) Income)	-	-	-	-	-	(0.96)	(0.96)	-

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

JC Summary Financial Statement **IRR for Equity** **33.49%**

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	1,666	-	-	21.0	23.0	32.1	33.1	54.4	56.7	59.1	61.5	64.1	76.7	81.3	94.2	-
	Opex	1,565	-	1.3	9.1	9.8	15.9	18.0	28.1	23.6	30.7	41.2	35.6	60.5	102.6	107.1	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	32	-	-	1.2	1.3	1.6	1.5	2.6	3.3	2.8	2.0	2.8	1.6	0.4	0.4	-
	Other	-0	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.0	-
	Pre Tax Income	70	-	-1.3	10.7	11.9	14.6	13.6	23.6	29.7	25.5	18.3	25.6	14.6	-21.7	-13.3	-
	Net Income	60	-	-1.3	10.7	11.9	14.6	13.6	22.5	28.2	24.2	17.4	24.3	13.8	-21.7	-13.3	-
	Dividend/Equity Return	62	-	-	-	-	-	1.1	1.6	2.2	2.6	3.0	3.4	4.1	2.8	1.1	8.0
Bal-ance Sheet	Cash min:0.8		2.1	0.8	11.5	23.4	38.0	50.5	71.4	97.5	119.0	133.4	154.3	202.5	79.9	8.0	-
	Total Asset		2.1	0.8	11.5	23.4	38.0	50.5	71.4	97.5	119.0	133.4	154.3	202.5	79.9	8.0	-
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	9.4	21.3	35.9	48.4	69.3	95.4	116.9	131.3	152.2	200.4	77.8	5.9	-
	Total Equity		2.1	0.8	11.5	23.4	38.0	50.5	71.4	97.5	119.0	133.4	154.3	202.5	79.9	8.0	-

Attachment 6: Summary Financial Analysis – Case A2

Summary of Operation and Tarrifs

			Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
			Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational		Operation from	2018	2014	2014	2016	2014	2016		
		Operatiion Period	20 yrs.	24 yrs.	24 yrs.	22 yrs.	24 yrs.	22 yrs.		
		Maximum Capacity ('000 m³/day)	270	190	13	84	15	0		
		Capacity Factor(%)	100%	100%	100%	100%	100%	100%		
		Usage(%)	76.5%	99.0%	79.9%	81.6%	81.6%	96.6%		
		Treatment Volume ('000 m³/day)	207	188	11	69	12	0		
		JC' Scope of work for Replacement(*)	△	△	△	△	△	△		
Financial		Tarrif (US$/m³, 2011 price)	0.246	0.248	0.454	0.211	0.410	136.58	91.16	45.42
	Usage	Opex	0.119	0.113	0.251	0.141	0.230	28.11	-	28.11
		Replacement Cost (after reserve account effect)	0.109	0.116	0.169	0.054	0.149	16.38	2.43	13.95
		Other Costs	0.006	0.006	0.011	0.005	0.010	15.74	14.65	1.09
		Tax	0.003	0.003	0.006	0.003	0.005	14.18	13.70	0.48
		Return of Investment	0.009	0.009	0.016	0.008	0.015	24.64	22.87	1.78
		(Less:Other (Interest) Income)	-	-	-	-	-	(0.94)	(0.96)	0.02

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

JC Summary Financial Statement

IRR for Equity **24.32%**

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	**1,783**	**-**	**-**	**7.2**	**9.1**	**16.2**	**18.3**	**29.6**	**25.0**	**33.0**	**45.3**	**38.2**	**67.3**	**119.9**	**125.1**	**-**
	Opex	1,691	-	1.3	9.1	9.8	15.9	18.0	28.1	23.6	31.0	42.7	35.9	63.5	113.3	118.3	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	10	-	-	-	-	0.0	0.0	0.2	0.1	0.2	0.3	0.2	0.4	0.7	0.7	-
	Other	0	-	-	-	0.1	0.1	0.1	0.1	0.0	-	-	-	-	-	-	-
	Pre Tax Income	**82**	**-**	**-1.3**	**-1.9**	**-0.8**	**0.1**	**0.1**	**1.3**	**1.2**	**1.8**	**2.4**	**2.1**	**3.4**	**5.9**	**6.2**	**-**
	Net Income	**67**	**-**	**-1.3**	**-1.9**	**-0.8**	**0.1**	**0.1**	**1.3**	**1.2**	**1.8**	**2.2**	**2.0**	**3.2**	**4.6**	**4.6**	**-**
	Dividend/Equity Return	**69**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.8**	**2.0**	**3.2**	**4.6**	**4.6**	**3.0**
Bal-ance Sheet	Cash -min:1.9		2.1	0.8	-1.1	-1.9	-1.8	-1.6	-0.4	0.8	2.6	3.0	3.0	3.0	3.0	3.0	-
	Total Asset		**2.1**	**0.8**	**-1.1**	**-1.9**	**-1.8**	**-1.6**	**-0.4**	**0.8**	**2.6**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**-**
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	-3.2	-4.0	-3.9	-3.7	-2.5	-1.3	0.5	0.9	0.9	0.9	0.9	0.9	-
	Total Equity		**2.1**	**0.8**	**-1.1**	**-1.9**	**-1.8**	**-1.6**	**-0.4**	**0.8**	**2.6**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**-**

Attachment 7: Summary Financial Analysis – Case A3

Summary of Operation and Tarrifs

		Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
		Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational	Operation from	2018	2014	2014	2016	2014	2016		
	Operatiion Period	20 yrs.	24 yrs.	24 yrs.	22 yrs.	24 yrs.	22 yrs.		
	Maximum Capacity ('000 ㎥/day)	270	190	13	84	15	0		
	Capacity Factor(%)	100%	100%	100%	100%	100%	100%		
	Usage(%)	76.5%	99.0%	79.9%	81.6%	81.6%	96.6%		
	Treatment Volume ('000 ㎥/day)	207	188	11	69	12	0		
	JC' Scope of work for Replacement(*)	–	–	–	–	–	△		
Financial	Tarrif (US$/㎥, 2011 price)	0.131	0.125	0.276	0.155	0.254	137.65	91.36	46.29
Usage	Opex	0.119	0.113	0.251	0.141	0.230	28.11	-	28.11
	Replacement Cost (after reserve account effect)	-	-	-	-	-	16.38	2.43	13.95
	Other Costs	0.005	0.005	0.011	0.006	0.010	16.56	14.65	1.91
	Tax	0.002	0.002	0.004	0.002	0.003	14.25	13.75	0.50
	Return of Investment	0.005	0.004	0.010	0.006	0.009	24.81	23.01	1.79
	(Less:Other (Interest) Income)	-	-	-	-	-	(0.93)	(0.96)	0.02

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,

—: JC will not do replacement works.

JC Summary Financial Statement

IRR for Equity **20.94%**

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	**987**	**-**	**-**	**7.2**	**9.1**	**16.2**	**18.3**	**29.6**	**25.0**	**31.5**	**35.8**	**36.7**	**48.8**	**51.9**	**54.7**	**-**
	Opex	934	-	1.3	9.1	9.8	15.9	18.0	28.1	23.6	29.6	33.6	34.4	46.0	48.8	51.4	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	6	-	-	-	-	0.0	0.0	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.3	-
	Other	0	-	-	-	0.1	0.1	0.1	0.1	0.0	-	-	-	-	-	-	-
	Pre Tax Income	**46**	**-**	**-1.3**	**-2.0**	**-0.9**	**0.2**	**0.2**	**1.3**	**1.2**	**1.7**	**1.9**	**2.0**	**2.6**	**2.8**	**3.0**	**-**
	Net Income	**39**	**-**	**-1.3**	**-2.0**	**-0.9**	**0.2**	**0.2**	**1.3**	**1.2**	**1.7**	**1.8**	**1.9**	**2.4**	**2.2**	**2.2**	**-**
	Dividend/Equity Return	**41**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.3**	**1.9**	**2.4**	**2.2**	**2.2**	**3.0**
Bal-ance Sheet	Cash -min:2.0		2.1	0.8	-1.2	-2.0	-1.8	-1.7	-0.4	0.8	2.5	3.0	3.0	3.0	3.0	3.0	-
	Total Asset		**2.1**	**0.8**	**-1.2**	**-2.0**	**-1.8**	**-1.7**	**-0.4**	**0.8**	**2.5**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**-**
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	-3.3	-4.1	-3.9	-3.8	-2.5	-1.3	0.4	0.9	0.9	0.9	0.9	0.9	-
	Total Equity		**2.1**	**0.8**	**-1.2**	**-2.0**	**-1.8**	**-1.7**	**-0.4**	**0.8**	**2.5**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**-**

Attachment 8: Summary Financial Analysis – Case B1

Summary of Operation and Tarrifs

			Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
			Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational		Operation from	2018		2014	2016	2014	2016		
		Operatiion Period	20 yrs.		24 yrs.	22 yrs.	24 yrs.	22 yrs.		
		Maximum Capacity ('000 m³/day)	270		13	84	15	0		
		Capacity Factor(%)	100%		100%	100%	100%	100%		
		Usage(%)	76.5%		79.9%	81.6%	81.6%	96.6%		
		Treatment Volume ('000 m³/day)	207		11	69	12	0		
		JC' Scope of work for Replacement(*)	○		○	○	○	△		
Financial		Tarrif (US$/m³, 2011 price)	0.247		0.455	0.213	0.410	137.64	91.36	46.28
	Usage	Opex	0.119		0.251	0.141	0.230	28.11	-	28.11
		Replacement Cost (after reserve account effect)	0.106		0.163	0.052	0.143	16.38	2.43	13.95
		Other Costs	0.010		0.018	0.008	0.016	16.56	14.65	1.91
		Tax	0.013		0.002	(0.000)	0.002	14.16	13.75	0.41
		Return of Investment	0.000		0.021	0.011	0.018	24.91	23.01	1.90
		(Less:Other (Interest) Income)	(0.001)		-	-	-	(0.96)	(0.96)	-

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

JC Summary Financial Statement

IRR for Equity **12.85%**

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	**1,047**	-	-	**3.7**	**4.1**	**12.7**	**13.1**	**34.2**	**35.8**	**37.6**	**39.4**	**41.3**	**51.9**	**52.4**	**60.8**	-
	Opex	986	-	1.3	3.4	3.9	9.2	9.6	15.1	16.1	17.9	22.2	26.8	40.6	63.6	67.9	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	21	-	-	0.0	0.0	0.4	0.4	1.9	2.0	2.0	1.7	1.5	1.1	0.5	0.6	-
	Other	-3	-	-	-	-	-	-	-	-	-	-	-	-	-0.5	-0.0	-
	Pre Tax Income	**43**	-	**-1.3**	**0.3**	**0.1**	**3.2**	**3.2**	**17.2**	**17.8**	**17.7**	**15.5**	**13.1**	**10.1**	**-11.2**	**-7.7**	-
	Net Income	**34**	-	**-1.3**	**0.3**	**0.1**	**3.2**	**3.2**	**16.3**	**16.9**	**16.9**	**14.8**	**12.4**	**9.6**	**-11.7**	**-7.7**	-
	Dividend/Equity Return	**36**	-	-	-	-	-	-	-	-	-	-	-	-	**0.5**	**5.2**	**7.6**
Bal-ance Sheet	Cash min:0.8		2.1	0.8	1.1	1.2	4.4	7.5	23.9	40.8	57.6	72.4	84.8	132.8	72.1	7.6	-
	Total Asset		**2.1**	**0.8**	**1.1**	**1.2**	**4.4**	**7.5**	**23.9**	**40.8**	**57.6**	**72.4**	**84.8**	**132.8**	**72.1**	**7.6**	-
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	-1.0	-0.9	2.3	5.4	21.8	38.7	55.5	70.3	82.7	130.7	70.0	5.5	-
	Total Equity		**2.1**	**0.8**	**1.1**	**1.2**	**4.4**	**7.5**	**23.9**	**40.8**	**57.6**	**72.4**	**84.8**	**132.8**	**72.1**	**7.6**	-

Attachment 9: Summary Financial Analysis – Case B2

Summary of Operation and Tarrifs

			Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
			Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational		Operation from	2018		2014	2016	2014	2016		
		Operatiion Period	20 yrs.		24 yrs.	22 yrs.	24 yrs.	22 yrs.		
		Maximum Capacity ('000 m³/day)	270		13	84	15	0		
		Capacity Factor(%)	100%		100%	100%	100%	100%		
		Usage(%)	76.5%		79.9%	81.6%	81.6%	96.6%		
		Treatment Volume ('000 m³/day)	207		11	69	12	0		
		JC' Scope of work for Replacement(*)	△		△	△	△	△		
Financial		Tarrif (US$/m³, 2011 price)	0.250		0.461	0.214	0.416	137.49	91.34	46.16
	Usage	Opex	0.119		0.251	0.141	0.230	28.11	-	28.11
		Replacement Cost (after reserve account effect)	0.109		0.169	0.054	0.149	16.38	2.43	13.95
		Other Costs	0.010		0.018	0.008	0.016	16.44	14.65	1.79
		Tax	0.003		0.008	0.003	0.007	14.31	13.75	0.56
		Return of Investment	0.009		0.013	0.007	0.012	24.66	23.00	1.66
		(Less:Other (Interest) Income)	-		0.001	-	0.001	(0.87)	(0.96)	0.09

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

JC Summary Financial Statement

IRR for Equity **18.43%**

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Profit and Loss	**Revenue**	**1,115**	**-**	**-**	**1.8**	**2.4**	**8.8**	**9.1**	**15.9**	**17.0**	**19.3**	**24.0**	**28.8**	**44.4**	**73.9**	**79.2**	**-**
	Opex	1,056	-	1.3	3.4	3.9	9.2	9.6	15.1	16.1	17.9	22.4	26.9	41.7	69.6	74.6	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	6	-	-	-	-	-	-	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	-
	Other	1	-	-	-	0.0	0.1	0.2	0.2	0.2	0.1	0.1	-	-	-	-	-
	Pre Tax Income	**52**	**-**	**-1.3**	**-1.6**	**-1.5**	**-0.5**	**-0.7**	**0.5**	**0.7**	**1.1**	**1.4**	**1.7**	**2.4**	**3.8**	**4.1**	**-**
	Net Income	**41**	**-**	**-1.3**	**-1.6**	**-1.5**	**-0.5**	**-0.7**	**0.5**	**0.7**	**1.1**	**1.3**	**1.6**	**2.3**	**3.0**	**3.1**	**-**
	Dividend/Equity Return	**43**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**3.1**	**3.0**
Balance Sheet	Cash -min:3.5		2.1	0.8	-0.8	-2.3	-2.8	-3.5	-3.0	-2.3	-1.2	0.2	1.7	3.0	3.0	3.0	-
	Total Asset		**2.1**	**0.8**	**-0.8**	**-2.3**	**-2.8**	**-3.5**	**-3.0**	**-2.3**	**-1.2**	**0.2**	**1.7**	**3.0**	**3.0**	**3.0**	**-**
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	-2.9	-4.4	-5.0	-5.6	-5.1	-4.4	-3.3	-2.0	-0.4	0.9	0.9	0.9	-
	Total Equity		**2.1**	**0.8**	**-0.8**	**-2.3**	**-2.9**	**-3.5**	**-3.0**	**-2.3**	**-1.2**	**0.2**	**1.7**	**3.0**	**3.0**	**3.0**	**-**

Attachment 10: Summary Financial Analysis – Case B3

Summary of Operation and Tarrifs

			Wastewater Treatment Plants (WWTPs)					Sludge Reuse Plant		
			Yen Xa	Yen So	Bay Mou	Phu Do	Ho Tay	All	SPC Part	JC Part
Operational		Operation from	2018		2014	2016	2014	2016		
		Operatiion Period	20 yrs.		24 yrs.	22 yrs.	24 yrs.	22 yrs.		
		Maximum Capacity ('000 m³/day)	270		13	84	15	0		
		Capacity Factor(%)	100%		100%	100%	100%	100%		
		Usage(%)	76.5%		79.9%	81.6%	81.6%	96.6%		
		Treatment Volume ('000 m³/day)	207		11	69	12	0		
		JC' Scope of work for Replacement(*)	–		–	–	–	△		
Financial		Tarrif (US$/m³, 2011 price)	0.133		0.283	0.159	0.259	138.81	91.49	47.32
	Usage	Opex	0.119		0.251	0.141	0.230	28.11	-	28.11
		Replacement Cost (after reserve account effect)	-		-	-	-	16.38	2.43	13.95
		Other Costs	0.008		0.017	0.010	0.016	17.54	14.65	2.89
		Tax	0.002		0.006	0.002	0.006	14.39	13.80	0.60
		Return of Investment	0.005		0.007	0.005	0.006	24.78	23.10	1.67
		(Less:Other (Interest) Income)	-		0.001	-	0.001	(0.86)	(0.96)	0.10

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

JC Summary Financial Statement

IRR for Equity **15.91%**

	(in USD million)	TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	**675**	**-**	**-**	**1.8**	**2.4**	**8.9**	**9.2**	**15.9**	**17.0**	**19.2**	**22.7**	**28.2**	**37.4**	**35.7**	**36.9**	**-**
	Opex	638	-	1.3	3.4	3.9	9.2	9.6	15.1	16.1	17.9	21.2	26.4	35.0	33.4	34.4	-
	Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	VAT	4	-	-	-	-	-	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	-
	Other	1	-	-	-	0.0	0.1	0.2	0.2	0.2	0.1	0.1	-	-	-	-	-
	Pre Tax Income	**32**	**-**	**-1.3**	**-1.6**	**-1.5**	**-0.4**	**-0.5**	**0.6**	**0.7**	**1.1**	**1.3**	**1.6**	**2.1**	**2.1**	**2.2**	**-**
	Net Income	**26**	**-**	**-1.3**	**-1.6**	**-1.5**	**-0.4**	**-0.5**	**0.6**	**0.7**	**1.1**	**1.3**	**1.6**	**2.0**	**1.6**	**1.7**	**-**
	Dividend/Equity Return	**28**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.7**	**1.6**	**1.7**	**3.0**
Bal-ance Sheet	Cash -min:3.3		2.1	0.8	-0.8	-2.3	-2.7	-3.3	-2.7	-2.0	-0.9	0.4	1.9	3.0	3.0	3.0	-
	Total Asset		**2.1**	**0.8**	**-0.8**	**-2.3**	**-2.7**	**-3.3**	**-2.7**	**-2.0**	**-0.9**	**0.4**	**1.9**	**3.0**	**3.0**	**3.0**	**-**
	Total Liability		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Paid in Capital		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-
	Retained Earnings		-	-1.3	-2.9	-4.4	-4.8	-5.4	-4.8	-4.1	-3.0	-1.8	-0.2	0.9	0.9	0.9	-
	Total Equity		**2.1**	**0.8**	**-0.8**	**-2.3**	**-2.7**	**-3.3**	**-2.7**	**-2.0**	**-0.9**	**0.4**	**1.9**	**3.0**	**3.0**	**3.0**	**-**

APPENDIX-A4

Risk Matrix (Join Company)

APPENDIX-A4 : RISK MATRIX (JOINT COMPANY)

Phase	Classification	Risk	Impact to the project	Comment	JC	HPC	Insurance
Common	Financial Arrangement		Cost increase Project delay/halt		○		
	Site	Land contamination, defect and so on	Cost increase Project delay/halt	If the risk occurs due to grounds attributable to JC, JC is to bear the risk and the cost.		○	
	Licenses and charters	The delay on procedures for setting up JC and gaining licenses	Cost increase Project delay/halt		○		
	Change of laws	The change or establishment of regulations and laws related to the construction, operation and maintenance for the facility	Cost increase Project delay/halt	JC is incapable of controlling the situation		○	
	–	Except above, the change or establishment of regulations and laws applied in general	Cost increase Project delay/halt	JC is incapable of controlling the situation The scope for the risk JC takes is to be determined in the documentation	△	△	
	Tax reforms	The change of the tax coverage and tax rate, or the establishment of the new tax code	Cost increase Project delay/halt	JC is incapable of controlling the situation		○	
	Licenses	The delay on gaining licenses which HPC should proceed	Cost increase Project delay/halt			○	
		The delay on gaining licenses which JV should proceed	Cost increase Project delay/halt		○		
		Incapable of gaining licenses caused by HPC	Project termination			○	
		Incapable of gaining licenses caused by SPC	Project termination		○		
	Politics	The policy change and political matter	Project delay/halt Project termination	JC is incapable of controlling the situation		○	
	Sabotage and pressure by industrial group	The difficult situation to continue the facility operation caused by the acts of sabotage by industrial group	Cost increase Project delay/halt Project termination			○	
	Infrastructure	Inadequate infrastructure to operate the facility, such as the lack of enough electricity, water supply, roads and so on.	Cost increase Project delay/halt Project termination			○	○
	Neighborhood	The lawsuits, claims and riots from neighborhood	Cost increase Project delay/halt Project termination	If the risk occurs due to grounds attributable to JC, JC is to bear the risk and the cost.		○	
	Environment	Environmental problems influenced by the instruction or requirement from HPC	Cost increase Project delay/halt Project termination			○	○
		Environmental problems caused by JC conducts, for instance toxic substance release	Cost increase Project delay/halt Project termination		○		○
	Third party liability	The damage to the third party caused by the conduct attributable to HPC	Cost increase			○	○
		The damage to the third party caused by the conduct attributable to JC	Cost increase		○		○
	Interest rate fluctuations		Cost increase	No assumption for borrowing	○		
	Foreign exchange fluctuations /Price fluctuations		Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
	Force majeure	Natural disaster, war, terror, strikes, riots, civil commotions and so on	Cost increase Project delay/halt Project termination	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	○
	HPC default		Cost increaseProject			○	

			delay/haltProject termination				
	JC default		Cost increase Project delay/halt Project termination		○		
Operation	Cost control for the operation of the facility	The increase of the operation cost due to the poor management done by JC	Cost increase		○		
		Price fluctuations/ foreign rate fluctuations	Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
	Replacement cost for the facility	Price fluctuations/ foreign rate fluctuations	Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
		The increase of the replacement cost due to the poor management done by JC	Cost increase		○		
		The increase of the replacement cost due to more frequent replacements than estimated	Cost increase		○		
	Demand volatility	The volatility on the volume of sewage water and sludge	Revenue decrease	The risk to be shared with the calculating formula in the Service Charge (Capacity Payment)	○	○	
	Lower quality of the processed water (than the demand standard)	Not to meet the requirement for the ability/performance, for instance, caused by worse influent condition than projected	Cost increase Project delay/halt			○	
		Not to meet the requirement for the effluent quality due to the poor performance, the manpower shortage and the lack of the staff skills	Cost increase Project delay/halt		○		
		Not to meet the requirement for the water quality due to the force majeure	Cost increase Project delay/halt	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	
		The increase of the sludge disposal expense caused by the poor management	Cost increase		○		
		The increase of the sludge disposal expense caused by the worse influent condition than projected	Cost increase			○	
	Over capacity to process water carried in	To exceed the ability/capacity to process sewage water in the facility. (JC is not responsible for the quality of water over the capacity.)	Project delay/halt			○	
	Labor management	The negative reputation accompanied with the employee scandal, corruption,	Cost increase Project delay/halt		○		
	Crisis management	Imperfect manuals for the crisis Disconnected communication in the crisis	Project delay/halt		○		
		The increase of the cost caused by mismanaging the strikes, the natural disaster, the pandemic and so on	Cost increase Project delay/halt		○		
	Damage to and deterioration of the facility, machines and equipment	The damage to the facility, machines and equipment caused by JC misconduct	Cost increase Project delay/halt		○		○
		The damage to the facility, machines and equipment caused by HPC	Cost increase Project delay/halt			○	○
		The damage to the facility, machines and equipment due to the force majeure	Cost increaseProject delay/halt	The definition of "force majeure" needs to be discussedJC is incapable of controlling the situation		○	○
		The damage by having machineries and valuables stolen	Cost increase Project delay/halt		○		○
Termination	Contract termination	Incapable of terminating the contract and operation	Cost increase		○		

	(during the contract period and at the expiry of the contract)	The increase of the cost at the termination of the contract, caused by HPC	Cost increase			○	
		The increase of the cost at the termination of the contract, caused by JC	Cost increase	–	○		
		The increase of the cost at the termination of the contract, due to the force majeure	Cost increase	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	

APPENDIX-B1

BOT Proposal for Yen So Central Bio-solid Processing Center

CONTENTS
Appendix-B1: BOT Proposal for Yen So Central Bio-solid Processing Center

Page

Chapter 1 Background and Basis of the Project

1.1 Background and Necessity of the Project

Hanoi City is the Capital of the Socialist Republic of Vietnam, the center of politics, economy and culture of the country. The urbanization speed of the capital has continuously accelerated during the recent years. However, the development of the infrastructure including urban sewerage and drainage system is slower than the urbanization.

To improve the urban sewerage system in order to enhance the ambient water environment and in turn, the living condition of Hanoi City, HPC is giving utmost importance to sewerage collection and treatment facilities. Currently, there are two pilot wastewater treatment plants (WWTPs) at Truc Bach and Kim Kien, whose treatment capacities are 3,000 and 4,800 m^3/day respectively; and one medium scale WWTP at North Thang Long with a treatment capacity of 38,000 m^3/day. In addition, there are a number of WWTPs are either in the planning/ designing stage or under construction. One large scale WWTP at Yen So with a capacity of 200,000 m^3/day is now under trial run and will start operation from April, 2012. Bay Mau Lake WWTP with a treatment capacity of 13,300 m^3/day is now in the stage of detailed design/ implementation, and will be operated from 2014. Feasibility study of Yen Xa WWTP has been prepared and is now under financial arrangement stage and planned to be completed in 2017. In addition, Phu Do WWTP and Ho Tay WWTP, whose treatment capacities are 84,000 m^3/day and 15,000 m^3/day respectively, are planned to be constructed by Built-Transfer (BT) contract arrangements. The expected start time is 2015 and 2013, respectively. With completion of these WWTPs, the wastewater treatment capacity will be rapidly increased in Hanoi.

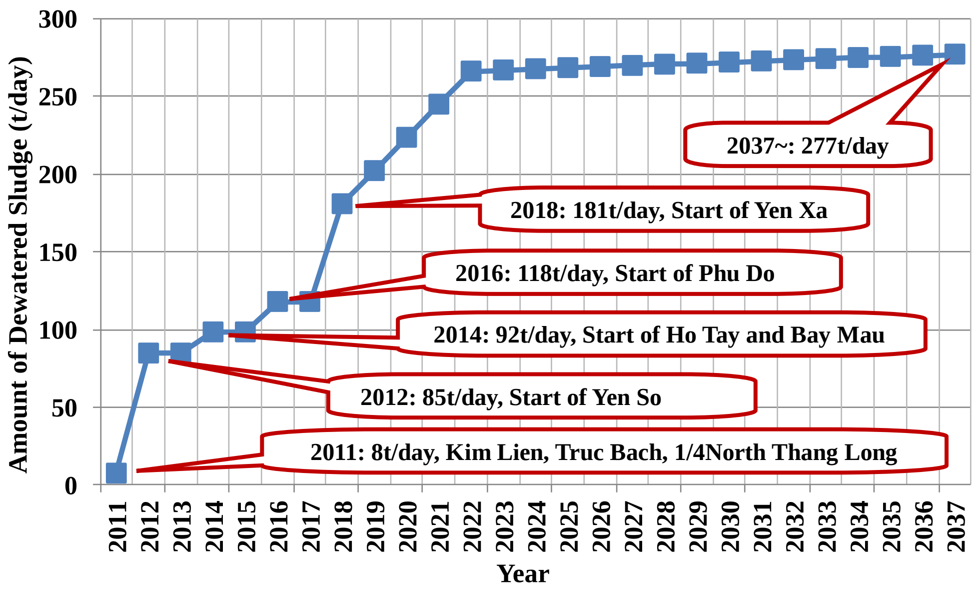
The summary of current and planned wastewater treatment plants are shown in the Table 1.1.1. By 2018, total treatment capacity will be around 630,000 m^3/day from the current 45,800 m^3/d, an increase of more than 1300%.

Table 1.1.1 Summary of Wastewater Treatment Plants in Hanoi

	WWTP	Capacity (m^3/day)	Current Situation	Expected Operation Start Year
1	Truc Bach	3,000	Operational	-
2	Kim Lien	4,800	Operational	-
3	North Thang Long	42,000	Operational	-
4	Yen So	200,000	Trial run	2012
5	Bay Mau	13,300	EPC	2014
6	Yen Xa	270,000	Financial Arrangement	2018
7	Ho Tay	15,000	Planned for BT	2014
8	Phu Do	84,000	Planned for BT	2016
	Total	**632,100**		

Source: Compiled by JICA Study Team, 2012

With rapid future increase of wastewater treatment capacities in Hanoi, amount of sludge generation will also increase considerably. For a full development scenario where all the WWTPs run with their design capacity, the total amount of dewatered sludge generation will be a whooping 620 t/d (refer to Chapter 2), compared to current sludge production of 8 t/d. As explained in Chapter 2, this situation is hard to reach considering the current influent water quality of the existing WWTPs, hence, instead of full development scenario, an optimum scenario can be considered. Figure 1.1.1 shows projected sludge generation amount for the optimum scenario (details can be found in Chapter 2). The maximum amount of dewatered sludge in this scenario is 277 t/d.



Source: Prepared by JICA Study Team based on secondary information

Figure 1.1.1 Sludge Generation Forecast

The sludge generated from current operating WWTPs are disposed at Nam Son Landfill site and Tieu Ky disposal site. The proposed extension of Nam Son Phase 2 will not accept sludge waste. Though HAPA is now carrying out a study on permanent sludge disposal site, there is still no conclusion. Finding a disposal site within the city limit or its vicinity for the entire amount of future sludge (263 t/d) seems to be almost impossible. Under such situation, it is required to reduce the amount of sludge waste and promote sludge reuse/ recycle. This will increase the service life of scarce landfill site, ensure proper sludge management and enhance sludge reuse/ recycle. Without such provision, smooth implementation of new/ planned WWTPs can also be hindered.

1.2 Selection and Justification of the Project Process

1.2.1 Basic Approach

As explained above, proper sludge management is a prerequisite for future sewerage sector development. At present the sludge disposal is carried out as an ad-hoc basis. The current practice is a threat to environment as it is not a sanitary landfill process. Complying with the social responsibility, HPC must stop this unhygienic practice and come up with appropriate solution.

The basic principles applicable in course of the selection of appropriate technology are as follows:

1. Centralize sludge management: Any sludge management system demands significant resource mobilization, so centralize sludge management facility which receives dewatered sludge from multiple WWTPs is cost effective and easy to manage.
2. Volume reduction: Dewatered sludge contains more than 80% water. Volume reduction can radically improve the cost requirement and operational complexity of any selected sludge management process.
3. Reuse and recycle: Sludge contains both organic and inorganic compounds, and both of which have reuse and recycle potential. Efforts to be made to impart resource recovery as much as possible.
4. Step wise development: As sludge management is rather cost incentive process, a step wise development matching with the demand increase is efficient.

1.2.2 Potential Sludge Management Options

Depending on the water content, the sludge can be divided into the followings, and for each type, there can be various management options. It is to be noted here that there are also various options to reduce the water contents.

- Dewatered sludge (water content around 80%)
- Compost or semi dried sludge (water content around 60%)
- Dried sludge (water content around 10 to 20%)
- Incinerated sludge/ ash (water content negligible)

Selection of optimum sludge management option depends on following criteria:

1. Design volume of dewatered sludge to be managed,
2. Compatibility with end use and its potential demand,
3. Easy O&M technology
4. Social acceptance
5. No impact from pathogenic microorganism and heavy metals,and
6. Promotion of reuse and recycle.

Popular sludge management options are shown in the Figure 1.2.1. It is to be noted that this is not exhaustive list. There are 11 sludge management options are proposed in the figure considering the ultimate end use.

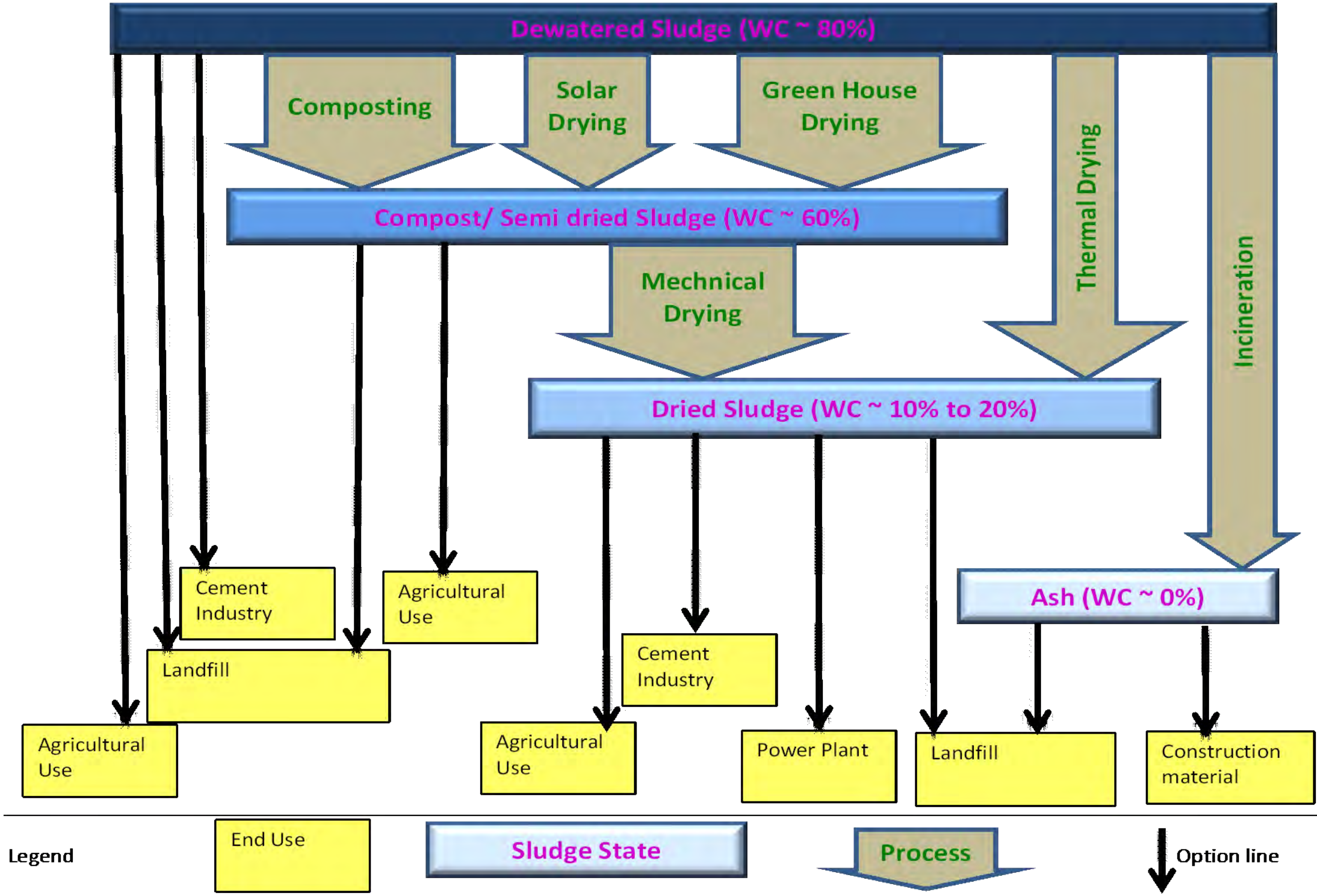


Figure 1.2.1 Popular Sludge Management Options

1.2.3 Selection of Optimum Sludge Management Options

The screening of the options for Hanoi situation is elaborated in Table 1.2.1.

Table 1.2.1 Preliminary Screening for Sludge Management Options

Option	Description	Evaluation
1. Dewatered sludge for agricultural use	To comply with criteria 1, can only be used for non human consumption purpose. Requires very advanced “no touch” mechanical mixing. No demand for such huge volume in and around Hanoi	Not possible
2. Dewatered sludge landfill	Required huge landfill volume is not possible to obtain in and around Hanoi	Can be used temporarily with other option
3. Dewatered sludge use in cement industry	Cement production capacity will reduce drastically.	Not acceptable
4. Semi dried sludge landfill	Required huge landfill volume is not possible to obtain in and around Hanoi. Does not satisfy criteria 4 after costly processing.	Not possible
5. Semi dried sludge for agricultural use	To comply with criteria 1, can only be used for non human consumption purpose. The maximum demand for greenery is 32t/d and design production of semi dried sludge is 130 t/d (Refer to Chap 2).	Can be used in parallel.
6. Dried sludge for agricultural use	To comply with criteria 1, can only be used for non human consumption purpose. The potential current demand for greenery is 32t/d and design production of dried sludge is 53t/d (Refer to Chpa 2)	Can be used in parallel.
7. Dried sludge use in cement industry	The potential current demand for cement industry is 105t/d.	Possible
8. Dried sludge use in power plant	The potential current demand for power plant is 410t/d.	Possible
9. Dried sludge landfill	Does not satisfy criteria 4 after costly processing.	Not acceptable
10. Incinerated ash landfill	Costly	Possible
11. Incinerated ash use as construction material	Costly	Possible

From the table above, it is obvious that the candidate options are composting, incineration and sludge drying (by thermal drying, etc.); although compost cannot be a stand-alone option due to lack of demand. Land filling can be carried out but as an interim measure. It is recommended to utilize a sanitary landfill option. However, in future land fill will not be a viable option.

A cost comparison of the candidate options are given below.

Table 1.2.2 Cost Comparison of Candidate Options (Unit: EUR/t of DS)

Incineration	Thermal Drying	Composting
450 – 800	300 – 800	250 – 600
High cost	Acceptable	Low cost, however consumption demand is limited. Also consumption is not constant year round.
Not recommendable	Recommendable	Can be recommended for parallel use together with other option

Source: ‘Ecological and economical balance for sludge management options’, by Jeremy Hall, Proceedings of the European Commission Workshop on “Problems around sludge” (http://ec.europa.eu/environment/waste/sludge/pdf/workshoppart4.pdf).

Table 1.2.2 compares the generalized treatment and disposal costs for some management options in the European context. The cost requirements in Vietnam will be less; however, the table can be a good tool for comparison. For each option, the spread of costs is large and overlap with those of other options, due to the influence of local circumstances on investment and operating costs reflecting size of plant, type of technology, etc. As can be seen, composting is a low cost option than thermal drying and incineration; but it cannot be a standalone option due to low demand and time fluctuation of demand. On the other hand, incineration is a high cost option.

Based on current operating plants in Japan, cost comparison between thermal drying and incinerator for different capacity is given in Table 1.2.3. This table also shows that thermal drying is cheaper than incinerator.

Table 1.2.3 Cost Comparison in Japanese Context (Unit: Yen/t of DS)

Incineration	Thermal Drying	Capacity
27,400	18,300	30 m3/d
20,365	16,000	60 m3/d

Source: Compiled by JICA Study Team based on primary data.

From the above discussion, it is proposed that sludge drying (by thermal drying or other similar method) is the most suitable option for sludge volume reduction in Hanoi.

The dried sludge can be reused/ recycled for greenery, cement industry and power plants.

The Proponent is therefore proposing the Project of "Central Biosolids Processing Center" at Yen So to reduce the volume of generated sewerage sludge by sludge drying principle and thereby facilitate the potential of sludge reuse and recycle.

1.2.4 Justification of BOT Scheme for the Project

Low commercial value is an inherent nature of sludge processing projects. The end product of the proposed sludge drying plant is dried sludge, which has less calorific value than coal. Similarly, the N content in the dried sludge can be at best a soil conditioner or soil improver, far short to claim as fertilizer. Though the end product can be reused and recycled in many forms, it is not expected to bring business profit. However, this kind of projects impact huge social and environmental benefits. Not only it reduces the requirement of increasingly scarce land by reducing the sludge volume drastically, but also it promotes reuse and recycle of resources. Therefore, it is a public commitment of HPC to carry out such projects.

In case HPC carries out this project mobilizing its own resources or by utilizing ODA loan, the life cycle cost of the project may be less but it will expose HPC to all kinds of risk associated with the implementation of this project. On the other hand, implementing this project by a BOT scheme will make HPC free from most of the technical and operational risk.

The main advantages of BOT scheme for this project are summarized below:

- HPC does not have to bear implementation and operation risk.
- HPC needs to deal with only one entity, the SPC for all issues covering implementation and operation.
- HPC does not have to go through the complex procedures for fund arrangement.
- HPC needs less administration works regarding bid document preparation, awarding, contract management and project management.
- Overall management skill and know-how of sludge processing and recycling could be transferred from Japanese public and private sectors.
- Integrated process of the design, construction and operation maintenance will enhance project sustainability.
- As SPC is expected to borrow fund from JICA's PSIF fund, it would be in a

better position to support HPC/MPI to pursue with JICA for realization of ODA loan for Yen Xa WWTP.

1.3 Objectives of the Project

The salient objectives of the proposed BOT scheme are,

1. To construct a biosolids (i.e., dewatered sludge) processing facility to reduce the volume of dewatered sludge in order to reduce the amount of landfill volume,
2. To promote and facilitate sludge (resource) reuse and recycle by various end users in a effective and efficient manner,
3. To support and sponsor technology transfer, and
4. To ensure maximum financial benefit to HPC.

1.4 Outline of the Project

The preliminary technical analysis and cost estimate is given in Chapter 2 and 3, respectively. The financial plan is proposed in Chapter 4. The project financing scheme is BOT as explained in Chapter 5. The summary outline is briefed here.

1. Location	:	Near Yen So WWTP
2. Required Area	:	3.3 ha (180 m x 180 m)
3. Drying method	:	Hybrid (solar and mechanical)
4. Main Facilities	:	Five green houses and four thermal dryer
5. Input (dewatered sludge)	:	180 m3/d (moisture content of 80%)
6. Output (dried sludge)	:	36 m3/d (moisture content of 10%)
7. End use	:	Cement and power plants, greenery, etc.
8. Construction Cost	:	App. 64 m US$ (preliminary)
9. Direct O&M cost	:	Around 2 US$/year
10. Financing scheme	:	BOT
11. Equity: Debt	:	30:70
12. Borrowing source	:	JICA PSIF (low interest loan)
13. Service Change to HPC	:	Between 11 and 15 m US$/year

1.5 Legal Basis of the Proposal and the Project

The following laws and regulations are referred to for the proposal of the BOT project.

- Decision 71/2010/QD-TTg, Promulgating the regulation on pilot investment in the public – private partnership form (Pilot PPP Law)
- Decree 108/2009/ND-CP - Decree On Investment In The Form Of Build-Operate-Transfer, Build-Transfer-Operate Or Build-Transfer Contract
- Decree No. 24/2011/ND-CP - Amending A Number of Articles of the November 27, 2009 Decree No. 108/2009/ND-CP on Investment in the Form of Build-Operate-Transfer Contract, Build-Transfer-Operate Contract, Build-Transfer Contract
- Law 61/2005/QH11 – Bidding Law
- Law No.16-2003-QH11 – Law on Construction
- Law 38/2009/QH12 - Law Amending and Supplementing a Number of Articles of the Laws Concerning Capital Construction Investment
- Decree 12-2009-ND-CP Management of investment projects for construction works
- Circular 03-2009-TT-BXD Providing detailed guidelines for implementation of a number of articles of Decree 12-2009-ND-CP on management of investment projects for construction works
- Circular 03-2011-TT-BKHDT Guiding implementation of Decree 108-20090ND-CP on investment on the basis of BOT, BTO and BT contracts

Chapter 2 Technical Concept

2.1 Outline

The detail technical study is expected to be carried out during the Feasibility Study to be conducted after the conclusion of BOT contract agreement between a Special Purpose Company (SPC) and Hanoi People's Committee (HPC). This chapter provides only a basic planning and design concept.

2.2 Demand Forecast

2.2.1 Wastewater Generation

Sludge generation amount depends on wastewater flow and difference between influent water quality (SS) and effluent water quality (SS) of WWTP.

Daily maximum wastewater flow and daily average wastewater flow for the existing, under construction and planned WWTPs in Hanoi are shown in Table 2.2.1.

Table 2.2.1 Wastewater flow from WWTPs in Hanoi

WWTP	Daily Maximum Wastewater Flow (m^3/day)	Daily Average Wastewater Flow (m^3/day)	Operational Year
Kim Lien	4,800	3,920	Operational
Truc Bac	3,000	2,450	Operational
North Thang Long	42,000	34,280	Operational
Yen So	200,000	190,000	2012
Ho Tay	15,000	12,240	2013
Bay Mau	13,300	10,850	2014
Phu Do	84,000	68,500	2015
Yen Xa	270,000	220,400	2018
Total	**632,100**	**542,640**	

Source: Compiled by JICA Study Team based on secondary data

Note: Daily average wastewater flow is estimated to be 81.6% of daily maximum wastewater flow referring to the F/S report of Yen Xa WWTP, 2011 (except Yen So WWTP).

. In regard to Yen So WWTP, daily average wastewater flow is 95% of daily maximum wastewater flow, because fixed amount of wastewater inflows from 2 nearby canals, and there is no fluctuation of inflow.

2.2.2 Dewatered Sludge Generation

(1) Conditions of calculation

Amount of dewatered sludge generated from the WWTPs is calculated based on the design conditions as adopted in the WWTP design. Those are as follows,

- Inflow SS = 250mg/L, Outflow SS = 15mg/L
- Moisture content of dewatered sludge = 80%
- In case digestion tank is operated in Yen So WWTP, organic materials of sludge will be digested and volume of dewatered sludge will be reduced by 35%.

(2) Maximum Amount of Dewatered Sludge

From the above condition, amount of maximum dewatered sludge generated from each WWTP is calculated as Table 2.2.2.

Table 2.2.2 Maximum Amount of Dewatered Sludge

WWTP	Daily Maximum Dewatered Sludge Amount (t/day)	Daily Average Dewatered Sludge Amount (t/day)
Kim Lien	4.7	3.8
Truc Bac	3.3	2.7
North Thang Long	50.5	41.2
Bay Mau	17.8	14.5
Yen So	325.8 (with digester = 211.8)	265.8 (with digester = 172.8)
Phu Do	100.2	87.5
Ho Tay	19.5	15.9
Yen Xa	344.7	281.3
Total	**866.5 (752.5)**	**712.7 (619.7)**

Source: JICA Study Team

(3) Gradual Increase of Sludge Generation

The sludge generation shown in the above table is the maximum sludge when the WWTPs receive the design sewerage volume (full development scenario). For the newly established WWTPs, initially influent sewerage volume is low and gradually increases as more areas are connected to the respective WWTPs.

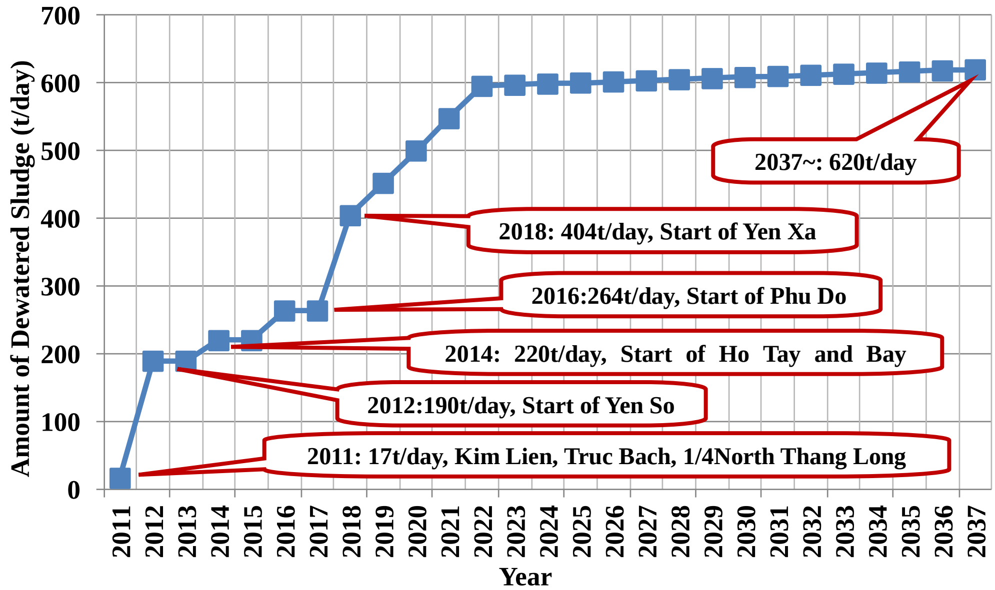
In regard to Yen Xa WWTP, although it is expected to start operating in 2018, only half the amount of planned wastewater is expected to reach the WWTP in the first year. After that the amount of wastewater shall increase gradually, and is expected to reach the planned volume in 2022.

In regard to North Thang Long WWTP, Currently, only amount 1/4th of the design flow is entering into the plant. Since the the urbanization of this basin has not progressed in comparison to previously plan and it is not expected to progress urbanization in the near future, it is expected that the full design capacity will be reached in 20 years.

The implementation schedule of Phu Do and Ho Tay WWTPs is not clear so far.

(4) Maximum Dewatered Sludge Generation (full development scenario) by year

From the above-mentioned operational condition, the maximum daily average dewatered sludge amount from 2011 to 2037 is shown in Figure 2.2.1. The maximum expected dewatered sludge is 620 t/d.

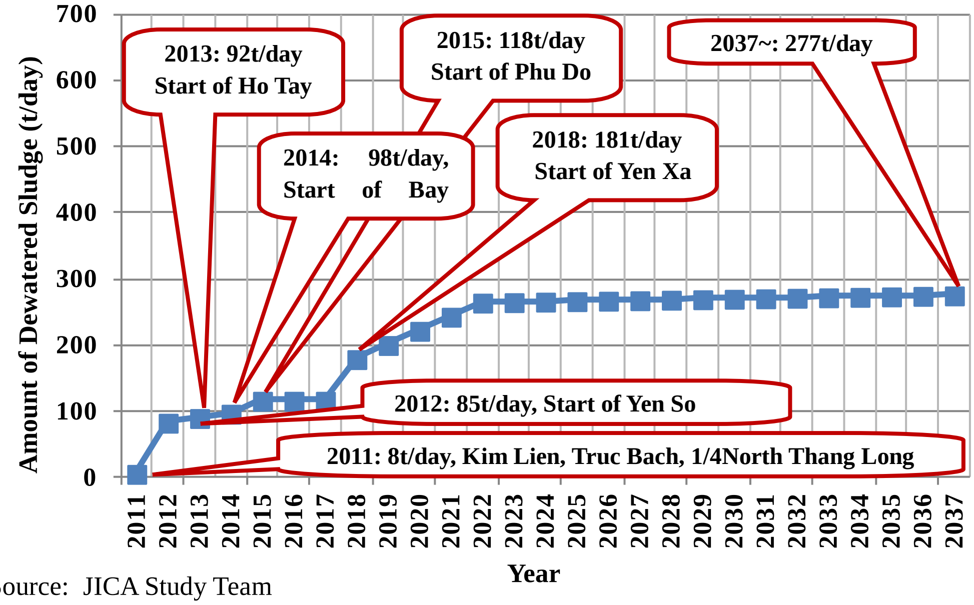


Source: JICA Study Team

Fig. 2.2.1 Annual Dewatered Sludge Generation in Hanoi (full development scenario)

(5) Optimum Scenario for Sludge Generation

At present there are 3 WWTPs are in operation and one WWTP is under trial run. In all cases, a common problem is that the influent sewerage SS load is much lower than the design load. This is due to partial treatment in septic tank and mild sloped main sewer and due to back flow from river and canal. Solving this situation is a long time proposition. In this condition, dewatered sludge generation will also be rather low. An optimum scenario is thus proposed considering influent SS as 120 mg/l. Annual dewatered sludge generation under optimum scenario is shown below. In this scenario, maximum sludge generation is 277 t/d.



Source: JICA Study Team

Figure 2.2.2 Annual Dewatered Sludge Generation (Optimum development scenario, influent SS=120mg/L)

2.3 Basic Planning

2.3.1 Planning Conditions

As explained in Chapter 1, due to scarcity of available land, dewatered sludge disposal by landfill cannot be a standalone viable option. So volume reduction is needed. Since any volume reduction is a cost intensive measure, processing of the entire generated sludge is not the best option. Rather a combination can yield better utilization of resources. It is thus proposed that sludge processing by thermal drying will be applied for two-third of the maximum sludge generation, i.e., 185 t/d. For the remaining one-third, sanitary landfill is recommendable.

Recycle and reuse of the dried sludge must be promoted through a combination of options like greenery use as soil condition, power plant as fuel, and cement industry as fuel and ingredient.

2.3.2 Study on Sludge Drying

As mentioned in Chapter 1, the most optimum option for sludge processing is justified to be sludge drying. However, there could be multiple ways of thermal drying, as follows:

1. Solar drying: In this method, dewatered sludge is spread over the land inside a green house covered with plastic sheet. By utilizing the heat entrapped inside the greenhouse, moisture content of the sludge is reduced. However, moisture content cannot be reduced to a low level by solar drying.
2. Thermal drying: In this method, dewatered sludge is put into a rotary dram. By burning oil or gas, air is heated and forced through the drum by a blower.
3. Hybrid: In order to reduce investment and operation cost, a new innovative process has been proposed, which is, “a pre-treatment by green house solar drying followed by thermal dryer”.
4. Carbonization: By pyrolysis or destructive distillation in a specially prepared furnace, sludge can be transformed into carbon by this method. The end product is favored for use in power plants.

A comparison of the options is given below.

Table 2.3.1 Comparison of the Alternate Sludge Drying Process

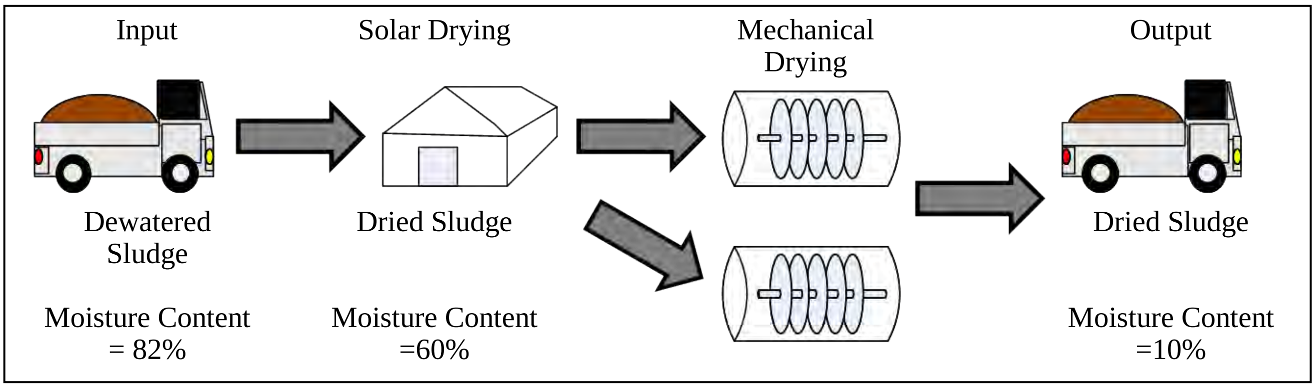
Method / Item	1) Solar Drying	2) Thermal Drying	3) Hybrid Process of Solar & Thermal	4) Carbonization
Initial Cost (million US$)	16	101	64	117
22years O&M Cost (million US$)	16	178	56	206
Total Cost (million US$)	32	279	120	323
Effect on Environment	Most eco-friendly, no energy input	Large consumption of energy	More eco-friendly than 1 and 2, More energy saving than 1 and 2	Highest consumption of energy
Required Area	4.0ha	0.9ha	3.3ha	0.9ha
Moisture content reduction to low level	Not possible	Possible	Possible	Possible

Item \ Method	1) Solar Drying	2) Thermal Drying	3) Hybrid Process of Solar & Thermal	4) Carbonization
Evaluation	× Not recommended, as it requires large area and cannot attain low moisture content	△ Recommendable	○ Most appropriate process	× Not recommendable as it is most expensive and least eco-friendly.

Source: JICA Study Team

Based on evaluation shown in the above table, the hybrid process of solar drying & thermal drying is selected as the most appropriate process for the sludge drying.

The concept of the hybrid process is shown in Figure 2.3.1.



Source: JICA Study Team

Figure 2.3.1 Concept of the hybrid process

The treatment conditions of the hybrid process are shown in Table 2.3.2.

Table 2.3.2 Treatment capacity of sludge drying facilities

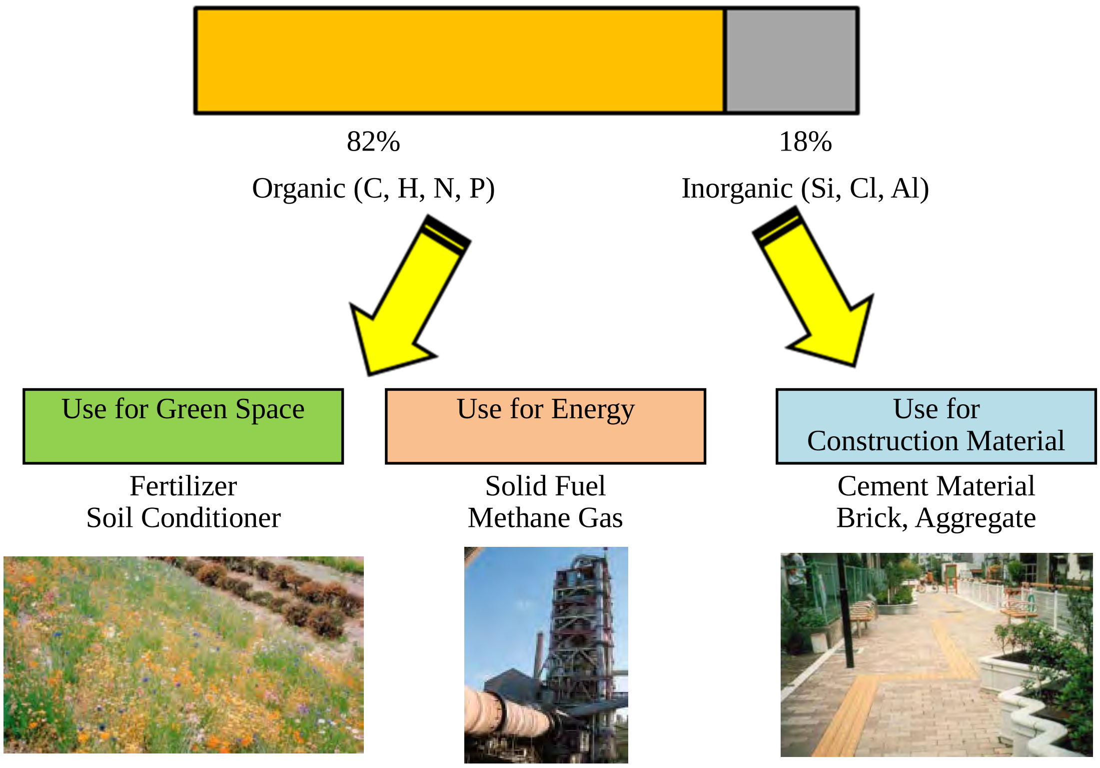
Facilities	Input	Output
Solar Green House	Dewatered Sludge Volume: 185t/day Moisture Content: 82%	Solar Dried Sludge Volume: 83.25t/day Moisture Content: 60%
Thermal Sludge Dryer	Solar Dried Sludge Volume: 83.25t/day Moisture Content: 60%	Dried Sludge Volume: 37t/day Moisture Content: 10%

Source: JICA Study Team

2.3.3 Study on End-use of Dried Sludge

(1) Sludge Reuse and Recycle

One of the major advantage of the thermal drying method is the end product can be reused. Generally sewage sludge contains about 82% organic components and 18% inorganic components. The organic components can be used as soil conditioner for the green space and as an alternate energy/ fuel source; and the inorganic components can be used for construction material as shown in Figure 2.3.2. The dried sludge has approximately 60% calorific value of low quality coal (The calorific values of carbonized sludge and coal are 3,000 and 6,300 kcal/kg). It may be noted that Sewage sludge is classified as renewable energy by Intergovernmental Panel on Climate Change (IPCC).



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

Figure 2.3.2 Recycling Method of Sewage Sludge Component

(2) Japanese Experience regarding use of Sludge

In Japan, land filling of sewage sludge has become increasingly restricted due to scarcity of land. As a result, reuse and recycling is now predominate management option and 78% of all generated sludge is reused and recycled in 2008. Major reuse and recycling methods adopted are greenery & agriculture, construction material, and cement industry. Out of these, cement industry is major reuse option as the share of this option reached 30 % of the whole produced sludge. Greenery & agricultural use is almost 10%, however it is applied to small scale treatment system. Changes of sewage sludge reuse and disposal in Japan is shown in Figure 2.3.3.

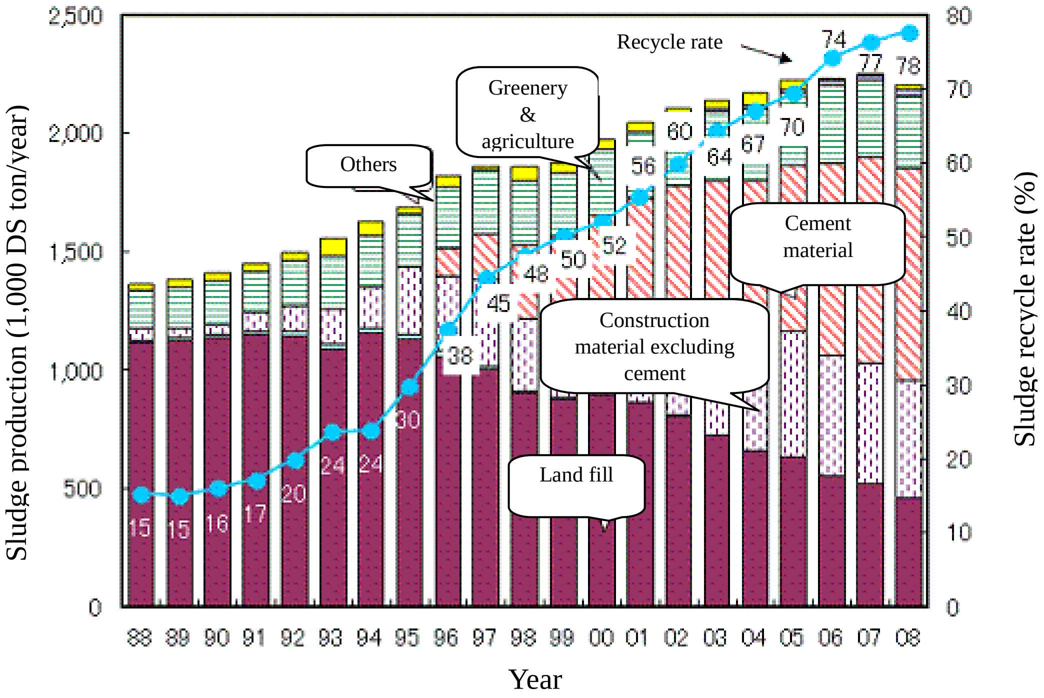


Figure 2.3.3 Sewage Sludge Reuses in Japan

Source: JICA Study Team

(3) Potential Demand Assessment of the Dried Sludge in Hanoi

The dried sludge from the thermal drying process can be used for many purposes; however, three end uses have been considered which can be applicable in Hanoi. These are,

- greenery use as soil conditioner (non human consumption products like flower),
- power plant as fuel, and
- cement industry as fuel and ingredient.

Between May and October 2011, JICA Study Team carried out needs assessment survey encompassing one power company (Pha Lai Coal-Fired Power Plant), two cement companies (But Son Cement JSC and Sai Son Cement JSC) and some floricultural companies in and around Hanoi. The current situation, interest, opinion and evaluation based on the needs survey are shown in Table 2.3.2.

Table 2.3.2 Results of Needs Survey

	Power Company	Cement Company	Floricultural Company
Current Situation & Interest	They have high interest in environmental problems.	Coal price is rapidly increasing. So they have high interest in alternative fuel.	They are interested in the cheaper alternative of fertilizer..
Opinion	It is too early to use sewage sludge as an alternative fuel. It is necessary to carry out F/S and demonstration experiment. Approval from MOI is needed.	If sludge products have acceptable feature, they can consider using sludge products proactively. The acceptable feature; - Moisture Content is less than 10% - Calorific Value is more than 3,000kcal/kg - Exhaust Gas meets the exhaust standard	If sludge products have an advantage, they intend to try to use them. One of the floricultural companies has an interest in the demonstration experiment in his field.
Evaluation	Highest potential but considered for future adaptation	<u>Recommendable for immediate adaptation</u>	Recommendable as secondary consumers, as total demand is low.

Source: JICA Study Team

The potential demand of sludge recycling products by each customer has been studied and is shown in Table 2.3.3.

Table 2.3.3 Potential Demand of Sludge Recycling Products around Hanoi

	Power Company	Cement Company	Floricultural Company
Plant Capacity	Conventional coal fired, 600 MW	1. Cement: 3 million t/year 2. Cement: 300,000 t/y	
Consumption of Coal or Fertilizer	4,100t/day (1,500,000t/year)	1,050t/day (380,000t/year)	20t/day (7,000t/year)
Potential Demand	410t/day (150,000t/year) (10% Alternative Fuel)	105t/day (38,000t/year) (10% Alternative Fuel)	32t/day (11,600t/year) (50% Alternative Nitrogen of Fertilizer)

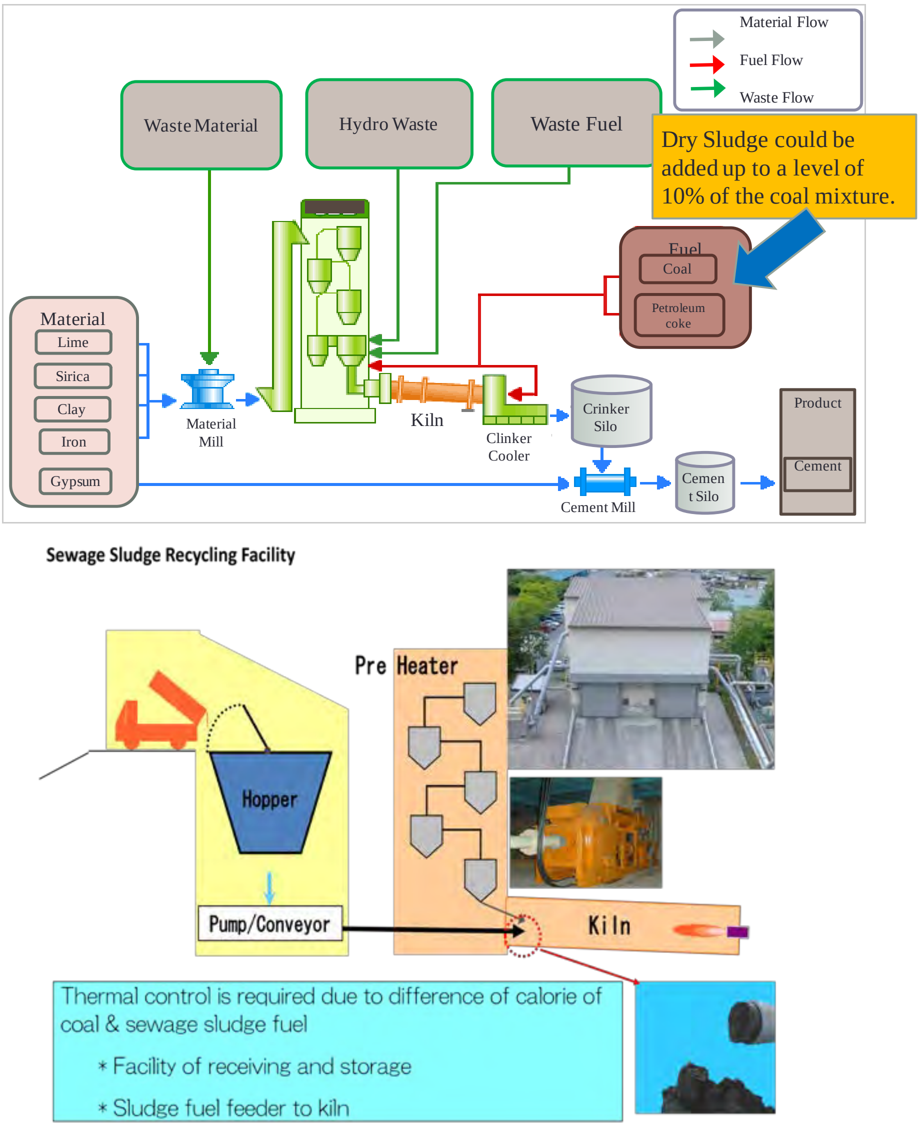
Source: JICA Study Team

It can be said that the power company is the most potential customer followed by cement industry. However, certain adjustment is required for the power and cement industries in order to utilize dried sludge. On the other hand, dried sludge can readily be used for greenery purpose though the demand is low and not constant year round.

(4) Potential Use of Dried Sludge in Cement Industries in Hanoi

Based on the above discussion, it is proposed that the dry sludge will be used as alternative fuel in cement factory and for greenery in the initial years of operation.

It is proposed that the dry sludge could be added to a level of 10% of the coal mixture without any adverse impact on the production system or the product as shown in Figure 2.3.4.



Source: Compiled by JICA Study Team based on secondary data

Figure 2.3.4 Sludge Recycling Process in Cement Factory

(5) Conclusion on the end user of the Dried Sludge in Hanoi

As explained above, greenery and cement industries are proposed as the initial end user of the dried sludge.

The power companies have the highest potential as end user (ref. Table 2.3.2). As a public enterprise, Government has more direct control over the power industries. It is expected that HPC together with the BOT proponent will pursue the Ministry of Industries to make adjustments in the power plants to receive the dried sludge.

As an incentive to the cement industries, HPC can issue an Eco-mark on the product. Also, HPC should promote public awareness by brochures and public events. Also, possibility of having a pilot scheme/ demonstration model should be discussed with HPC so that cement industries can get motivation.

In principle, the BOT proponent will actively engage in the promotion of dried sludge reuse and recycle with cooperation from HPC. HPC can ensure maximum utilization of dried sludge for all greenery use of HPC. Also, HPC shall consider providing new laws and/or official introductions to utilize dry sludge in greenery, cement companies and power plants. For instance, HPC can endorse an eco mark for the cement produced having dried sludge input. It is assumed that HPC will assume lead role in promoting dried sludge reuse and recycling and SPC will provide reasonable efforts in this regard.

2.3.4 Study on Sludge Transportation

In principle, respective WWTPs will deliver the dewatered sludge to the Sludge Processing Center by covered truck. It is assumed that WWTPs will bear the cost of such delivery.

It is also assumed that dried sludge will be collected by the end users from the Sludge Processing Center and the end users will bear the related cost.

For both the cases, the WWTPs and end users can maintain their own fleet or entrust the job to a transport company through out-sourcing.

2.4 Concept Design of Biosolids Processing Center

2.4.1 Applicable Standards

For the design purpose, Vietnamese Standards are applied whenever possible. In case, no VN standard is available, Japanese Standards are applied.

Table 2.4.1 Standard Applied in the Design

Item	Standard Applied
Effluent standard	Vietnamese Standard
Exhaust standard	Vietnamese Standard
Detail of Thermal Dryer	Japanese Standard

Source: JICA Study Team

2.4.2 Design Conditions

The following design conditions have been applied in the design.

Table 2.4.2 Design Conditions Applied

Item	Design Condition	Notes
Input dewatered sludge amount	185 t/d	2/3 of the planned sludge generation under optimum scenario
Input dewatered sludge moisture content	Around 82%	In line with the design output from Yen Xa WWTP
Output dried sludge moisture content	Less than 10%	Based on the request from the cement companies (refer to Table 2.3.3)
Proposed Site	Yen So dredged soil land-reclamation site	Site is owned by HPC and can be allocated by HPC for this purpose
Available Area	3.3 Ha	Maximum available land

Source: JICA Study Team

2.4.3 Solar Green House

Input sludge amount: 185 t/day
Input sludge moisture content: 82%
Output sludge moisture content: 60%

Area loading is equivalent to 6.2t/m^2/year (based on the experience of EU and South Africa)
Required drying bed area (m^2)

= 185 t/day * 365days / 6.2t/m^2/year =10,868m^2 (□ 7 @ 12m*130m)

Amount of output sludge from solar green house =
{185 * (1-0.82)} / (1-0.6) = 83.25 t/d

Deposit sludge cake = 400mm deep.
Turn daily for approx 25 days.

Efficiency of solar drying owes to climate change. Since the wet-weather season in Hanoi has high humidity and less sunny hours, drying efficiency declines. On the other hand, efficiency in dry-weather season rises due to long sunny hours. Operation mode in dry-season and wet season shall be developed through examining drying efficiency, thickness of sludge dosing and quality of dewatered sludge.

Some examples of solar drying are shown below. List of required equipment for Green House operation is shown in Table 2.4.3.

 Solar Green House, EU	 Solar Drying, Nong Khaem WWTP, Bangkok
 Sludge Turn-over & Drying, Johannesburg	 Natural Composting, Johannesburg

Table 2.4.3. List of the Equipment of Solar Green House

Equipment	Specification	Quantity	Remark
Solar Green House	W12m*L130m*H5m	7	
Ventilating Equipment		14	2/house
Wheel Loader	For sludge spreading, agitation, conveyance	2	
Truck Scale	For measuring dewatered sludge	1	

Source: JICA Study Team

Outline of the Solar Green House

<table>
<tr><td>Specification
Steel frame,
Acrylic plastic board (Weather proof)
Exhaust equipment (5units/house),
Lighting
Rest station for workers,
Storage of equipments
Wastewater treatment facilities</td><td>Equipments
Tractor for agitating, Small track
Conveyor, Forklift
Weighing Machine</td></tr>
<tr><td>Full view
</td><td>Full view
</td></tr>
<tr><td>Entrance
</td><td>Interior, Exhaust equipments
</td></tr>
</table>

Source: JICA Study Team

2.4.4 Thermal Sludge Dryer

Input sludge amount: 83.25t/day
Input sludge moisture content: 60% (Solar dried sludge)
Output sludge moisture content: less than 10% (For use in cement industry)

Design Calculation is shown in the Table 2.4.4. List of required equipment for Thermal Sludge Drier operation is shown in Table 2.4.5.

Table 2.4.4 Design Calculation of Thermal Sludge Dryer

Item	Design Calculation
1. Design Condition	
Sludge Generation	Dewatered sludge 83.25 t/day Moisture content 60% (Solar dried sludge) Amount of solid 33.3 ds-t/day
2. Sludge Thermal Drying	
Drying Method	Direct Heating Method (Rotary Dryer)
Input sludge	83.25 wet-t/day
Input solid	33.3 ds-t/day
Dried sludge moisture content	10%
Operating days	365 days/year
Operating hours	24hrs
Output of dried sludge	33.3 * 100 / (100 – 10) = 37.0 t/day
Daily amount of water evaporation	83.25 – 37.0 = 46.25 t/day
Hourly amount of water evaporation	46.25 / 24 =1.93 t/hr
<u>Machine calculations</u>	
Amount of evaporation per belt area	58 kg-water/m^2・d ～ 89 kg-water/m^2・d ※rated operation (KES standards)
Required belt area	1.93 t/hr / (89 kg/ m^2・d / 1000 / 24) = 520 m^2 1 line = 210 m^2 520 m^2 / 210 m^2/line = 2.5 lines ⇒ 3 lines are needed
Quantity of heat pump dryer	Stand by = 1 line Total including stand by = 4 lines <u>In the case of worst efficiency</u>

	It is depended on sludge condition, for example high viscosity, low water cooling etc. 1.93 t/hr / (58 kg/ m^2・d / 1000 / 24) = 799 m^2 799 m^2 / 210 m^2/line = 3.8 lines (4 lines) ⇒ OK If the condition will be temporarily worse, 4 line dryers would be worked and all sludge could be dried.
3. Results Volume of heat pump dryer Operating hours	 Usually working 3 lines 1 line stand by 3 lines: 24 hr/d×365 d/y (The dryer will be controlled by frequency inverters)

Source: Study Team

Table 2.4.5 List of the Equipment for Thermal Sludge Drier

No.	Item	Specification	Number
1	Hopper of solar dried sludge		2
2	Conveyor for sludge input	Flight conveyor Hopper of solar dried sludge → Inlet of heat pump dryer	4
3	Heat pump dryer	Amount of sludge treatment;30t/d	4
4	Conveyor for transmitting dried sludge	Screw conveyor Outlet of heat pump dryer → Conveyor for transmitting dried sludge	4
5	Conveyor for transmitting dried sludge	Flight conveyor → Hopper for dried sludge	1
6	Conveyor for transmitting dried sludge	Screw conveyor Spreading to hopper for dried sludge	1
7	Hopper for dried sludge		2
8	Fan for deodorizing	Volume;30m^3/min	1
9	Active carbon adsorption tower	Volume;30m^3/min	1
10	Discharge pump	Volume;1.7m^3/min	2
11	Feeding pump	Volume;1.6m^3/min For feeding of cooling water to the dryers	2

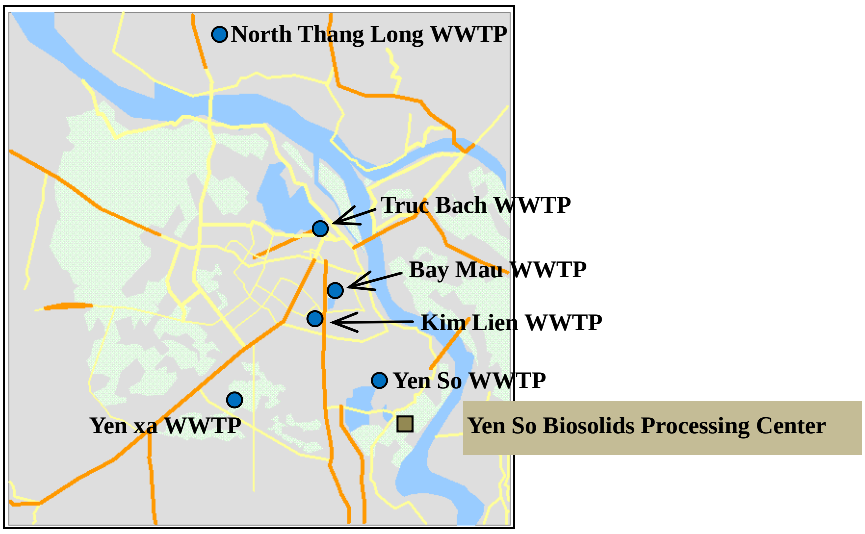
Source: Study Team

2.4.5 Location and Layout Plan

Three options were considered for the selection of the Project location, namely, Yen Xa WWTP, Yen So dredged soil land reclamation site, and Cau Dien Composting Plant. Evaluation criteria used included availability of sufficient area, traffic accessibility, environmental mitigation measure and future up-grading possibility. Yen So dredged soil reclamation site is advantageous because of availability of sufficient land area, distance from current residences and future land use plan for eliminating residences.

Though Yen So dredged soil reclamation site is located outside the dyke area, the current land elevation is as high as existing nearby residential areas. Since the center should have measures against accidental pollution run-off, such measures should be elaborated in F/S and D/D stage. Since the proposed site is far from the nearby residents, it would be possible to maintain the buffer zone against offensive odor as required by Vietnamese Law.

The recommended location of the proposed Biosolids Processing Center is shown in Figure 2.4.1.



Source: JICA Study Team (Picture courtesy of Google Map)

Figure 2.4.1 Location Map

The current condition of the proposed site is shown in the picture below.

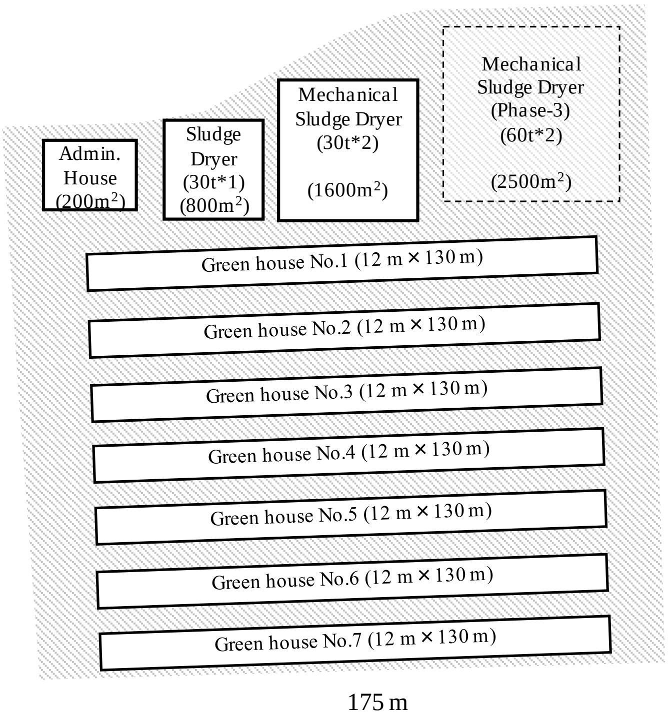
Source: JICA Study Team

Figure 2.4.2 Current Condition of the Proposed Site

The layout plan of the sludge processing center is proposed as shown in Figure 2.4.3. The area of the site is about 3.3ha (around 180 m x 180 m). The center facilities include seven (7) green houses, four (4) units of thermal dryer and an administration house.

The plan view of the Sludge Processing Center, technical plot plan of the thermal dryer units, flow diagram of the thermal dryer units, and plan of the solar green house are shown in Figure 2.4.4, 2.4.5, 2.4.6 and 2.4.7, respectively.

Yen So Sludge Recycle Center



Source: JICA Study Team

Figure 2.4.3 Sludge Recycling Process in Cement Factory

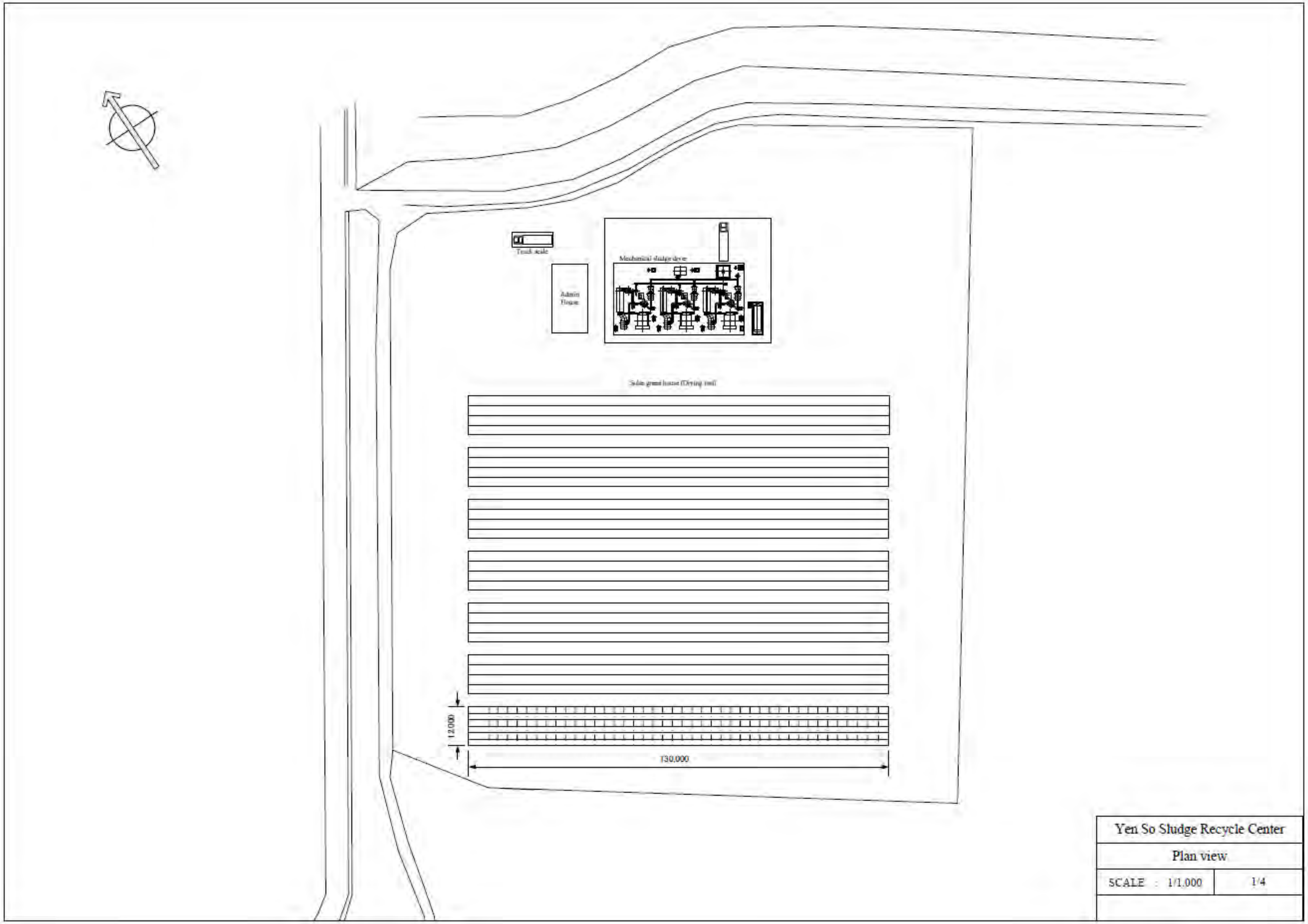


Figure 2.4.4 Plan View of the Sludge Processing Center **(**Source: JICA Study Team)

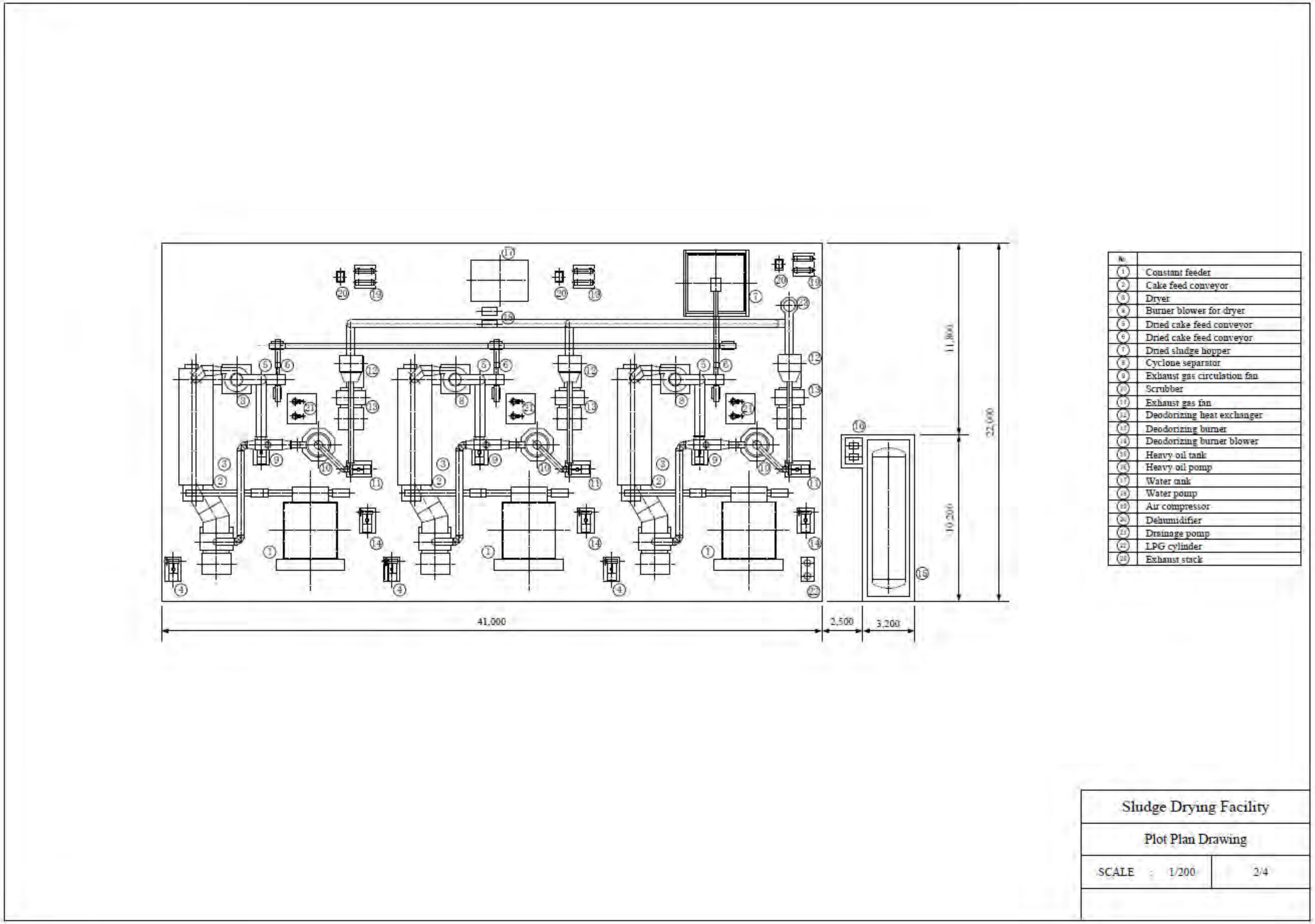
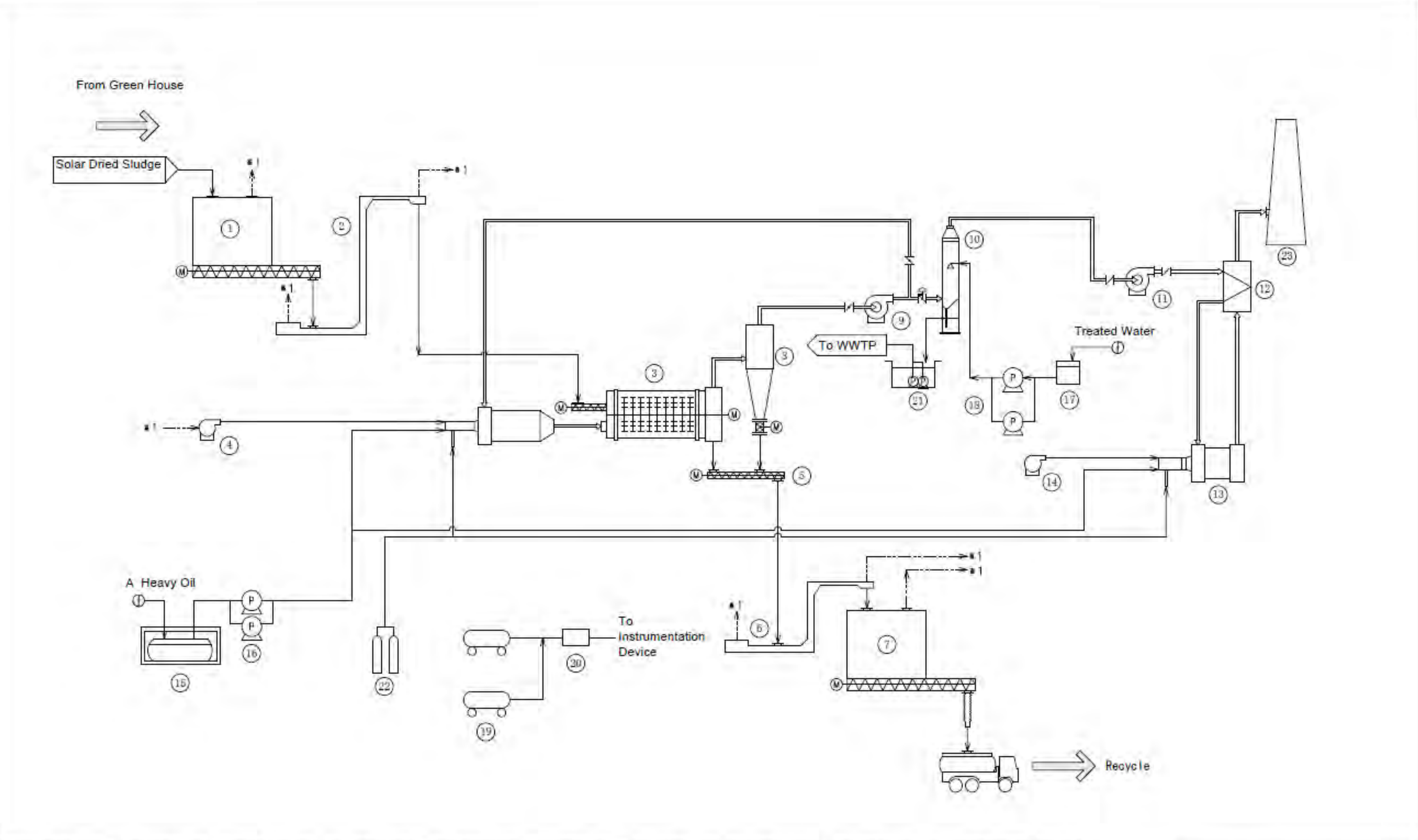


Figure 2.4.5 Plot Plan of Mechanical Facilities (Source: JICA Study Team)



No.	1	2	3	4	5	6	7	8	9	10
	Constant feeder	Cake feed conveyor	Dryer	Burner blower for dryer	Dried cake feed conveyor	Dried sludge hopper	Dried sludge hopper	Cyclone separator	Exhaust gas circulation fan	Scrubber
No.	11	12	13	14	15	16	17	18	19	20
	Exhaust gas fan	Deodorizing heat exchanger	Deodorizing burner	Deodorizing burner blower	Heavy oil tank	Heavy oil pomp	Water tank	Water pomp	Air compressor	Dehumidifier
No.	21	22	23							
	Drainage pomp	LPG cylinder	Exhaust stack							

Sludge Drying Facility	
Flow sheet	
SCALE : -	3/4

Figure 2.4.6 Flow Sheet (Source: JICA Study Team)

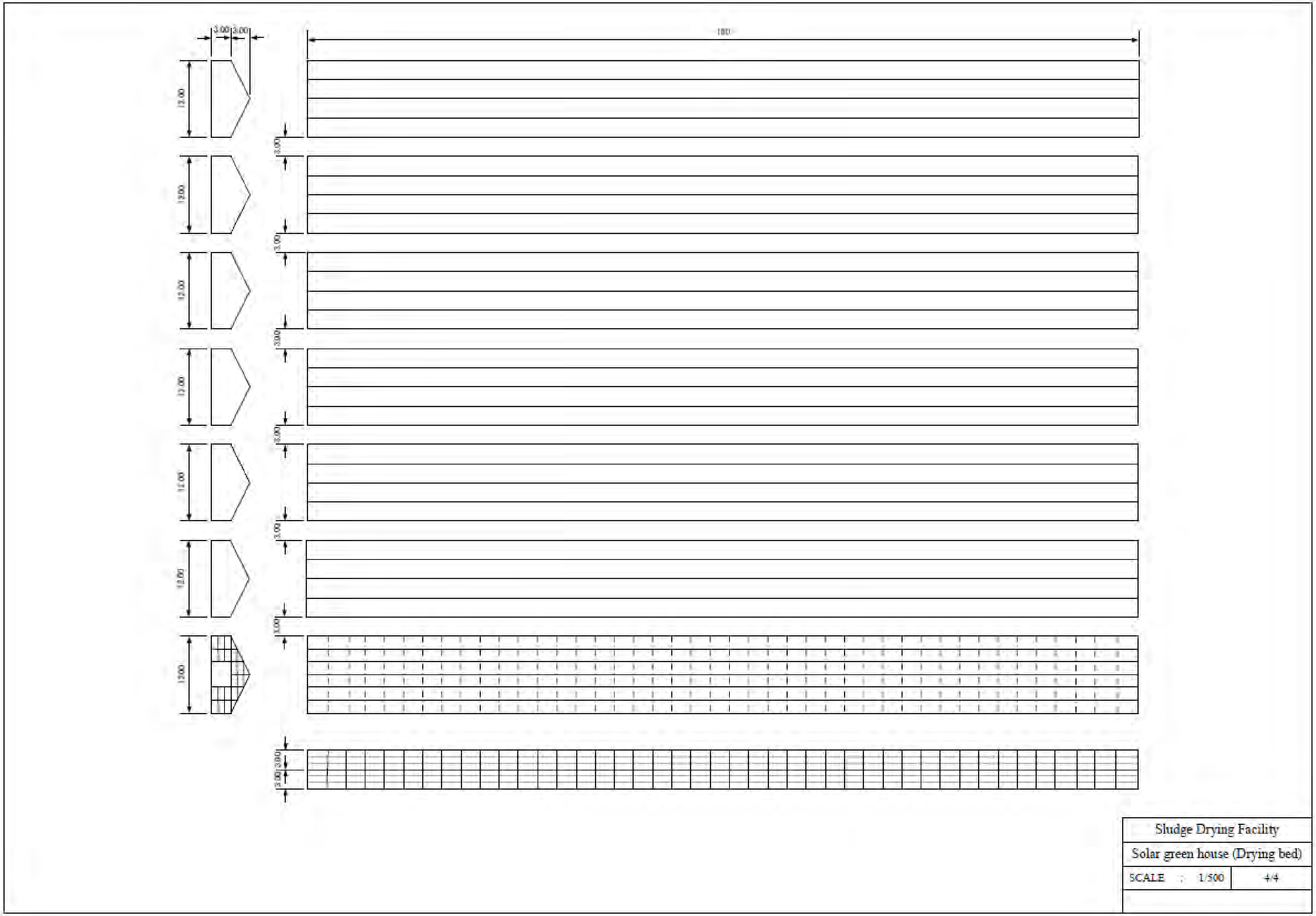


Figure 2.4.7 Plan of the Solar Green House **(**Source: JICA Study Team)

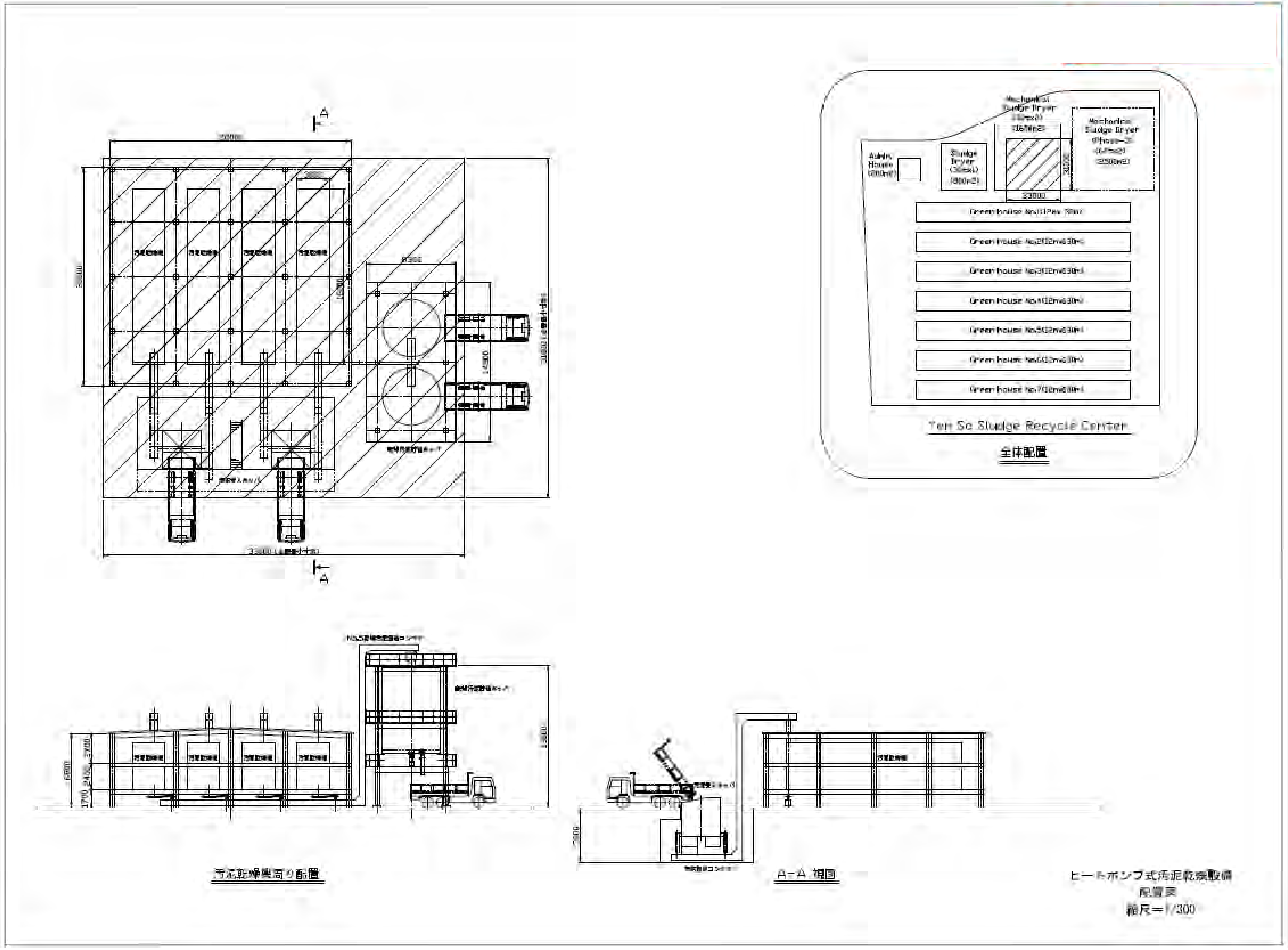


Figure 2.4.8 Plot Plan of the Sludge Dryer (Heat Pump Type) (Source: JICA Study Team)

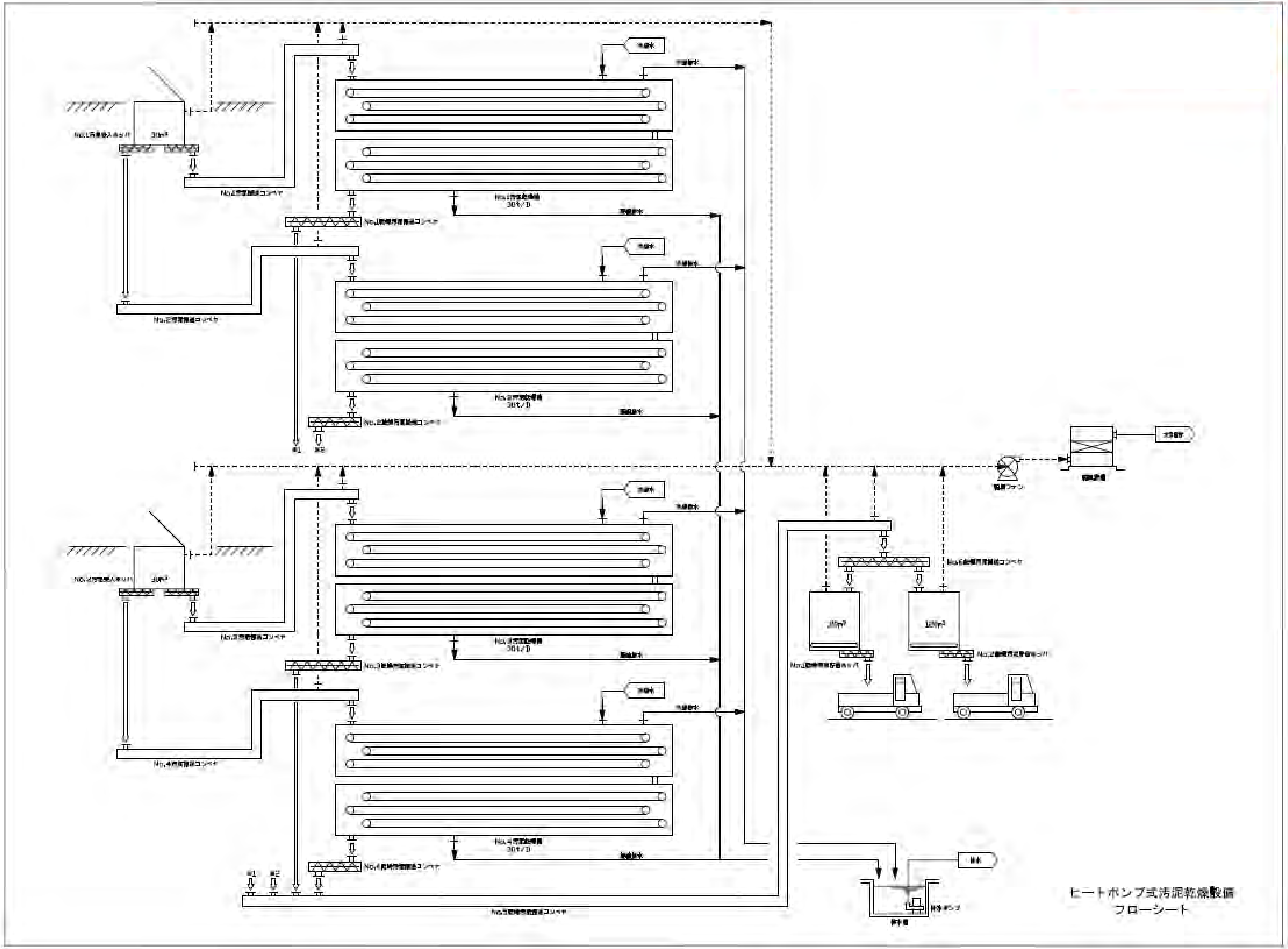


Figure 2.4.9 Flow Diagram of the Thermal Dryer Units (Source: JICA Study Team)

2.5 Plant Operation

During the operation stage, the required number of staffs are shown in the following table.

Table 2.5.1 Required Operation Staff for Sludge Processing Center

	Works items	Jobs Category	Numbers
1	Director	Wastewater treatment	1
2	General affairs	Manager	1
		General	0
		Procurement	0
		Sub total	1
4	Drying Beds	Manager	1
		Water analysis	0
		Monitoring & Control	0
		Daily check & Round	2
		Sub total	3
5	Maintenance	Manager	1
		Drying Beds	0
		Drying Machines	1
		Sub total	2
6	Drying Machines	Manager	1
		Operation	8
		Daily check & Round	3
		Sludge disposal	
		Sub total	12
7	Guards	Manager	0
		Guards	4
		Environmental Eqip.	
		Sub total	4
Total			23

Chapter 3 Preliminary Cost Estimation

3.1 Basic Condition

The basic conditions, definitions and assumptions applied for the cost estimate are presented in this section.

(1) Project Execution Method

The Feasibility Study for the BOT project will be executed by outsourcing the task to a reputed Japanese/ Vietnamese consulting company.

The design, procurement, construction will be executed by outsourcing the tasks to a reputed Japanese EPC Contractor.

The operation will be entrusted to the proposed Joint Company for sewerage sector O&M expected to form comprising HSDC and the BOT proponent.

(2) Price Level

The cost is estimated based on the price level of April 2011.

(3) Foreign Currency

For this Proposal, United States Dollar (USD) is used as only currency. Japanese Yen (JPY) and Vietnam Dong (VND) are converted to USD.

(4) Exchange Rate

The foreign currency exchange rates used are,

- VND/US$ = 20,944
- JPY/US$ = 83.15, and
- JPY/VND = 0.00397

(5) Unit Price

The construction cost is based on Vietnamese standard price and Japanese standard price as follows:

- Costs of general civil works are based on Vietnamese standard price of 2008 as used in the JICA Yen Xa WWTP F/S after applying a price escalation from 2008 to 2011.

- Costs of green house, wheel loader, thermal dryer, administration house, storage, track scale and firefighting station are based on quotation from Japanese manufacturers.

3.2 Preparatory Cost

The cost required until the start of the EPC contract can be termed as preparatory cost. The items include,

- Establishment of SPC
- Establishment of Office
- Mobilization of SPC staff
- Feasibility Study
- EIA and environmental clearance
- Contract negotiation for EPC contract

The estimated cost is USD 4.9 million.

3.3 EPC Cost

It is proposed that engineering, procurement and construction will be carried out through one EPC contract.

(1) Direct Construction Cost

The work items of construction works are as follows:

- Civil Works: Solar green house, Administration house with storage, Fire fighting station, Land preparation, Road, General utilities, others
- Mechanical and Electrical Works: Thermal sludge dryer, Wheel loader

Table 3.3.1 shows the breakdown of construction cost. The direct construction cost is around USD 48 million.

Table 3.3.1 Breakdown list of EPC Cost of sludge drying facilities

Item	Unit	Quantity	Unit Price (US$)	Cost (US$)	Remarks
1. Solar Green House					
(1) Civil Works					
1) Green House (12m x 130m x 7unit)	m^2	10,920	481	5,252,520	Japanese Standard
2) Concrete Foundation	m^3	5,460	72	393,120	Code No.6111
3) Form Work for Foundation	m^2	994	4.8	4,771	Code No.6311
4) Reinforcement Work for Foundation	t	51	1,683	85,833	Code No.6411
(2) Electrical and Mechanical Works					
1) Wheel Loader	nos	3	120,000	360,000	Japanese Standard
(3) Others	L.S.	1	609,624	609,624	10% of (1)+(2)
Sub-Total				6,705,868	
				6,706,000	round to nearest 1,000
2. Thermal Sludge Dryer					
(1) Electrical and Mechanical Works					
1) Drying Facililies (Capacity = 120t)	L.S.	1	21,528,000	21,528,000	Japanese mfr.
(Heat Pump Style)					
2) Wastewater Treatment Facilities	L.S.	1	1,251,000	1,251,000	Japanese mfr.
(2) Civil Works					
1) House for Drying Facilities	L.S.	1	2,839,000	2,839,000	Japanese mfr.
Sub-Total				25,618,000	
				25,618,000	round to nearest 1,000
3. General Structures					
(1) Civil Works					
1) Land Preparation					
i) General Clearance	m^2	32,400	1.5	48,600	Code No.1211
ii) Stripping of top soil	m^3	16,200	1.2	19,440	Code No.2101
iii) Stripping of top soil(Spoiled material)	m^3	4,860	0.5	2,430	Code No.2101 -1
iv) Embankment by imported sandy material	m^3	81,000	5.1	413,100	Code No.2102
v) Disposal	m^3	21,060	2.5	52,650	Code No.2105
2) Concrete Foundation for Administration House	m^3	100	72	7,200	Code No.6111
3) Form Work for Foundation	m^2	40	4.8	192	Code No.6311
4) Reinforcement Work for Foundation	t	0.5	1,683	842	Code No.6411
5) Concrete for Retaining Wall	m^3	54	84	4,536	Code No.6121
6) Form Work for Wall	m^2	40	6.1	244	Code No.6321
7) Reinforcement Work for Wall	t	1.2	1,697	2,036	Code No.6421
8) Road (Asphalt Paveme nt)	m^2	18,080	26	470,080	Code No.7120
9) Fence	m	720	109	78,480	Code No.7321
10) Gate	nos	1	8,558	8,558	Code No.7311
11) Administration House	m^2	100	1,203	120,300	Japanese Standard
12) Storage	m^2	100	601	60,100	Japanese Standard
13) Track Scale	nos	1	60,132	60,132	Japanese Standard
14) Firefighting Station	L.S.	1	120,300	120,300	Japanese Standard
15) General Utilities	L.S.	1	293,844	293,844	20% of 1) - 13)
16) Miscellanous work	L.S.	1	352,613	352,613	20% of 1) - 14)
Sub-Total				2,115,677	
				2,116,000	round to nearest 1,000
Grand-Total				34,440,000	

Source: JICA Study Team

(2) Total EPC Cost

The total EPC cost comprises the construction and procurement cost, engineering service cost, physical contingency, and various taxes and duties. The direct construction cost is explained above; the other components are assumed as certain percentage of direct construction cost as explained below.

- The engineering service cost for detailed design and construction supervision is estimated as 10 % of total construction and procurement cost.
- The tax and duties include VAT and income tax, which is assumed to be 10% of the sum of construction and procurement cost, and engineering service cost.

The preliminary cost estimates for the EPC is shown in Table 3.3.2, which is around USD 64 million.

Table 3.3.2 Initial cost of sludge drying facilities

Item	Amount (1,000US$)	Remarks
(1) Construction Cost		
1) Solar Green House	6,706	
2) Thermal Sludge Dryer	25,618	
3) General Structures	2,116	
Sub-Total	34,440	
(2) Engineering Fee	3,444	10% of (1)
(3) Tax	3,788	10% of ((1)+(2))
Total	41,672	

Source: JICA Study Team

3.4 O&M Cost (Routine O&M, Repair and Replacement)

The work items of O&M works can be divided into two broad categories.

- To receive dewatered sludge from WWTPs, to operate green house and thermal drier to make dried sludge, and to provide the dried sludge to end users, and
- To maintain all equipments of the sludge processing facilities (including repair and replacement)

The items of O&M cost is shown as below.

Table 3.4.1 Items of O&M Cost

No.	Items	Contents
1	Labor Cost	
2	Utilities	Electricity consumption cost Oils Consumables
3	Monitoring and inspection cost	
4	Major Repair	
5	Cleaning and yard maintenance	

No.	Items	Contents
6	Other Expenses	Small scale repairs Rental car fee Telephone fee Business equipment rental fee Office supplies Others (water supply, etc.)
7	O&M Consultant	
8	Insurance	
9	Provisional sum for contingency	
10	Overhead	
11	Replacement	

Source: JICA Study Team

Breakdown of some of the items are elaborated further.

- Labor cost

	Works items	Jobs Category	Numbers (Persons)	Labor unit cost(/year)		Sub total(/year)	
				VND	US$	VND	US$
1	Director	Wastewater treatment	1	376,992,000	18,000	376,992,000	18,000
2	General affairs	Manager	1	175,929,600	8,400	175,929,600	8,400
		General	0	75,398,400	3,600	0	0
		Proqurement	0	75,398,400	3,600	0	0
		Sub total	1			175,929,600	8,400
4	Drying Beds	Manager	1	175,929,600	8,400	175,929,600	8,400
		Water anaysis	0	75,398,400	3,600	0	0
		Monitoring & Control	0	75,398,400	3,600	0	0
		Daily check & Round	2	75,398,400	3,600	150,796,800	7,200
		Sub total	3			326,726,400	15,600
5	Maintenance	Manager	1	175,929,600	8,400	175,929,600	8,400
		Drying Beds	0	75,398,400	3,600	0	0
		Drying Machines	1	75,398,400	3,600	75,398,400	3,600
		Sub total	2			251,328,000	12,000
6	Drying Machines	Manager	1	175,929,600	8,400	175,929,600	8,400
		Operation	8	75,398,400	3,600	603,187,200	28,800
		Daily check & Round	3	75,398,400	3,600	226,195,200	10,800
		Sludge disposal					
		Sub total	12			1,005,312,000	48,000
7	Guards	Manager	0	175,929,600	8,400	0	0
		Guards	4	75,398,400	3,600	301,593,600	14,400
		Environmental Eqip.					
		Sub total	4			301,593,600	14,400
Total			23			2,437,881,600	116,400

- Electricity consumption cost

Cost by category	Unit cost, as of April 2011 (VND)
Off peak hours (13hr)	1,139
Low load hours (6hr)	708
Peak hours (5hr)	2,061

- Oil cost : The cost of diesel oil as of April 2011 is 21,000 VND/L.

- Monitoring and inspection cost

	Items	Unit price
1	Inspection Equipment	1,000 US$/year
2	Sludge quality analysis as TCVN5945-2005 (12 times/year)	50,000,000 VND/time
	Firefighting equipment	1,000 US$/year

- Other Expenses

Items	Price	Unit
Small-scale repair	50,000	US$/year
Rental car fee (car + gasoline)	272,101	US$/year
Telephone fee	3,000	US$/year
Business equipment rental fee	10,000	US$/year
Office supply	5,000	US$/year
Others (water supply etc.)	40,000	US$/year
Total	380,101	US$/year

- Replacement cost : The total proposed O&M period is 22years (2016 – 2037). A replacement is required at 11th year (2026).

The O&M cost is shown in Table 3.4.2. The total O&M cost is around USD 86 million. The average O&M cost per year is USD 3.9 million including the replacement cost in 11^{th} yaer.

Table 3.4.2 O&M Cost

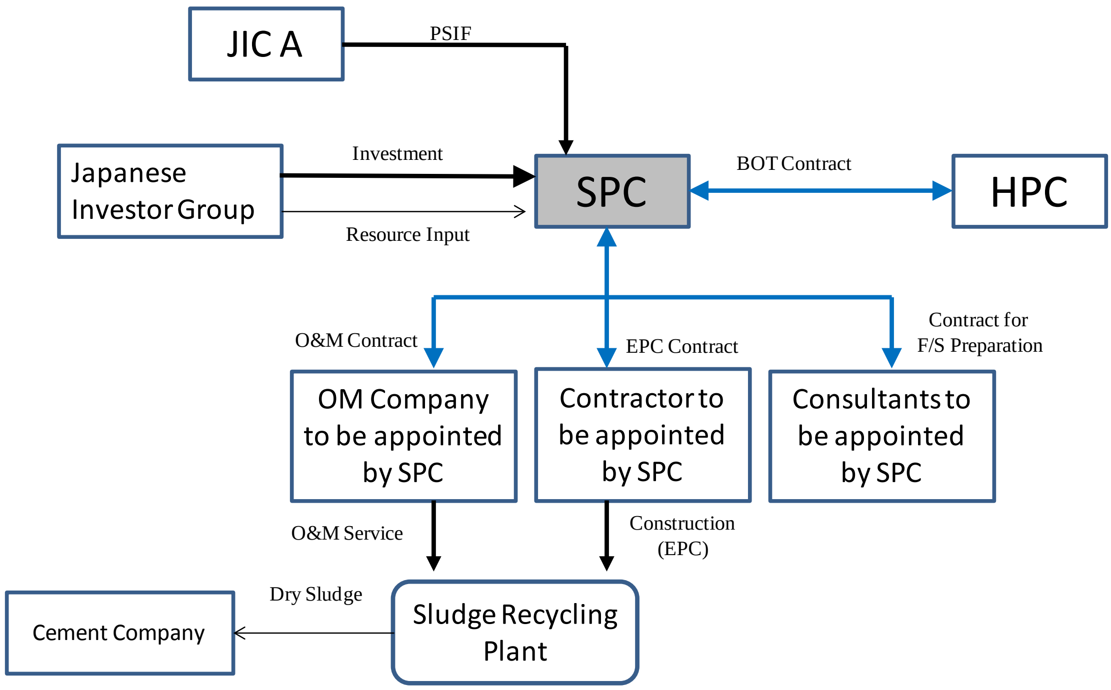
	Items	Contents		Year																						Sub Total
				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	
1	Labor cost			116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	2,561
2	Utilities	Electricity consumtion cost		367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	8,069
		Oils		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	331
		Consumables		390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390	8,583
		Sub-Total		772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	16,983
3	Legal inspection cost			31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	674
4	Repairs			433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	9,526
5	Cleaning and yard maintennance			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	106
6	Expenses			380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	8,362
7	O&M Consultant			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Insurance		(0.4% of 1-7)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	153
Sub-Total(1-8)				1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	38,365
9	Provisional sum for Contingencoy		(5% of 1-8)	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	1,918
10	Overhead		(6.5% of 1-8)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	2,494
Total				1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	42,777
11	Replacement													10,000	10,000											20,000
Grand Total				1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	11,945	11,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	1,945	62,779

Chapter 4 Proposed Project Scheme

4.1 Outline of BOT Scheme

4.1.1 Structure of BOT Scheme

A Built-Operate-Transfer (BOT) scheme is proposed for the Yen So Biosolids Processing Center. The main advantages of such scheme are elaborated in Section 1.2.4. The proposed operation time is 22 years. After that the facilities will be transferred to HPC. The structure of the proposed scheme is shown in Figure 4.1.1.



Source: JICA Study Team

Figure 4.1.1 Structure of Proposed Project Scheme

4.1.2 Outline of SPC

It is proposed that a Special Purpose Company (SPC) will be formed who will be the executor of the BOT scheme. The SPC will be comprised of a consortium of Japanese firms arranged by ORIX Corporation.

The tasks of the SPC after the establishment of the SPC, are as below;

1) F/S preparation and approval (from October, 2013, to September, 2014)
2) Design and Construction (from October, 2014, to December, 2015)
3) O&M (from January, 2016, to December, 2034)

As shown in Figure 4.1.1, SPC will subcontract above three works. The SPC will outsource F/S preparation and approval to Japanese and Vietnamese consultants, and outsource the design and construction works to a contractor through an Engineering, Procurement and Construction (EPC) contract. In addition, the SPC will also outsource O&M of the Center to the O&M Company, which is supposed to be established by HSDC and a Japanese consortium.

Under these situations, the SPC is required to have management and administration staff only. The required staff of the SPC is shown in Table 4.1.1.

Table 4.1.1 Required Staff of SPC

Position	Nationality/Status	Number
Chairman	Japanese/Full-time	1
General Director	Japanese/Full-time	1
Chief of Technical Affairs	Japanese/Part-time	1
General Staff	Vietnamese/Full-time	1

Source: JICA Study Team

It is to be noted that the member entities of the Japanese consortium in the O&M company is preferably identical to that of SPC.

4.1.3 Equity and Debt

As shown in Table 3.2.2, the construction cost of the sludge recycling facility is estimated to be 41.7 million US$. The expenditure in the first 2 years (before operation stage) is estimated to be 13.9 million US$, which consists of 3.0 million US$ of initial development cost, 0.75 million US$ of SPC administrative expense and 10.15 million US$ of other expense. Required fund for the project is therefore estimated and it will be provided as below;

Required Fund: 55.6 million US$
- Equity (30%) : 16.7 million US$
- Debt: PSIF (70%) : 38.9 million US$

As for the share of the equity, ORIX Corporation will arrange the share of the equity with other Japanese companies.

4.1.4 Investors

It is proposed that ORIX, KOBELCO and Nippon Koei to be the investors of the Project and they will be the partners of the Special Purpose Company (SPC).

(Corporate profiles of each firm have been attached with this document.)

4.2 Proposed Project Implementation Schedule

The proposed Yen Xo Biosolids Processing Center is essential to manage the huge dewatered sludge coming out from existing WWTPs and the WWTPs to be completed. The dewatered sludge productions from existing WWTPs are low and can be managed with current disposal practice. After completion of Yen So WWTP and Yen Xa WWTP, the amount of dewatered sludge will be increased rapidly, so that the center should be constructed before completion of the both WWTPs.

Yen So WWTP will generate sludge soon, but those are digested sludge, so they will have less organic matter. Such sludge is less appropriate for use as alternate fuel in cement industry. To confirm sludge recycling process, additional study is required by using sludge digested in Yen So WWTP.

For the Project implementation, the following schedule is proposed:

- March 2012 — Preparation of Draft Proposal of BOT Project
MOU for Selection of Investor of BOT Project
- August 2012 — Commencement of Additional study by using digested sludge from Yen So WWTP
- September 2012 — Approval by relevant ministries after addition to national BOT Project List
- March 2013 — 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
- January 2016 — Commencement of Operation

The implementation schedule of this BOT Project in relation with other projects (like Yen Xa WWTP and O&M Joint Company) is shown in the Figure 4.2.1.

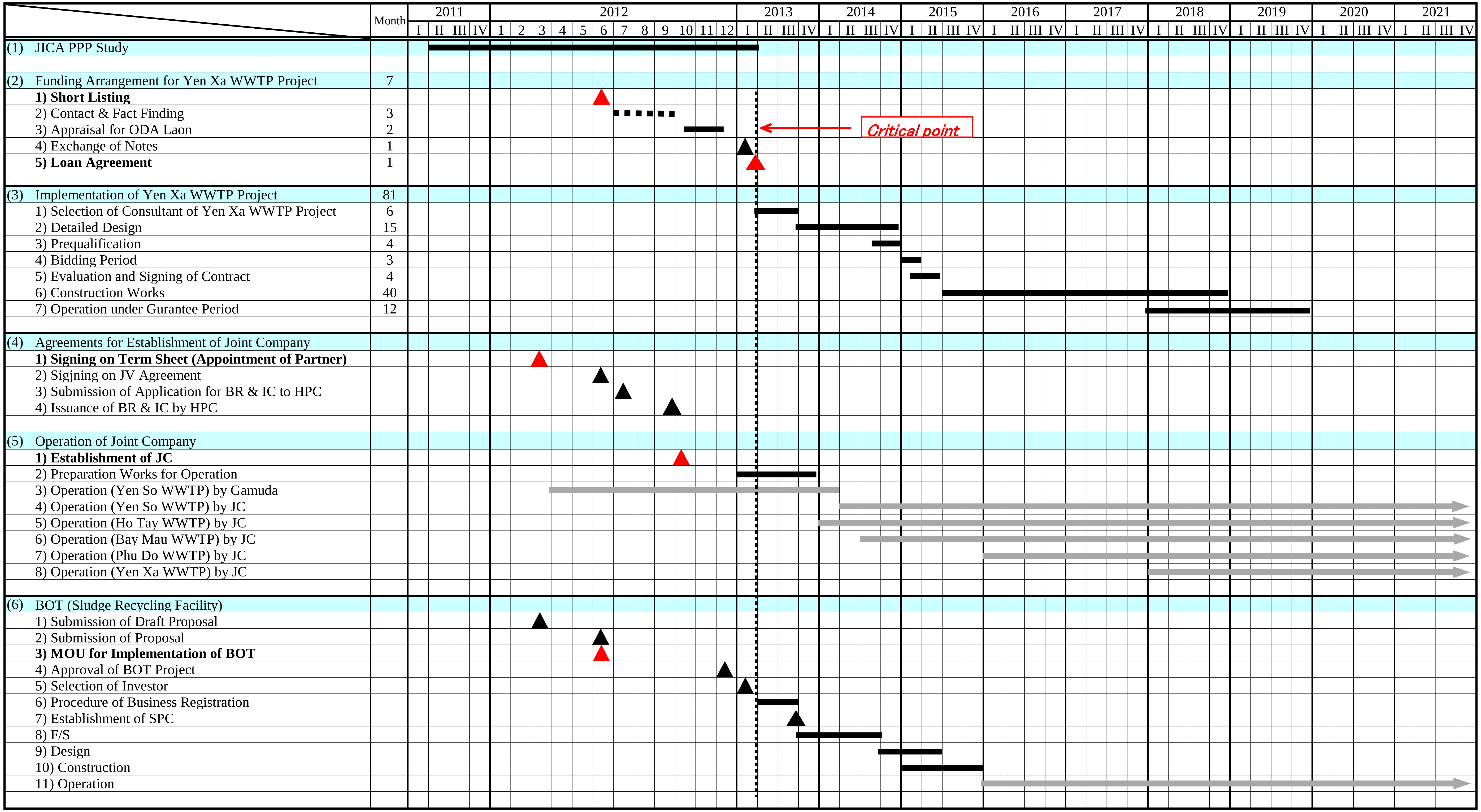


Figure 4.2.1 Proposed Implementation Schedule of Yen Xa WWTP Project and Relevant Projects

Chapter 5 Financial Analysis

5.1 Methodology of Financial Analysis

To conduct the financial analysis, we prepared a financial model for the "Yen So Central Bio-solid Processing Center" (The Facility) to be conducted under the Built-Operate-Transfer scheme ("BOT Project"). The financial model is structured so that analysis of many cases can be done by changing several assumptions as described in the section "5.2 Conditions and Assumptions" below. Outputs are summary of i) Balance Sheet, ii) Profit and Loss Statement, and iii) Cash Flow Statement. Certain financial ratios to evaluate the financial viability are also calculated in the financial model.

5.2 Conditions and Assumptions

Assumptions in the financial model consist of 6 areas, i.e., i) Business plan (schedule and scope), ii) Taxes, iii) Financing, iv) Initial Development and Construction Cost v)Operation and Maintenance Cost, vi) Revenues, and vii) Reserve accounts.

Currency for calculation is US dollars.

Table 5.2.1 Business Plan Assumptions

Item	Assumption
Sharing of Roles among Related Parties in relation to the BOT Project	**<u>HPC</u>** - To grant long term license to SPC to construct, own, operate, and maintain the Facility effective during the period of the BOT Project. - Subject to performance by SPC in accordance with the pre-agreed operating standard, to pay to SPC the tariff for its operation of the Facility. - To be transferred the Facility by SPC at the expiry of the period of the BOT Project with no consideration. - To cooperate with SPC for smooth production and absorption of the bio-solid in accordance with the agreement for production and offtake of dry sludge (regarding the preliminary terms and conditions of the agreement, see Appendix-B2.).

Item	Assumption
	<u>SPC</u> - To build, own, and operate and maintain in accordance with the pre-agreed operating standard, the Facility during the period of the BOT Project (maintenance of the Facility to include to take responsibility for replacements with taking the risk of functional deterioration. SPC will do necessary replacement of the facilities with receiving “pre agreed” service charge include replacement.). - To transfer the Facility to HPC at the expiry of the period of the BOT Project with no consideration. - To cooperate with HPC for smooth production and absorption of the bio-solid in accordance with the agreement for production and offtake of dry sludge as mentioned above. **<u>JC</u>** - In accordance with certain long term O&M sub-contract with SPC, to operate and maintain the Facility (maintenance of the Facility to include replacement works but JC does not take the risk of functional deterioration. JC will replace the facilities with the money which it will receive then.).
Schedule	・Establishment of entities - SPC: **<u>January 1, 2014</u>** ; JC: **<u>January 1, 2013</u>** ・Construction Period: **<u>one year (year 2015)</u>** ・Period of O&M (operation and maintenance): **<u>22 years from January 1, 2016</u>** · Period of operation and maintenance is assumed to end the same date as the end date of JC’s O&M contract for Yen Xa WWTP (which is assumed as 20th anniversary of the assumed starting date of the Yen Xa O&M contract, i.e., January 1, 2018). ・Project Period: Construction period plus period of O&M
Capacity of the Facility	The Facility is assumed to treat up to 184m^3 per day of raw sludge to be transported to the Facility from the WWTPs in Hanoi.

<table>
<tr><th>Item</th><th>Assumption</th></tr>
<tr><td>Operating ratio</td><td>In the beginning 3 years in the operation period, less than 100% of operation is assumed. Thereafter, full operation is assumed.
<Operating Ratio Assumption>
<table>
<tr><th>Year</th><th>2016</th><th>2017</th><th>2018</th><th>thereafter</th></tr>
<tr><td>Operating Ratio</td><td>64%</td><td>64%</td><td>98%</td><td>100%</td></tr>
<tr><td>Annual Treatment Volume (‘000m3)</td><td>43.2</td><td>43.1</td><td>66.0</td><td>67.4</td></tr>
</table></td></tr>
<tr><td>Scheme</td><td>BOT scheme is assumed, where SPC, established solely for the purpose of conducting this BOT Project, shall build, own, operate, and maintain the Facility during the Project Period, and transfer the Facility to HPC at the expiry of the Project Period without consideration.</td></tr>
</table>

Table 5.2.2 Tax Assumptions

<table>
<tr><th>Item</th><th>Assumption</th></tr>
<tr><td>Taxes and rates</td><td>・Value added tax : **10%**
・Income tax : **According to the following tax incentive**
・Property tax : **None**</td></tr>
<tr><td>Income tax incentive</td><td>・Applicable income tax rate
<table>
<tr><td>Until 15th anniversary of operation</td><td>10%</td></tr>
<tr><td>Thereafter (until 45th anniversary of operation)</td><td>25%</td></tr>
</table>
・Further reduction of tax rate from the above
<table>
<tr><td>Until 4th anniversary of operation</td><td>100%</td></tr>
<tr><td>Until 9th anniversary of operation thereafter</td><td>50%</td></tr>
</table>
・Applicable income tax rate after above incentives
<table>
<tr><td>Until 4th anniversary of operation</td><td>0%</td></tr>
<tr><td>Until 9th anniversary of operation thereafter</td><td>5%</td></tr>
<tr><td>Until 15th anniversary of operation thereafter</td><td>10%</td></tr>
<tr><td>Thereafter (until 45th anniversary of operation)</td><td>25%</td></tr>
</table></td></tr>
</table>

Table 5.2.3 Financing Assumptions

Item	Assumption
Minimum cash amount held in SPC	- USD 1 million during Construction Period - USD 8 million during O&M Period
Schedule for equity investment to SPC	- Initial Investment: USD 5 million in 2015 to compensate initial development cost (USD 4 million) plus cash (USD 1million) - Thereafter: additional investment to pay for the construction cost etc. during Construction Period
Equity IRR	- Equity IRR ("EIRR") in this analysis is defined as the internal return rate of dividends and final equity return (after expiry of Project Period) to the initial equity investment to SPC by the shareholders of SPC. - In this analysis, 15% EIRR is assumed as the Target EIRR, i.e., the level of tariff revenue is set so that the Target EIRR is expected to be realized.
Subsidy	- No subsidy is assumed.
Financing	**Debt : Equity ratio is assumed as 70 : 30** **Equity** - Equity investment is assumed to be made during Construction Period up to 30 % of the total funding amount and in accordance with the schedule for equity investment to SPC as described above. **Debt** - SPC is assumed to obtain long term loan in accordance with the following conditions: · Signing: Year 2014 · Source: Private Sector Investment Finance program (PSIF) provided by JICA · Currency: Japanese Yen (converted in its effect to USD loan using currency swap transaction) · Grace Period: until end of 2018 · Repayment Conditions: Principal repayments 19 years' equal principal payment from 2019 (ending in 2037, the last year of Project Period)

	· Fees: Not assumed · Interest rate: 5% (USD base after currency swap)
Inflation	- 3% p.a. of inflation (USD base) is assumed.

Table 5.2.4 Initial Development and Construction Cost Assumptions

Item	Assumption
Construction Cost	- Construction cost is assumed as USD 41,672 thousand, inclusive of 10% tax. (Amount described here is fixed price, i.e., Amounts actually assumed in the financial model is the same as the amount described here.) - Construction cost is assumed to be paid once at completion of the Facility in 2015.
Initial Development Cost	- USD3,000 thousand of initial development cost in 2014, as well as USD750 thousand p.a. of SPC administrative expense in 2014 and 2015 are assumed to be paid. (Amounts described here are both 2011 price, i.e., Amounts actually assumed in the financial model reflect the effect of inflation after 2011.)
Depreciation	- For accounting and tax calculation purpose, construction cost and replacement cost is assumed to be booked as fixed asset at completion of construction and replacement, and to be depreciated over the remaining years of the Project Period so that the fixed asset so booked at the end of the Project Period becomes zero.

O&M cost is divided into i)variable cost, ii)fixed cost, and iii)replacement cost and assumed respectively. The amounts so assumed each year (all 2011 price) are described in Attachment 1. (Please note, however, that Attachment 1 does not include SPC's administration cost which in this financial model is assumed as USD 750,000 p.a. (2011 price).)

The mine cost items included in the O&M cost are as follows:

Table 5.5.5 O&M Cost Assumptions

Variable cost	Utility (electricity), Chemicals, etc.
Fixed cost	Labor cost, Legal inspection cost, Repair cost, Cleaning and yard maintenance cost, O&M Consultant Fee, Insurance cost, SPC administrative cost
Replacement Cost	Cost necessary to replace functionally deteriorated equipments etc..

In addition to the cost above, JC's profit portion (which constitutes 5% of JC's O&M cost) is added to SPC's O&M cost.

Tariff revenue and interest income revenue from cash deposit to reserve accounts is assumed.

Table 5.2.6 Assumptions for revenues

Tariff revenue (Revenue from HPC)	- As is usual with this type of long term contracts, the revenue which SPC will receive from HPC is assumed to be composed by several sub-charges each of which is intended to cover corresponding cost items. For details, please refer to Attachment 2. - As described in the section of "Financial Assumptions" above, the level of tariff revenue is set so that the Target EIRR (which in this financial analysis is 15%) is expected to be realized.
Other revenue	- Income earned from cash deposit is assumed as follows: · On the amount deposited into reserve accounts, 1% p.a. of interest income is assumed. · On the amount deposited into other accounts (i.e., unrestricted cash amount), no interest income is assumed.

Two reserve accounts is assumed to be established to which cash is deposited and reserved for future debt service (interest payment and principal repayment of loan) and future replacement in relation to the Facility. They are typical in this type of transaction.

Table 5.2.7 Assumptions for Reserve accounts

Replacement Reserve Account (RRA)	- In RRA, cash necessary to compensate future replacement works is assumed to be deposited. - The amount in each year which is to be deposited in RRA is calculated so that the cash outflow in each year for the purpose of replacement is levelized as much as realistically possible.
Debt Service Reserve Account (DSRA)	- In DSRA, cash amount equivalent up to 6 months' debt service (interest payment and principal repayment) is deposited in preparation for debt service in case operating cash flow is not sufficient for it.

5.3 Results of Financial Analysis

5.3.1 Tariff

The chart below shows summary of operation and tariff based on the assumptions described in the above. Tariff (expressed in 2011 price) is calculated to be USD 136.84 per m^3 of raw sludge to be transferred to the Facility.

Table 5.3.1 Summary of Operation and Tarrifs

			All	SPC Part	JC Part
Operational	Operation from		2016		
	Operatiion Period		22 yrs.		
	Maximum Capacity ('000 m³/day)		0		
	Capacity Factor(%)		100%		
	Usage(%)		96.6%		
	Treatment Volume ('000 m³/day)		0.178		
	SPC Scope of work for Replacement(*)		○		
Financial	Tarrif (US$/m³, 2011 price)		136.84	91.14	45.70
	Usage	Opex	28.11	-	28.11
		Replacement Cost (after reserve account effect)	16.38	2.43	13.95
		Other Costs	16.00	14.65	1.35
		Tax	13.50	13.70	-0.20
		Return of Investment	25.33	22.85	2.48
		(Less:Other (Interest) Income)	(0.96)	(0.96)	-

* ○ : JC will take responsibility, △ : JC will do replacement works but will not take the risk of obsolescence,
—: JC will not do replacement works.

5.3.2 Cash Flow and Financial Forecast of SPC

The chart below shows summary of SPC financial results based on the assumptions described in the above. As far as the resultant financial ratios are concerned, the level of those ratios (e.g.: minimum DSCR, EIRR, etc.) could to certain extent satisfy foreign financiers and investors.

For details of SPC financial result, refer to Attachment 3

Table 5.3.2 Summary of SPC Financial Results

(USD million)

Item		Amount/Ratio
Profit & Loss	**Revenue**	**309.9**
	Pre Tax Income	**87.1**
	Net Income	**76.3**
Cash Flow	**Net Income**	**76.3**
	+ Depreciation	75.0
	+ Interestment Expense	25.7
	Cash Flow before Debt Service, Investment, and Financing	**176.9**
	－ Initial Investment	-41.7
	－ Replacement Cost	-33.3
	＋Equity Investment	16.7
	＋PSIF	38.9
	Cash Flow bef. Debt Service	**157.5**
	－Interest Expense	-25.7
	－Principal Repayment	-38.9
	Cash Flow after Debt Service (Dividend and Equity Return)	**93.0**
	－Dividend	-76.3
	－Equity Return	-16.7
Finan-cial Ratios	**Debt Service Coverage Ratio (Loan Life)**	**2.14**
	Minimum Debt Service Coverage Ratio	**1.36**
	Equity IRR	**15.0%**
	Minimum Equity to Equity + Loan Ratio	**30.1%**
	Minimun Cash (excluding reserve accounts)	**1.0**
	Minimun Cash During O&M Period (excluding reserve accounts)	**8.0**

5.3.3 Proposal of Service Charge and Payment Condition

The Study Team estimated costs required for implementation of the BOT project for Sludge Recycling Facility. The cost consists of construction cost, daily operation and maintenance cost, repair cost for structures and equipments. The result of cost estimate is shown in Figure 5.3.1. As shown in the figure, significant costs are construction cost (64 million US$) and repair cost (18 million US$) in 12th year of operation period. The O&M and repair will be carried out by the Joint Company. It is assumed that the Joint Company will charge to SPC its own O&M and repair cost plus profit which constitutes 5% of the cost.

The service charge is calculated based on the conditions as shown Table 5.3.1. The service charge is arranged to be uniformity on yearly basis as shown in Figure 5.3.2. It will be charged to HPC by SPC.

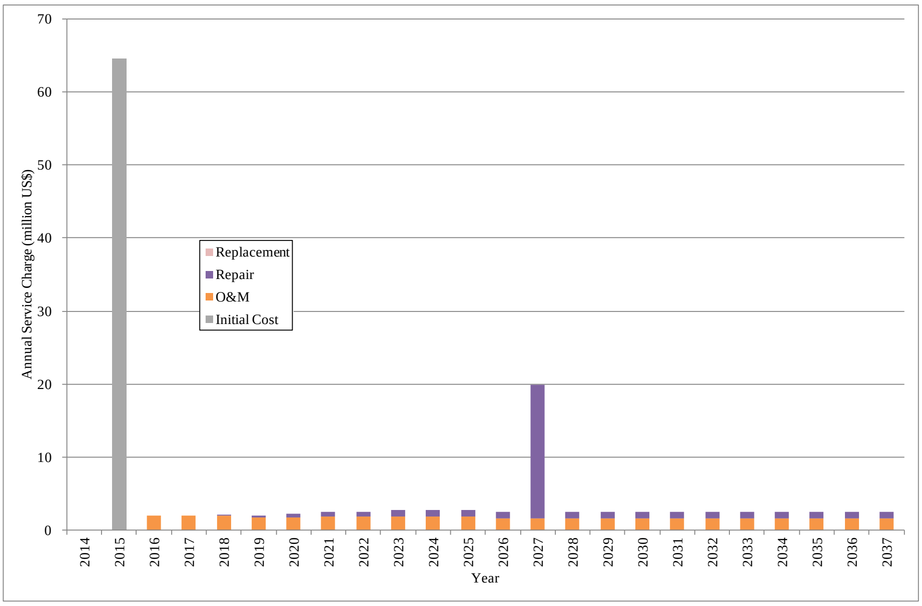


Figure 5.3.1 Actual Expenditure of Construction/O&M/Repair of Sludge Recycling Facility

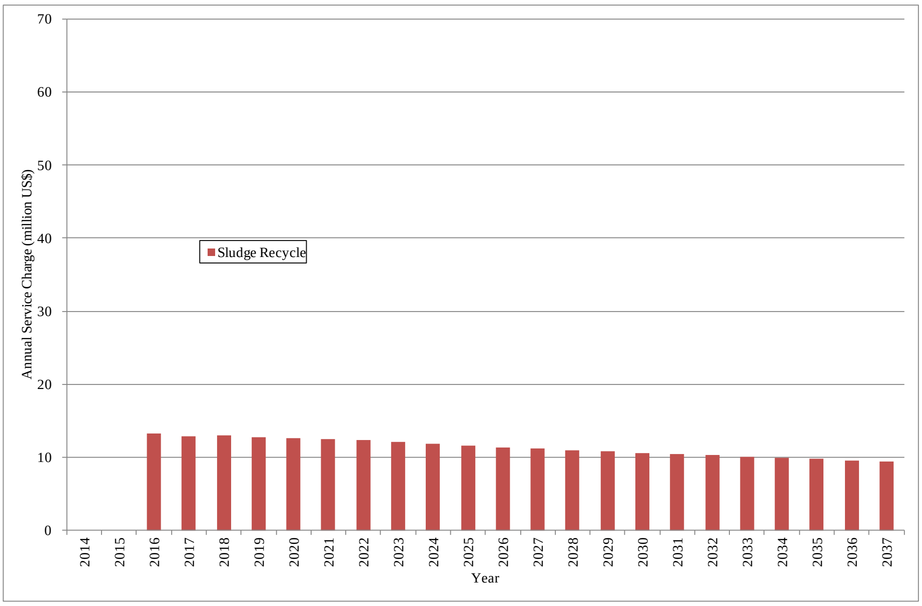


Figure 5.3.2 Service Charge to be paid by HPC for BOT of Sludge Recycling facility

The average service charge to HPC and payment for O&M to the JC are as below;

- Average Service Charge to HPC (11.6 million US$/year, 145 US$/m^3 of dewatered sludge)

- Expected Average Payment for O&M cost to JC (3.2 million US$/year, 40 US$/m^3 of dewatered sludge)

Regarding this, we summarized the contents in the attached "Preliminary Terms and Conditions for Production and Offtake of Dry Sludge" (Appendix-B2). Please refer to it.

Table 5.3.3 Operational Assumptions of Yen So Central Bio-solid Processing Center

	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Days		365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	365
Capacity and Operating Assumptions																									
Maximum Capacity (㎥/day)	4061.2			185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Capacity Factor(%)	100.00%			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Usage(%)	96.64%			64.00%	64.00%	98.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Sludge reuse Volume ('000㎥ p.a.)	1433.5			43	43	66	67	68	67	67	67	68	67	67	67	68	67	67	67	68	67	67	67	68	67
O&M Cost Assumptions																									
Utility($/000㎥)	13,966	-	-	21,045	21,103	13,781	13,506	13,469	13,506	13,506	13,506	13,469	13,506	13,506	13,506	13,469	13,506	13,506	13,506	13,469	13,506	13,506	13,506	13,469	13,506
Other Variable($/000㎥)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance ('$000/year)	16144	-	-	862	862	862	862	862	862	862	862	862	862	627	627	627	627	627	627	627	627	627	627	627	627
Other Fixed Cost ('$000/year)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inflation for Costs		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Replacement Cost Assumptions																									
Replacement Cost		-	-	510	510	510	510	510	510	510	510	510	510	11,037	11,037	510	510	510	510	510	510	510	510	510	510
Inflation of Replacement Cost		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%

Table 5.3.4　Revenue Structure

Sub-charge Category		Corresponding O&M Cost	Unit (example)	Example of calculation (in 2016, assuming 21000 as VDN/USD exchange rate)	Payment condition (example)	Adjustment of unit charge amount during operation period	
						Adjustment by Inflation	Adjustment by Foreign exchange fluctuation
Variable Payment	Foreign Cost Portion	Variable and foreign currency indexed O&M cost (e.g.: imported fuel)	per m^3	0.046419 (USD/m^3) * 190,000 (m^3/day) *365 (days) *75% (Usage) = 2,414 thou USD =50,701 mil VDN	To be paid based on the actual amount (m^3) treated	Yes (Based on the inflation in the country using the indexing currency)	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Cost Portion	Variable and domestic O&M cost (e.g.: utility)	per m^3			Yes (Based on the inflation in Viet Nam)	None

Sub-charge Category		Corresponding O&M Cost	Unit (example)	Example of calculation (in 2016, assuming 21000 as VDN/USD exchange rate)	Payment condition (example)	Adjustment of unit charge amount during operation period	
						Adjustment by Inflation	Adjustment by Foreign exchange fluctuation
Availability Payment 1	Foreign Cost Portion	Fixed and foreign currency indexed O&M Cost (e.g.: cost for imported spare parts)	per month	5.45661(USD/m3/ month) *190,000 (m^3/day) *12 (month) *100% (Availability) = 12,441 thou USD =261,263 mil VDN	To be paid based on the actual availability of the facility. (e.g.: The amount may be reduced in case of a material accidental shutdown)	Yes (Based on the inflation in the country using the indexing currency)	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Portion	Fixed and domestic O&M cost (e.g.: payroll)	per month			Yes (Based on the inflation in Viet Nam)	None
Availability Payment 2	Foreign Cost Portion	Equity investment, Foreign currency indexed loan	per month			None	Yes (Adjustment will be done so that the amount paid in VND is equivalent to the amount which would be otherwise paid in the indexed currency)
	Domestic Portion	Domestic currency indexed loan	per month	(Not assumed so far)		None	None

Note that detailed analysis of O&M costs has yet to be done to determine the structure of the Revenue in detail.

Table 5.3.5 SPC Summary Financial Forecast

IRR for Equity 14.99%

(in USD million)		TOTAL	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 to 2027 (ave.)	2028 to 2032 (ave.)	2033 to 2037 (ave.)	2038
Pro-fit and Loss	**Revenue**	**310**	**-**	**-**	**-**	**-**	**11.9**	**12.1**	**12.6**	**12.7**	**12.9**	**13.1**	**13.2**	**13.7**	**14.7**	**15.8**	**-**
	Opex	103	-	-	4.1	0.8	3.2	3.3	3.4	3.5	3.6	3.7	3.8	4.2	4.9	5.6	-
	Depreciation	75	-	-	-	-	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.2	5.1	5.1	-
	VAT	21	-	-	-	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	-
	Interest Expense for PSIF	-	-	-	-4.1	-4.9	-0.9	0.0	0.0	1.6	4.5	7.3	10.2	18.5	13.9	1.3	-0.0
	Other	24	-	-	4.1	4.9	2.9	1.9	1.9	0.3	-2.7	-5.7	-8.7	-17.4	-13.0	-1.0	0.0
	Pre Tax Income	**87**	**-**	**-**	**-4.1**	**-0.8**	**4.0**	**4.1**	**4.5**	**4.6**	**4.7**	**4.9**	**5.1**	**5.3**	**3.0**	**3.8**	**-**
	Income Tax	11	-	-	-	-	-	-	0.2	0.2	0.2	0.2	0.3	0.3	0.7	0.9	-
	Net Income	**76**	**-**	**-**	**-4.1**	**-0.8**	**4.0**	**4.1**	**4.2**	**4.3**	**4.5**	**4.7**	**4.8**	**5.0**	**2.3**	**2.8**	**-**
Cash Flow	**Net Income**	**76**	**-**	**-**	**-4.1**	**-0.8**	**4.0**	**4.1**	**4.2**	**4.3**	**4.5**	**4.7**	**4.8**	**5.0**	**2.3**	**2.8**	**-**
	+ Depreciation	75	-	-	-	-	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.2	5.1	5.1	-
	+ Int. Expense	26	-	-	-	-	2.0	2.0	2.0	2.0	1.9	1.8	1.7	1.3	0.8	0.3	-
	±Reserve account	-	-	-	-	-1.0	-2.8	-2.8	-3.8	-2.7	-2.7	-2.7	-2.7	3.9	0.1	0.3	-
	CF bef. DS, Invest, & Fin	**177**	**-**	**-**	**-4.1**	**-1.8**	**5.1**	**5.2**	**4.3**	**5.5**	**5.5**	**5.6**	**5.7**	**12.5**	**8.3**	**8.5**	**-**
	− Initial Investment	-42	-	-	-	-41.7	-	-	-	-	-	-	-	-	-	-	-
	− Replacement Cost	-33	-	-	-	-	-	-	-	-	-	-	-	-6.7	-	-	-
	＋Equity Investment	17	-	-	5.1	11.6	-	-	-	-	-	-	-	-	-	-	-
	＋PSIF	39	-	-	-	38.9	-	-	-	-	-	-	-	-	-	-	-
	Cash Flow bef. Debt Service	**158**	**-**	**-**	**1.0**	**7.0**	**5.1**	**5.2**	**4.3**	**5.5**	**5.5**	**5.6**	**5.7**	**5.8**	**8.3**	**8.5**	**-**
	−Interest Expense	-26	-	-	-	-	-2.0	-2.0	-2.0	-2.0	-1.9	-1.8	-1.7	-1.3	-0.8	-0.3	-
	−Principal Repayment	-39	-	-	-	-	-	-	-	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-
	Cash Flow aft. Debt Service	**93**	**-**	**-**	**1.0**	**7.0**	**3.1**	**3.2**	**2.3**	**1.4**	**1.6**	**1.8**	**1.9**	**2.4**	**5.4**	**6.1**	**-**
	−Dividend	-76	-	-	-	-	-	-3.1	-4.2	-2.8	-1.6	-1.8	-1.9	-2.4	-5.4	-4.4	-0.0
	−Equity Return	-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-16.7
	Net Cash Flow	**-**	**-**	**-**	**1.0**	**7.0**	**3.1**	**0.1**	**-1.9**	**-1.3**	**0.0**	**0.0**	**0.0**	**-0.0**	**-0.0**	**1.7**	**-16.7**
Bal-ance Sheet	Unrestricted Cash		-	-	1.0	8.0	11.1	11.2	9.3	8.0	8.0	8.0	8.0	8.0	8.0	16.7	-
	Cash in Reserve A/Cs		-	-	-	1.0	3.8	6.5	10.3	13.1	15.8	18.5	21.2	1.5	1.3	-	-
	Total Asset		**-**	**-**	**1.0**	**50.7**	**54.7**	**55.6**	**55.7**	**55.2**	**56.0**	**56.8**	**57.6**	**60.3**	**34.7**	**16.7**	**-**
	PSIF		-	-	-	38.9	38.9	38.9	38.9	36.9	34.8	32.8	30.7	20.5	10.2	-	-
	Total Liability		**-**	**-**	**-**	**38.9**	**38.9**	**38.9**	**38.9**	**36.9**	**34.8**	**32.8**	**30.7**	**20.5**	**10.2**	**-**	**-**
	Paid in Capital		-	-	5.1	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	-
	Retained Earnings		-	-	-4.1	-4.9	-0.9	0.0	0.0	1.6	4.5	7.3	10.2	23.1	7.7	0.0	-
	Total Equity		**-**	**-**	**1.0**	**11.8**	**15.8**	**16.7**	**16.8**	**18.3**	**21.2**	**24.1**	**26.9**	**39.8**	**24.4**	**16.7**	**-**
Ra-tios	DSCR ("Total" column = LLCR)	2.14	-	-	-	-	2.58	2.61	2.18	1.36	1.41	1.47	1.53	1.71	2.88	3.62	-
	Equity to Debt+Equoity		0%	0%	100%	30%	30%	30%	30%	31%	32%	34%	35%	45%	62%	100%	0%

Chapter 6 Project Evaluation

6.1 Technical Evaluation

This is the first project for sludge recycling in Vietnam. The Study Team proposes the Bio-solid Processing Center with hybrid process of sludge drying which consists of "Solar Green House" and "Mechanical Thermal Sludge Dryer". In the discussion in Chapter 2, it is estimated that the cost of the process is reasonable and it will be operated effectively.

The offtaker of the Dry Sludge is proposed to be But Son Cement Company. At present, But Son Cement Company is considering the offtake of the Dry Sludge positively, however, the company has still considered conditions of the offtake, and it may take a few years to achieve the agreement through many discussions and technical considerations. Under these situations, the Study Team is considering a plan of JICA technical assistant program on promotion of sludge recycling activities for smooth implementation of the Project

6.2 Financial Evaluation

In the Study, the service charge of the BOT Project is estimated at 133 US$/ton of dewatered sludge, in order to achieve the Equity IRR of 15%. It is equivalent to 0.058 US$/$m^3$ of wastewater. The service charge of wastewater treatment service (including replacement cost) is expected between 0.243 – 0.447 US$/$m^3$ (0.248 US$/$m^3$ in average), which are depending on scale of WWTP. It means the service charge of the sludge recycling is additionally required around 13 – 24 % of service charge of wastewater treatment. The Project FIRR (Financial rate of Return) is estimated around 12 %. The Project shall be financially quite feasible, if proposed service charge is accepted by HPC.

6.3 Economic Evaluation

At present, dewatered sludge is disposed (landfilled) at Nam Son Landfill site and Tieu Ky disposal site. The cost of the landfill is low at the present, however, it is supposed to be forbidden near future, because of land availability and environmental reason. In the Study, it is assumed that the landfill of the dewatered sludge will be forbidden and the dewatered sludge should be dried to reduce the volume. Under theses conditions, the Study Team proposed the BOT Project, which adopts the lowest cost method of sludge drying.

The service cost of the BOT Project is estimated around 133 US$/ton, which is much higher than the current disposal cost of dewatered sludge. In the current conditions in Hanoi, the landfill cost is estimated less than 50 US$. If there is a possibility of disposal/ landfill of dewatered sludge outside of the dyke in Hanoi, the economic benefit is not expected to meet the cost of the BOT Project. Only in the case that landfill site is not available, or the land cost become much more expensive, the economic benefit will meet the cost of the BOT Project, and will become economically feasible.

6.4 Environmental and Social Evaluation

It is proposed that a Feasibility Study will be conducted after the approval of the BOT scheme. An Environmental Impact Assessment (EIA) will be carried out during the F/S. An Environmental Management Plan (EMP) will also be prepared to address any negative impact found.

A preliminary environmental assessment indicates the following positive and negative impacts.

Positive impacts

- Proposed project will ensure much better environmental disposal of sewage sludge compared to land filling.
- The project will provide opportunities for resources recovery (fuel, soil nutrient).
- This project will also contribute to global warming reduction by reducing methane production as compared to land filling.

Negative impacts

- Offensive odor if buffer zone is not maintained properly
- Heavy metals might accumulate in soil, if dried sludge is used as soil conditioner.

The project location is selected in a way to ensure the required buffer zone as required by the Vietnamese law. So, odor will not be an issue.

To understand the chemical composition of the dewatered sludge, JICA Study Team carried out chemical analysis during April 2011 by taking dewatered sludge samples from 3 existing WWTPs, namely, Kim Lien, Truc Bach, and North Thang Long. The result is shown in the following table. The result shows that only Hg cross the allowable limit.

Table 6.5.1 Chemical Composition of Dewatered Sludge

Parameter	Unit	Kim Lien **WWTP**	Truc Bach **WWTP**	North Thang Long **WWTP**	**Maximum allowable limit by Japanese Standard** *1	**Note**
Cd	mg/kg	1.65	1.83	1.54	0.005%	
Ni	mg/kg	61.26	37.1	181.55	0.03%	
Pb	mg/kg	67.45	77.68	91.04	0.01%	
Cr	mg/kg	88.65	37.1	181.55	0.05%	
Hg	mg/kg	22.96	12.51	11.52	0.0002%	NG

Source: JICA Study Team

*1: There is not Vietnamese fertilizer official standard on sewage sludge, so Japanese standard is applied.

6.5 Institutional Evaluation

The SPC is the executor of the BOT Project. The SPC will outsource his major works, such as F/S preparation and approval, Design and Construction, and O&M, to reliable companies, and the SPC will take all responsibilities of the works. The work performance will highly depend on selection of the outsourcing companies. The outsourcing companies shall be selected carefully.

Chapter 7 Qualifications of the Proposal/ Risk Management

7.1 Risk Matrix

The risk matrix of the BOT Project is shown in Table 7.1.1.

Table 7.1.1 Risk Matrix (BOT Project)

Phase	Classification	Risk	Impact to the project	Comment	SPC	HPC	Insurance
Common	Financial Arrangement		Cost increase Project delay/halt		○		
	Site	Land contamination, defect and so on	Cost increase Project delay/halt	If the risk occurs due to grounds attributable to SPC, SPC is to bear the risk and the cost.		○	
		The choice of the proper site for the facility	Project delay/halt Project termination	If the risk occurs due to grounds attributable to SPC, SPC is to bear the risk and the cost.		○	
	Licenses and charters	The delay on procedures for setting up JC and gaining licenses	Cost increase Project delay/halt		○		
	Change of laws	The change or establishment of regulations and laws related to the construction, operation and maintenance for the facility	Cost increase Project delay/halt	JC is incapable of controlling the situation		○	
		Except above, the change or establishment of regulations and laws applied in general	Cost increase Project delay/halt	JC is incapable of controlling the situation The scope for the risk JC takes is to be determined in the documentation	△	△	
	Tax reforms	The change of the tax coverage and tax rate, or the establishment of the new tax code	Cost increase Project delay/halt	JC is incapable of controlling the situation	—	○	
	Licenses	The delay on gaining licenses which HPC should proceed	Cost increase Project delay/halt			○	
		The delay on gaining licenses which SPC should proceed	Cost increase Project delay/halt		○		
		Incapable of gaining licenses caused by HPC	Project termination			○	
		Incapable of gaining licenses caused by SPC	Project termination		○		
	Politics	The policy change and political matter	Project delay/halt Project termination	JC is incapable of controlling the situation		○	
	Sabotage and pressure by industrial group	The difficult situation to continue the facility operation caused by the acts of sabotage by industrial group	Cost increase Project delay/halt Project termination			○	
	Infrastructure	Inadequate infrastructure to operate the facility, such as the lack of enough electricity, water supply, roads and so on.	Cost increase Project delay/halt Project termination			○	○
	Neighborhood	The lawsuits, claims and riots from neighborhood	Cost increase Project delay/halt Project termination	If the risk occurs due to grounds attributable to SPC, SPC is to bear the risk and the cost.		○	
	Environment	Environmental problems influenced by the instruction or requirement from HPC	Cost increase Project delay/halt Project termination			○	○

		Environmental problems caused by SPC conducts, for instance toxic substance release	Cost increase Project delay/halt Project termination		○		○
	Third party liability	The damage to the third party caused by the conduct attributable to HPC	Cost increase			○	○
		The damage to the third party caused by the conduct attributable to SPC	Cost increase		○	—	○
	Interest rate fluctuations		Cost increase	No assumption for borrowing	○		
	Foreign exchange fluctuations /Price fluctuations		Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
	Force majeure	Natural disaster, war, terror, strikes, riots, civil commotions and so on	Cost increase Project delay/halt Project termination	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	○
	HPC default		Cost increase Project delay/halt Project termination			○	
	SPC default		Cost increaseProject delay/haltProject termination		○		
Planning & design	Planning & design	The delay and the increase of the cost due to the significant design change, exceeding the demand standard, requested by HPC	Cost increase Project delay/halt			○	
		The request for the significant design change from SPC	Cost increase Project delay/halt		○		
Construction	Construction period	The delay on the completion date, or incompletion of the facility, caused by HPC	Cost increase Project delay/halt			○	
		The delay on the completion date, or incompletion of the facility, caused by SPC	Cost increase Project delay/halt		○		
	Construction cost	Cost overrun caused by HPC, for instance, the instruction issued by HPC	Cost increase			○	
		Cost overrun caused by SPC	Cost increase		○		
	Construction management	The failure on supervision of the construction process	Cost increase Project delay/halt		○		
	Damage to the facility	The damage to the facility caused by the contractor during the construction period expect the force majeure	Cost increase Project delay/halt		○		
		The damage to the facility caused by HPC during the construction period expect the force majeure (if any)	Cost increase Project delay/halt			○	
	Facility performance	Not to meet the requirement including shoddy construction	Cost increase Project delay/halt		○		

		Not to meet the qualification for performance test	Cost increase Project delay/halt		○		
	Cost control for the operation of the facility	The increase of the operation cost due to the poor management done by SPC	Cost increase	SPC offsets the risk with JC under O&M agreement	○		
		Price fluctuations/ foreign rate fluctuations	Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
	Replacement cost for the facility	Price fluctuations/ foreign rate fluctuations	Cost increase	The risk to be shared with the calculating formula in the Service Charge	○	○	
		The increase of the replacement cost due to the poor management done by SPC	Cost increase		○		
		The increase of the replacement cost due to more frequent replacements than estimated	Cost increase		○		
	Demand volatility	The volatility on the amount of dewatered sludge carried in to the facility	Cost increase	The risk to be shared with the calculating formula in the Service Charge (Capacity Payment)	○	○	
	Disposal of dry sludge	The refusal to accept the dry sludge from anyone despite the best efforts by SPC	Cost increase			○	
	Lower quality of the processed water (than the demand standard)	Not to meet the requirement for the ability/performance projected, caused by HPC	Cost increase Project delay/halt			○	
		Not to meet the requirement for the ability/performance projected, caused by SPC	Cost increase Project delay/halt		○		
		Not to meet the requirement for the ability/performance due to the force majeure	Cost increase Project delay/halt	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	
	Over capacity in the facility	To exceed the ability/capacity to process dry sludge in the facility	Project delay/halt	JC does not accept the excess sludge over capacity		○	
	Labor management	The negative reputation accompanied with the employee scandal, corruption,	Cost increase		○		
	Crisis management	Imperfect manuals for the crisis Disconnected communication in the crisis	Cost increase Project delay/halt		○		
		The increase of the cost caused by mismanaging the strikes, the natural disaster, the pandemic and so on	Cost increaseProject delay/halt		○		
	Damage to and deterioration of the facility, machines and equipment	The damage to the facility, machines and equipment caused by SPC misconduct	Cost increase	SPC offsets the risk with JC under O&M agreement	○		
		The damage to the facility, machines and equipment caused by HPC	Cost increase			○	○
		The damage to the facility, machines and equipment due	Cost increase Project delay/halt	The definition of "force majeure" needs to be discussed		○	○

		to the force majeure		JC is incapable of controlling the situation			
		The damage by having machineries and valuables stolen	Cost increase Project delay/halt		○		○
	Facility defect	The repair cost for fixing the defect discovered during the defect liability period	Cost increase Project delay/halt		○	—	—
		The repair cost for fixing the defect discovered beyond the defect liability period	Cost increase Project delay/halt		○	—	—
Termination	Contract termination (during the contract period and at the expiry of the contract)	Incapable of terminating the contract and operation	Cost increase		○		
		The increase of the cost at the termination of the contract, caused by HPC	Cost increase			○	
		The increase of the cost at the termination of the contract, caused by JC	Cost increase		○		
		The increase of the cost at the termination of the contract, due to the force majeure	Cost increase	The definition of "force majeure" needs to be discussed JC is incapable of controlling the situation		○	
	Title transfer	Not to meet the condition stipulated at the date of the title transfer	Cost increase		○		

APPENDIX-B2

Draft of Preliminary Terms and Conditions for Production and Offtake of Dry Sludge

Draft of Preliminary Terms and Conditions for Production and Offtake of Dry Sludge

(FOR DICCUSSION PURPOSE)

This document illustrates preliminary terms and conditions for production and offtake of dry sludge to be produced in the Yen So Bio-Solid Processing Center ("the Center") to be constructed.

Parties	Hanoi People's Committee ("HPC") and a special purpose company ("SPC") to be established for construction, operation, and maintenance of the Center under the BOT scheme ("Project").
Capacity of the Center	The Center shall have the capacity of drying Raw Sludge up to 185 ton per day ("Maximum Treatment Volume") and producing dry sludge ("Dry Sludge") up to 37 ton per day ("Maximum Production Volume").
Dewatered Sludge	The Center shall treat the Dewatered sludge to be produced and transported from the following waste water treatment facilities ("Source WWTPs"): Eight wastewater treatment plant: 1) Truc Bach WWTP, 2) Kim Lien WWTP, 3) North Thang Long WWTP, 4) Yen So WWTP, 5) Ho Tay WWTP, 6) Bay Mou WWTP , 7) Phu Do WWTP and 8) Yen Xa WWTP
Moisture Contents of Sludge	Dewatered Sludge (Input): not more than 82% Dry Sludge (Output): not more than 10%
Schedule of the Project	Establishment of SPC: September, 2013 Commencement Date of Production and Offtake: January, 2016 End Date of Production and Offtake: December, 2037

Operation Period	Period from the commencement date of Production and Offtake to the end date thereof.
Basic obligations of SPC	The Basic obligations of SPC include the following: 1. To complete the Center before the Planned Commencement Date of Production and Offtake 2. To produce the Dry Sludge up to certain amount not exceeding the Maximum Production Volume during Operation Period, subject enough supply of Raw Sludge by HPC 3. To own, operate and maintain the Center during the Operation Period observing the operational standard to be defined later 4. To transfer the Center to HPC immediately after the Project Period [without any consideration thereof] 5. To cooperate with HPC for the day to day operation of the Center in accordance with the Daily Operating Procedure and Dry Sludge Offtake Procedure 6. To obtain and maintain necessary permits and approvals which are necessary to fulfill the obligations of SPC hereunder and are appropriate to be obtained and maintained by SPC
Basic Obligations of HPC	The Basic obligations of HPC include the following 1. To deliver the land with necessary utilities (water supply and power supply utilities) for SPC to design, construct, own, operate and maintain the Center without any consideration, without any charge and without any encumbrance for SPC. 2. To supply the Dewatered Sludge up to the amount not exceeding Maximum Treatment Volume and in accordance with the Daily Operating Procedure. 3. To transport the Dewatered Sludge from the sites of the Source WWTPs to the site of the Center 4. To pay the Service Charge in accordance with the

	conditions of payments thereof. 5. To own the Center from SPC immediately after the Project Period 6. To cooperate with SPC for the day to day operation of the Center in accordance with Daily Operating Procedure and Dry Sludge Offtake Procedure 7. To obtain and maintain necessary permits and approvals which are necessary to fulfill the obligations of HPC and SPC hereunder and are appropriate to be obtained and maintained by HPC. 8. To support SPC to obtain and maintain necessary permits and approvals which are necessary to fulfill the obligations of SPC hereunder and are appropriate to be obtained and maintained by SPC
Daily Operating Procedure	[to be defined later. including day to day procedure to determine I]the treatment/production volume of the Center and ii)the schedule for scheduled maintenance.]
Dry Sludge Offtake Procedure	[to be determined later, the outline being described in Attachment 1]
Service Charge	HPC shall pay to SPC Service Charge calculated in accordance with the formula described in Attachment 2
Remarks	THIS DOCUMENT WAS PREPARED AS A DRAFT FOR PRELIMINARY DICUSSION ONLY. ANY PARTY IS NOT BOUND BY THE TERMS AND CONDISIONS HEREIN. IN ADDITION, DESCRIPTIONS HEREIN ARE NOT COMPLEHENSIVE MAY CHANGE, AND INTENTIONALLY OMIT CERTAIN CLAUSES WHICH ARE USUALLY INCLUDED IN THIS TYPE OF DOCUMENTS, INCLUDING “EVENT OF DEFAULTS”, “GOVERNING LAWS”, “COVENANTS”, “REPRESENTATIONS AND WARRANTIES”, ETC..

Attachment 1: Dry Sludge Offtake Procedure

1 Continuous Marketing of Potential Dry Sludge Offtakers

1.1 SPC's Responsibility for Marketing

SPC shall be responsible to continuously make efforts which it can reasonably do, to research, find, contact, and negotiate with the potential offtakers of the Dry Sludge around Hanoi City

As of the date when this document is prepared, the situation of the marketing efforts by the potential sponsors of SPC is as follows:

Potential Offtakers: But Son Cement Company

Situation of Negotiation; Waiting for answer from But Son Cement Company on the Proponent's proposal

Proposed Dry sludge offtake plan

Volume: 37 ton of dry sludge per day as maximum (The volume will depend on receiving volume of dewatered sludge from wastewater treatment plants in Hanoi)

Condition: The SPC will hand over the dry sludge to But Son Cement Company without any charge, and But Son Cement will transport the dry sludge from the Bio-solid Processing Center to the company with their own cost.

1.2 HPC's Support for Marketing

As long as SPC makes reasonable efforts as described in Clause 1.1 above, HPC shall continuously provide necessary supports for SPC to do the activities as described therein.

2 Preparation of Dry Sludge Offtake Plan

2.1 SPC's responsibility for Dry Sludge Offtake Plan

SPC shall be responsible for the preparation and implementation of a plan (the "Dry Sludge Offtake Plan") according to which the Dry Sludge is planned to be offtaken. The Dry Sludge Offtake Plan shall be prepared and submitted to HPC according to the following schedule:

i) By [6] months prior to the Operation Period, in relation to the whole Operation Period;

ii) By [3] months prior to each operating year in the Project Period, in relation to the next operating year; and

iii) By [2] month prior to each quarter of operation in the Project Period, in relation to the next 2 consecutive quarter of operation (required only if the plan deviates from the annual plan as referred to in "ii)" above).

2.2 Contents of Dry Sludge Offtake Plan

The Dry Sludge Offtake Plan shall at least include the following contents and shall be required to be prepared considering i) to observe the applicable law in Hanoi ii) to maximize economical benefit for HPC, and iii)to minimize the environmental adverse effect.

i) Names and outline of business of the potential offtakers;

ii) Status of negotiation with and such potential offtakers;

iii) (Where appropriate) summary terms and conditions of offtake by such potential offtakers

iv) Dry sludge offtake plan (volume, price, cost, etc.) for the period;

v) Amount and period of which such shortfall shall be created, and measures which SPC is taking to minimize such shortfall, if there is a shortfall of the volume so offtaken according to the Dry Sludge Offtake Plan to the pre-agreed production volume.

2.3 Discussion on the Dry Sludge Offtake Plan

After submission by SPC of the Dry Sludge Offtake Plan, if HPC deems it necessary to discuss about the plan, HPC and SPC shall discuss the plan. If HPC and SPC agree that the plan can be improved in accordance with clause 1 above, SPC shall make efforts (which it can reasonably do before the beginning of the implementation of the plan) to improve the plan and submit it again to HPC.

3 HPC's backup for Offtake

If , despite the exercise of reasonable diligence by SPC, it cannot make all of the Dry Sludge offtaken by third parties, HPC shall offtake the shortfall ("Shortfall") of the Dry Sludge not being offtaken, if and to the extent that i)such shortfall materially adversely affects the ability of SPC to operate the Center, ii)SPC has taken all reasonable due care and reasonable alternative measures in order to avoid the effect of such shortfall on SPC's ability to operate the Center iii) such shortfall is not the direct or indirect result of the failure of SPC to perform any of its obligations hereunder, and iv) SPC has given HPC prompt notice describing such shortfall and its effect upon the ability of SPC to operate the Center.

4 Dry Sludge Offtake Fee and Cost

4.1 Fees

All fees receivable in relation to the offtake of Dry Sludge shall be on account of HPC.

4.2 Costs

All costs payable in relation to the offtake of Dry Sludge shall be on account of the parties as described below:

i) Up to [****] per year, on account of SPC

ii) Costs after applying "i)" above is on account of HPC

Attachment 2: Service Charge payment Formula

1 Payment Structure

The Service Charge to be paid shall consist of three parts, as follows

1.1 Variable Payment

This Part of the Service Charge shall represent payment for the actual volume to treat the Raw Sludge and shall consist of Component A 1and Component A2.

1.2 Availability Payment

This Part of the Service Charge shall represent payment for the availability (capacity) to treat the Raw Sludge and shall consist of Component B1, Component B2, Component B3, and Component B4.

1.3 Other payment

[Start up charge, additional charge if Raw Sludge from Source WWTPs does not meet the Quality of Raw Sludge etc., to be defined later]

2 Payment Formulas

2.1 Variable Payment

2.1.1 Component A1

Component A1 is designated to cover variable and foreign currency indexed O&M Cost (e.g.: imported fuel)

For each billing period, Component A1 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component A1n} = \text{TVn} * \text{A1R} * (\text{UCPI[UWPI]n}/\text{UCPI[UWPI]}) * \text{EXn} / \text{EX}}$$

Where:

Component A1n = Amount to be paid as Component A1 for billing period n

TVn = Actual treatment volume of sludge in the Center for billing

		period n
A1R	=	Component A1 unit charge in VDN per m^3, which shall be pre-determined
UCPI[UWPI]n	=	Consumer [Wholesale] Price Index for USA applicable for the billing period
UCPI[UWPI]	=	Consumer [Wholesale] Price Index for USA when A1R, B1R, and B3R is determined
EXn	=	Exchange rate to exchange 1 [US Dollar] to Vietnam Don for the billing period
EX	=	Exchange rate to exchange 1 [US Dollar] to Vietnam Don when A1R, B1R, and B3R is determined

2.1.2 Component A2

Component A2 is designated to cover variable and VDN indexed O&M Cost (e.g.: utility)

For each billing period, Component A2 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component A2n} = \text{TVn} * \text{A2R} * (\text{VCPI[VWPI]n}/\text{VCPI[VWPI]})}$$

Where:

Component A2n	=	Amount to be paid as Component A2 for billing period n
TVn	=	See 2.1.2
A2R	=	Component A2 unit charge in VDN per m^3, which shall be pre-determined
VCPI[VWPI]n	=	Consumer [Wholesale] Price Index for Vietnam applicable for the billing period
VCPI[VWPI]	=	Consumer [Wholesale] Price Index for Vietnam when A2R, B2R, and B4R is determined

2.2 Availability Payment

2.2.1 Component B1

Component B1 is designated to cover fixed and foreign currency indexed O&M Cost (e.g.: cost for imported spare parts)

For each billing period, Component B1 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component B1n} = \text{TCn} * (\text{Hn} / \text{Ha}) * \text{B1R} * \text{AFn} * \{100\% + (\text{AFn} - \text{AFpn}) * \text{ADB1\%}\} * (\text{UCPI[UWPI]n}/\text{UCPI[UWPI]}) * \text{EXn} / \text{EX}}$$

Where:

Component B1n	=	Amount to be paid as Component B1 for billing period n
TCn	=	Treatment capacity of the Center as most recently determined and applicable for the billing period n, which in principle do not exceed Maximum Treatment Capacity
Hn	=	Total Hours in the billing period n
Ha	=	Hours in the year in which the billing period falls in
B1R	=	Component B1 unit charge in VDN per m^3 per year, which shall be pre-determined
AFn	=	Actual availability factor for the billing period
AFpn	=	Projected availability factor for the billing period as agreed between HPT and SPC
ADB1%	=	If AFn > AFpn [**] %, which represents additional charge percentage for exceeding the planned availability factor (AFpn) for the billing period If AFn < AFpn, 0%

UCPI[UWPI]n, UCPI[UWPI], EXn, EX = See 2.1.1

2.2.2 Component B2

Component B2 is designated to cover fixed and domestic O&M cost

For each billing period, Component B2 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component B2n} = \text{TCn} * (\text{Hn} / \text{Ha}) * \text{B2R} * \text{AFn} * \{100\% + (\text{AFn} - \text{AFpn}) * \text{ADB2\%}\} * (\text{VCPI[VWPI]n}/\text{VCPI[VWPI]})}$$

Where:

Component B2n = Amount to be paid as Component B2 for billing period n

TCn, Hn, Ha, AFn, AFpn = See 2.2.1

B2R = Component B2 unit charge in VDN per m^3 per year, which shall be pre-determined

ADB2% = If AFn > AFpn [**] %, which represents additional charge percentage for exceeding the planned availability factor (AFpn) for the billing period

If AFn < AFpn, 0%

VCPI[VWPI]n, VCPI[VWPI] = See 2.1.2

2.2.3 Component B3

Component B3 is designated to cover foreign currency denominated capital cost

For each billing period, Component B3 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component B3n} = \text{TCn} * (\text{Hn} / \text{Ha}) * \text{B3R} * \text{AFn} * \{100\% + (\text{AFn} - \text{AFpn}) * \text{ADB3\%}\} * \text{EXn} / \text{EX}}$$

Where:

Component B3n = Amount to be paid as Component B4 for billing period n

TCn, Hn, Ha, AFn, AFpn = See 2.2.1

B3R = Component B4 unit charge in VDN per m^3 per year, which shall be pre-determined

ADB3% = If AFn > AFpn [**] %, which represents additional charge percentage for exceeding the planned availability factor

(AFpn) for the billing period

If AFn < AFpn, [**%], which represents penalty percentage for not achieving the planned availability factor (AFpn) for the billing period

EXn, EX = See 2.1.1

2.2.4 Component B4

Component B4 is designated to cover VDN denominated capital cost

For each billing period, Component B4 is the amount calculated in accordance with the following formula:

$$\boxed{\text{Component B4n} = \text{TCn} * (\text{Hn} / \text{Ha}) * \text{B4R} * \text{AFn} * \{100\% + (\text{AFn} - \text{AFpn}) * \text{ADB4\%}\}}$$

Where:

Component B4n = Amount to be paid as Component B4 for billing period n

TCn, Hn, Ha, AFn, AFpn = See 2.2.1

B4R = Component B4 unit charge in VDN per m^3 per year, which shall be pre-determined

ADB4% = If AFn > AFpn [**] %, which represents additional charge percentage for exceeding the planned availability factor (AFpn) for the billing period

If AFn < AFpn, [**%], which represents penalty percentage for not achieving the planned availability factor (AFpn) for the billing period

APPENDIX-C

Documents of Working Groups & Seminar

1st Working Group

(17 May 2011)

Working Group Progress Meeting (1) on 17th May, 2011

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

- Regulatory Flame 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

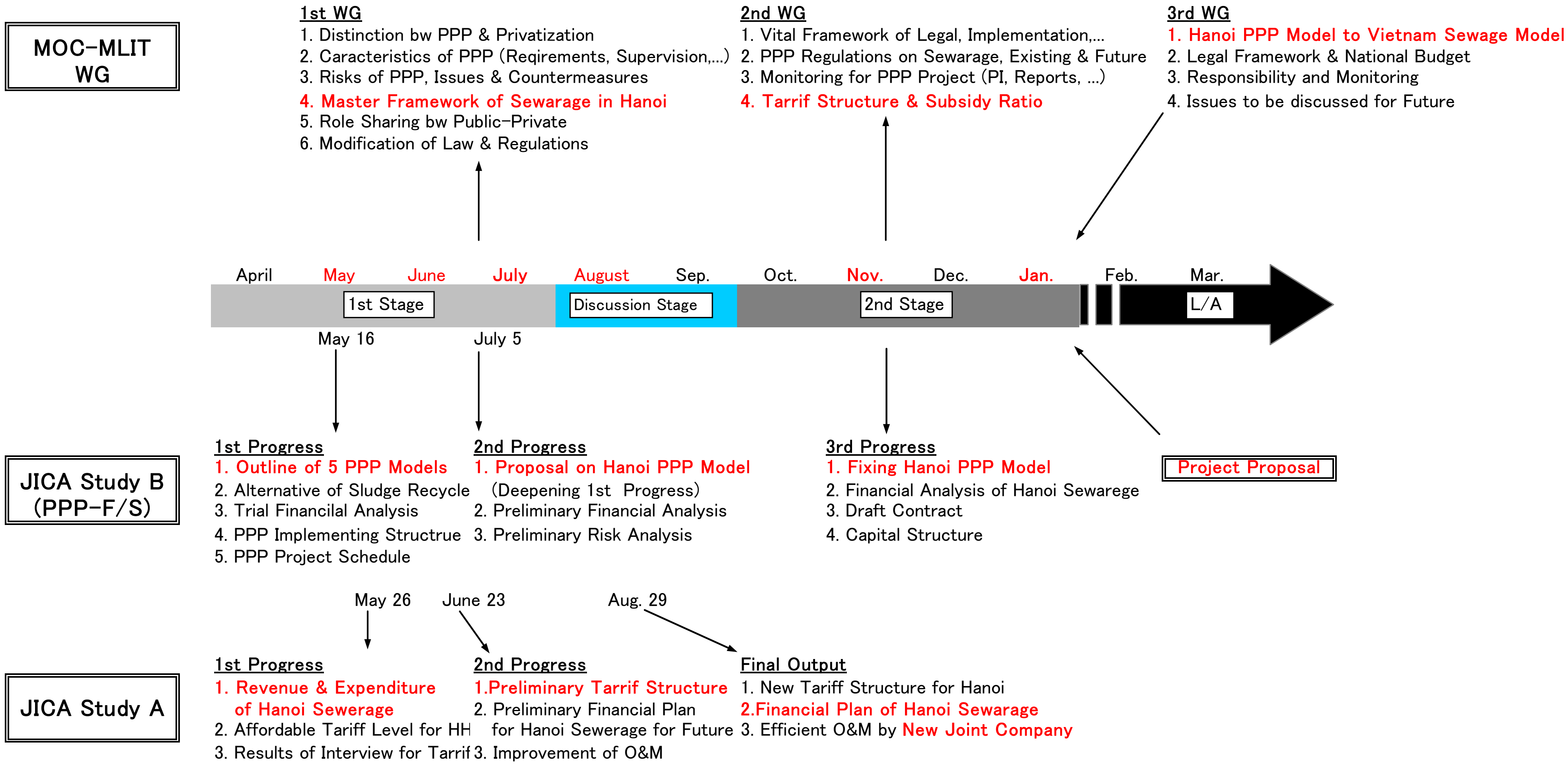
(5) Five (5) PPP Models
- Classification of 5 PPP Models
- Comparison of 5 PPP Models

(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 Sewarage 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;

17th May	First Progress Meeting
5th July	Second Progress Meeting
Someday, July	PPP Lectures
21st 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

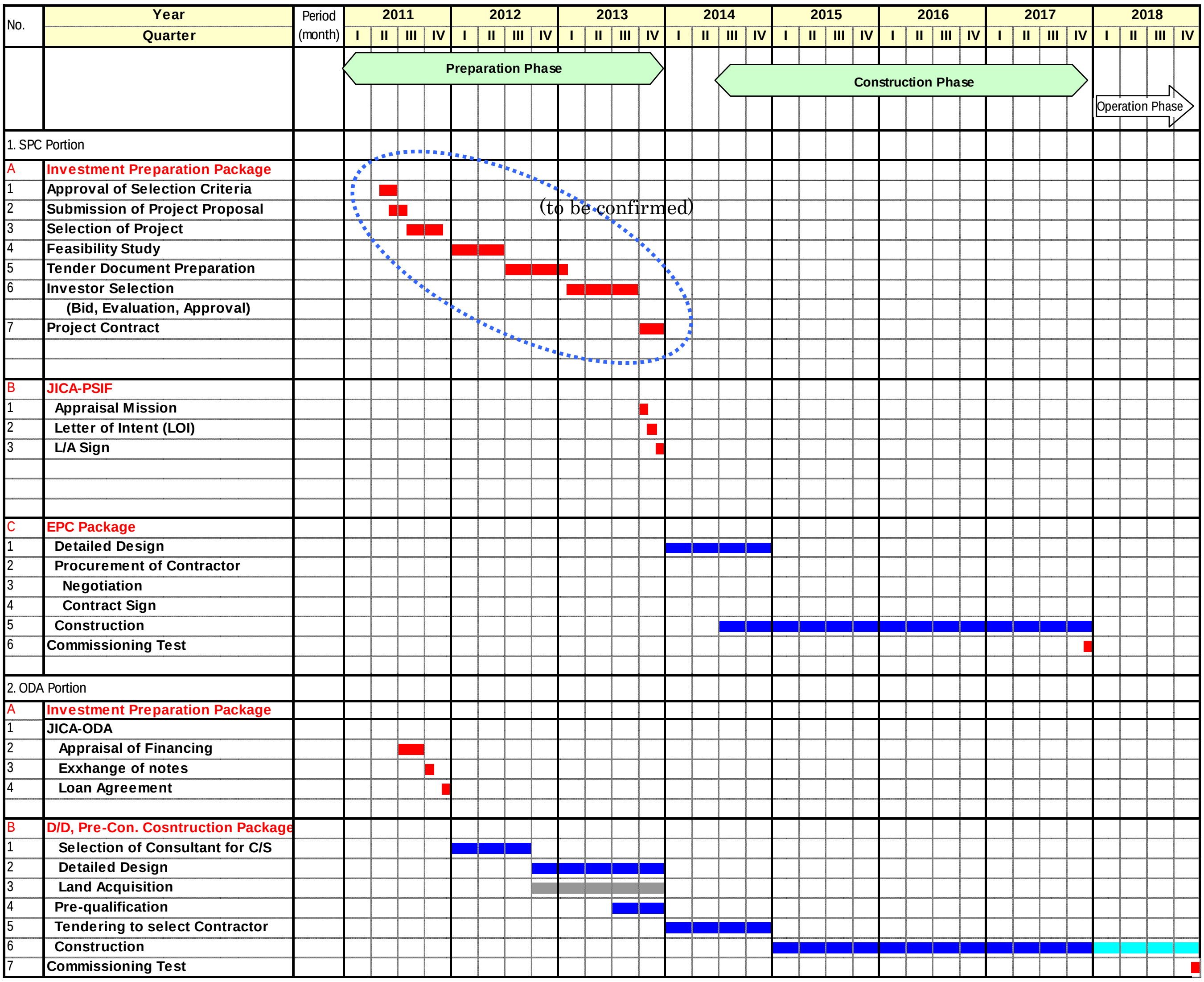


Table-2 Work Schedule of Study-B, Phase 1 "Formulation of Proposal on PPP Sewerage Project (Hanoi Model)"

		Study Team	Counterpart	April	May	June	July	August
1)	Study on Current Condition and Future Plan of SewerageDevelopment in Hanoi							
1-1)	Social Condition and Relevant Policies	OR						
1-2)	Review and Analysis of Relevant PPP Laws							
	Collection and Review and of Relevant PPP Laws	OR, PWC						
	Analysis of Current Problems and Recommendation	PWC						
1-3)	Study on Current Condition and Alalysis of Problems of Water and Sewerage Sector	NK						
1-4)	Review of Relevant Laws and Regulation for Construction	NK						
1-5)	Survey for Trends of Activities of Private Companies and Donners in PPP Pprojects in Hanoi	NK						
2)	Study on Sewerage System Development in Hanoi							
2-1)	**Confirmation of Planning Condition and Alternative Study of Sludge Treatment and Recycling**							
	Current Situation and Problems, Sludge Generation Forecast, Study on Potential of Recycling Sludge Use, Study on Target Area of Sludge Collection	OR/NK						
	Proposal of 3 Alternative Plans for Additional Treatment and Alternative Study	OR/NK						
	Sludge Quality Analysis (Laboratory Test)	OR/NK						
	Study and Proposal for Suitable Sludge Treatment	OR						
2-2)	Study on Integrated Control and Monitoring System							
	Confirmation of Concept of Integrated System	HEL						
	Alternative Study for System Development	HEL						
	Basic Design	HEL						
2-3)	Study on Financial Obligation of Beneficiallies and Relevan Organizatins							
	Study on Suitable Sewerage Tariff Level of Domustic and Non-domestic Useres	PWC						
	Confirmation of Financial Condition of HPC and Financial Capacity for Preparation of Subsidy	PWC						
	Study on Options of Private Funds to the Project	PWC						
3)	Study on PPP Scheme							
3-1)	Study on Basic Condition of "Hanoi Model" of PPP Project							
	Data Collation/ Review/ Analysis of Similar Projects (Case Study)	NK/OR						
	Study on Basic PPP Scheme	NK/OR/PWC						
	Study on Task Allocation/ Risk Allocation	PWC						
3-2)	**Alternative Study of Four (4) PPP Models**							
	Confirmation of Conditions of Project Scheme	NK/OR/PWC						
	Preparation of Preliminary Business Plans (including Financial Model Study)	PWC						
3-3)	Proposal and Discussion for "Hanoi Model" of PPP Project							
	Formulation of "Hanoi Model" of PPP Project	PWC						
	Evaluation of Effects of PPP Introduction	PWC						
					1st Cost Estimate	2nd Cost Estimate		
4)	Preliminary Design and Cost Estimate							
4-1)	**Preliminary Design of Sludge Treatment Facilities**							
	Fixing Required Capacity, Scale and Type of facilities	OR						
	Layout Plan of Facilities	OR/NK						
4-2)	**Review of Design of Wastewater Treatment Facilities and Wastewater Collection System**							
	Preparation of Review Report	NK						
	Preparation of Alternative Design (if necessary)	NK						
4-3)	**Preliminary Design of Integrated Control and Monitoring System**							
	System Design	HEL						
	Preparation of Major Equipment List	HEL						
4-3)	**Construction Cost Estimate and Construction Schedule**							
	F/S Design Review	NK						
	Construction Cost Estimate of Wastewater Treatment Facilities	NK						
	Construction Cost Estimate of Sludge Treatment Facilities	OR/NK						
4-3)	**Operation, Maintenance and Replacement Cost Estimate**							
	O&M Cost of Wastewater Treatment Facilities	HEL						
	O&M Cost of Sludge Treatment Facilities	HEL						
	(including proposal for future O&M Method, and Replacement Plan for Equipments)							
6)	Final Confirmation and Arrangement in Phase 1							
	Preparation of Progress Report							
	Modification based on Comments							
	Final Confirmation and Arrangement through Discussions							
	Working Group Meeting (Study B)				5/17		7/5, 7/21	8/30

Working Group Meeting (Study A): 5/26; 6/20, 6/23, 6/28; 8/24, 8/29

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) Carbonaization, 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
Phase-1	**548,000**	**15,415 m**	**135,000 m^3/day**	(under the Study)
Overall	882,000	27,641 m	270,000 m^3/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
Construction Cost	114	220	Case-1	13	347
			Case-2	24	358
			Case-3	26	360
O&M Cost (Yearly)	-	5.6	Case-1	0.5	6.1
			Case-2	0.9	6.5
			Case-3	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) (milion. 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	Same as Model-2

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^3 (US$ 0.019/m^3)	0.75 million US$/ year (US$ 0.019 m^3 x 135,000 m^3/day x 80% x 365 days)	1.50 million US$/ year
Case-2 Affordable to Pay, based on around 1% of Household Income VND 1,564/m^3 (US$ 0.076/m^3) (4.0 times of Case 1)	3.00 million US$/ year (US$ 0.076 m^3 x 135,000 m^3/day x 80% x 365 days)	6.00 million US$/ year
Case-3 Affordable to Pay, based on around 2% of Household Income VND 3,600/m^3 (US$ 0.180/m^3) (9.5 times of Case 1)	7.10 million US$/ year (US$ 0.180 m^3 x 135,000 m^3/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

(28th Sep. – 7th Oct.) & (6th Nov. – 15th 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 (12th Oct. – 1st 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
10:00-1020	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

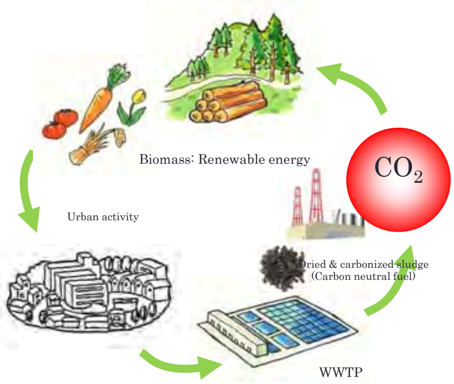
- Selection of sewage sludge reuse
  - Through Needs Survey on field and literature
- Concept of step-wised project programming
- Sludge treatment facility planning for recycle
  - Step-1:Selection of final sludge product
  - Step 2: Alternative study of sludge treatment process
- Alternative study of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

Sewage sludge reuse (1/2)

IPCC defines sewage sludge as “Renewable energy”.

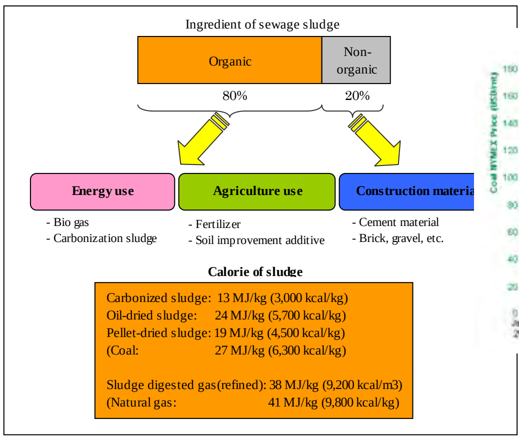
Sewage sludge is replaced to fossil fuel, therefore mitigates CO_2 & CH_4 emission in land fill site

Gas	Global warming potential
CO_2	1
CH_4	21
N_2O	310



Sewage sludge reuse (2/2)

contains calorie of approx. 60 % of coal



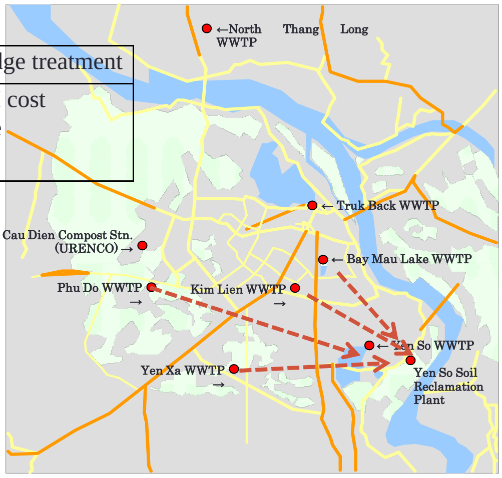
- Right: Coal price, New York Merchandize EX.50-80 USD/ton
- Left: Calorie of fuel sludge, Japan

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 sewage sludge treatment

	5 WWTP	6 WWTP
	Septage	Septage
Yen Xa WWTP ⇒	Yen Xa WWTP ⇒	Yen Xa WWTP

Natural treatment to artificial treatment due to sludge increase

Solar drying/Fuel use or Land fill ⇒ Fuel use

Concept of project programming (2/2)

Phasing	Alternative 1	Alternative 2&3
Long term	(Dried & Carbonized Fuel) Kim Lien, Truc Bac, Yen So, North Thang Long $\xrightarrow{\text{Sludge}}$ Yen So SC Phu Do → Yen So SC Septage → Yen So SC Yen Xa WWTP $\xrightarrow{\text{Sludge}}$ Yen So SC	(Dried & Carbonized Fuel) Kim Lien, Truc Bac, Yen So, North Thang Long $\xrightarrow{\text{Sludge}}$ Yen Xa WWTP Phu Do → Yen Xa WWTP Septage → Yen Xa WWTP
Phase 1	(Solar Drying Bed & Yen So Sludge Center) Yen Xa WWTP $\xrightarrow{\text{Sludge}}$ Yen So SC	(Dried & Carbonized Fuel) Yen Xa WWTP
Phase 2	(Dried & Carbonized Fuel) Kim Lien, Truc Bac, Yen So, North Thang Long $\xrightarrow{\text{Sludge}}$ Yen So SC Septage → Yen So SC Yen Xa WWTP $\xrightarrow{\text{Sludge}}$ Yen So SC	(Dried & Carbonized Fuel) Kim Lien, Truc Bac, Yen So, North Thang Long $\xrightarrow{\text{Sludge}}$ Yen Xa WWTP Septage → Yen Xa WWTP

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)
  ----------------- 1st priority
- Alternative 2: thickening – dewatering –drying (mechanical drying)
- Alternative 3: thickening – dewatering – carbonizing

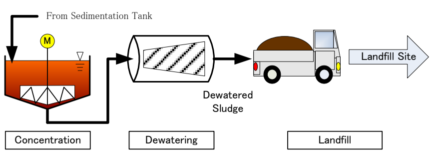
Sludge treatment facility planning (3/3)

Step 1: Primary Screening

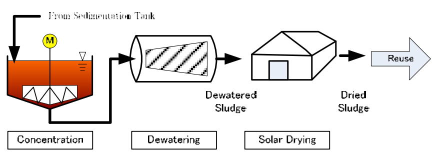
Final Form of Sludge Treatment	Estimation	Step 2
Landfill of Dewatered Sludge	Baseline (Current Condition)	○
Compost for Agriculture	Heavy Metals Accumulation in Soil High Competition against Kitchen Garbage Compost	×
Compost for Soil Conditioner (Solar Drying)	Low Cost, Sustainable	○
Dried Sludge Fuel 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

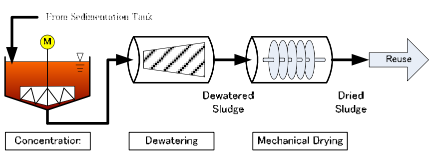
Base Model (Current Condition)



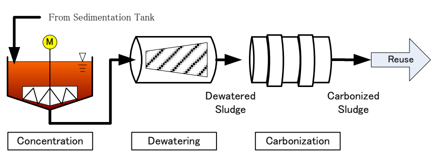
Alternative-1 (Solar Drying)



Alternative-2 (Dried Sludge Fuel)

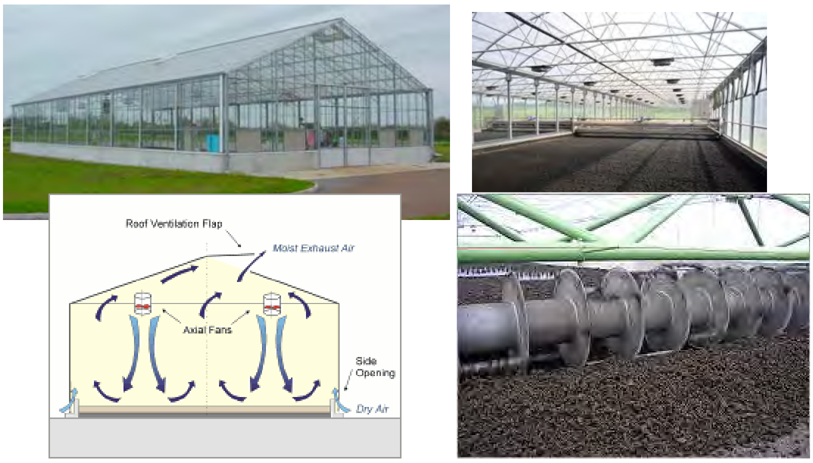


Alternative-3 (Carbonized Sludge Fuel)

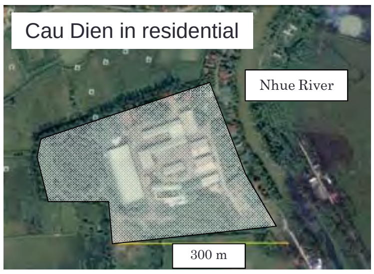


Solar green house of sewage sludge drying

- 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

2^{nd} Working Group

(15 July 2011)

Consideration of PPP Model for Sewerage System Development in Hanoi

July 15th, 2011

1

Purpose of the Study

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

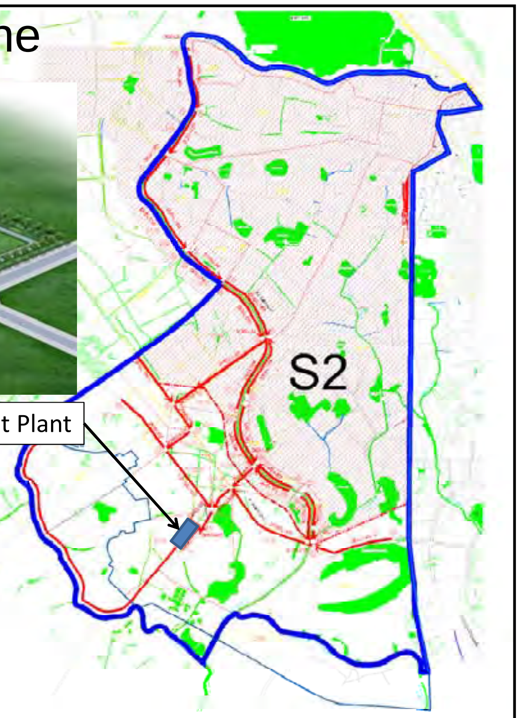
Topics

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

Project Outline

Image of Yen Xa Wastewater Treatment Plant



Project Outline	
Service Population	900,000
Service Area (ha)	4,874
Main Sewer Length (m)	27,641
Treatment Capacity (m^3/day)	270,000

Consideration of Sources for Funding, Repayment and Operation/ Maintenance

	Initial Construction Cost			Expenditure in Operation Period
Items of Cost	Pipe Network	WWTP	Sludge Recycling	OM Cost/ Replacement Cost
Payer (Source)	Central Government (Tax Income)	HPC (Tax Income)		Beneficiaries (Tariff Income)
Type of Payment	Initial Expenditure	Yearly Expenditure		Monthly Expenditure

Characteristic of Sewerage Project

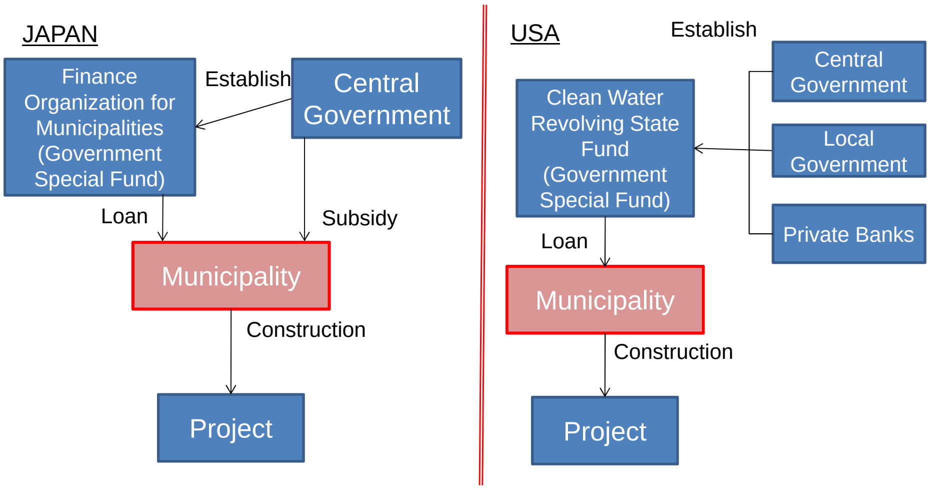
- Initial investment cost is huge, so Large amount of loan and subsidy is generally required.
- Sewerage tariff income is expected to cover OM costs, however, it can hardly cover repayment of initial investment cost. The financial gap is usually covered by tax income.

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%

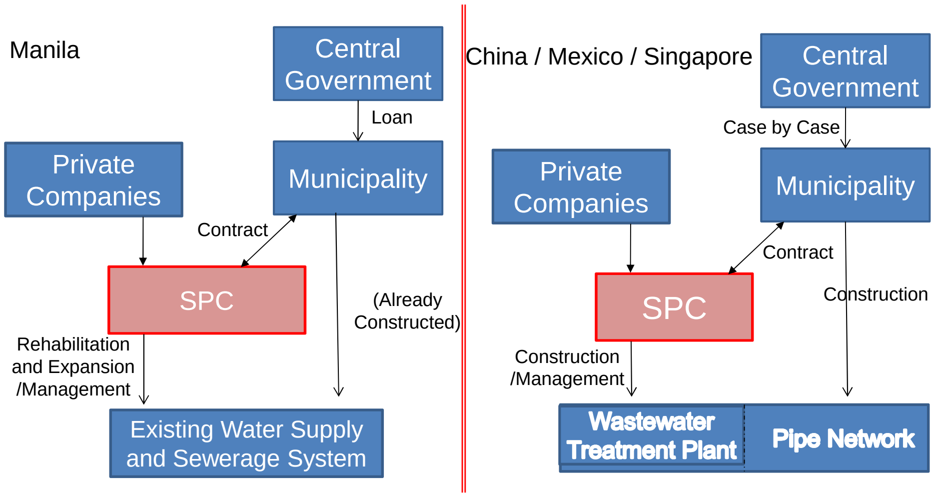
- From view point of fund preparation cost for HPC, "Central Government Subsidy " is the best option, and "HPC own budget" is the second best. However, total of these sources is not enough to cover the initial investment cost for the sewerage system development.
- If municipal pond is not available,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

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



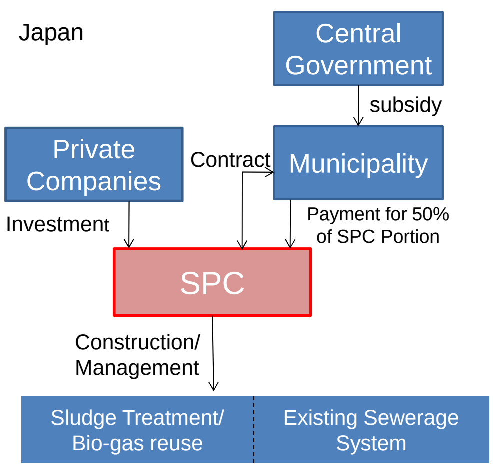
Both governments established organizations to provide low interest loan to municipalities for sewerage system development. This system is very useful for development of many municipalities in long term

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.

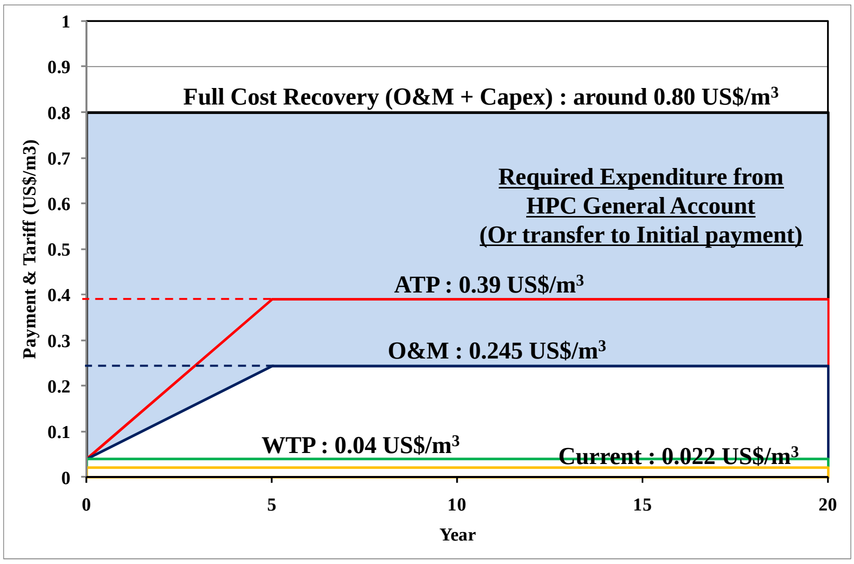
Alternatives of Source of Repayment, Operation/ Maintenance

	Financial Source of Repayment, O&M, etc.	Amount
1	Sewerage Tariff	4500 VND/m³ (0.022 US$/m³)
2	HPC Ordinary Account in 2011 budget	21 ,431 billion VND (1,023 million US$)

	Type	Amount
1	Current Sewerage Tariff	450 VND/m³ (0.022 US$/m³)
2	Current Water Tariff	4,500 VND/m³ (0.220 US$/m³)
3	For OM Cost Recovery	4,900 VND/m³ (0.235 US$/m³)
4	Full Cost Recovery (Initial and OM Cost)	16,800 VND/m³ (0.800 US$/m³)

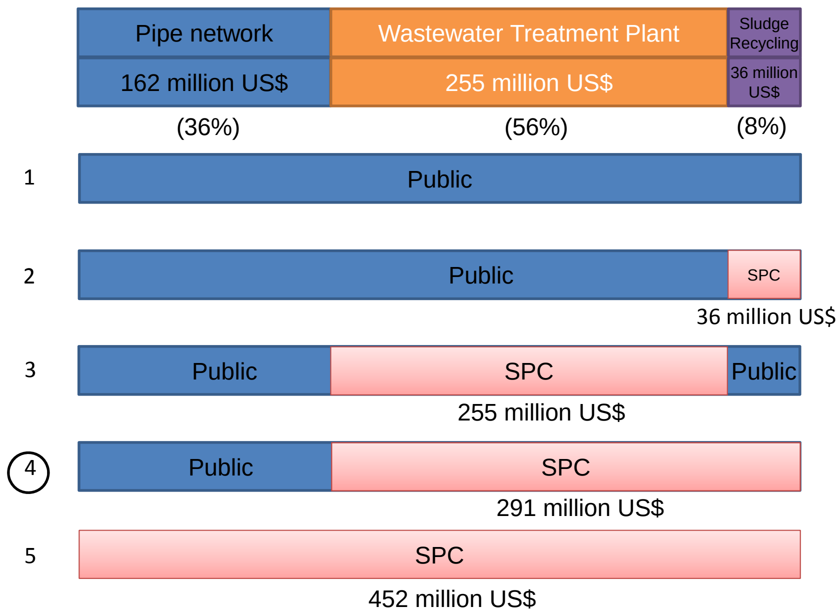
It is almost impossible to increase sewerage tariff to "Full Cost Recovery" level.

Financial Gap between Full Cost Recovery and Tariff Income



Study on PPP Model for Hanoi Sewerage

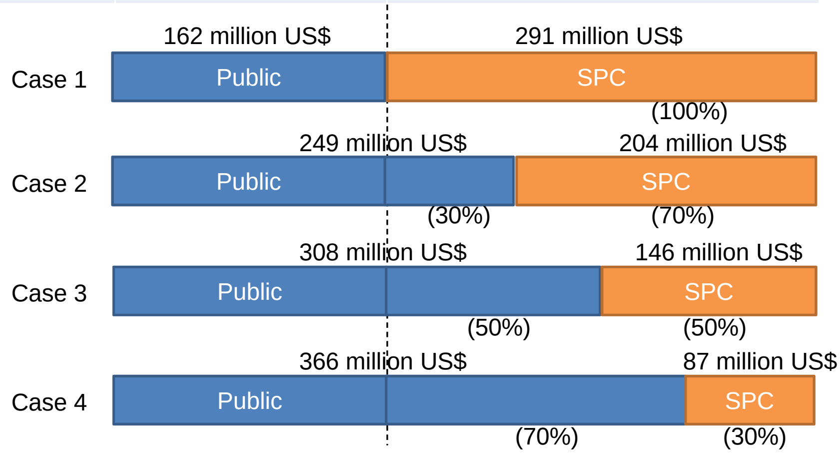
Scope Sharing between Public and SPC/ PPP 5 Models



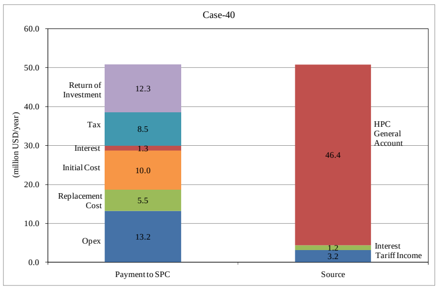
Consideration of Funding Source for Initial Investment

<u>Case Study: PPP Model - 4</u>

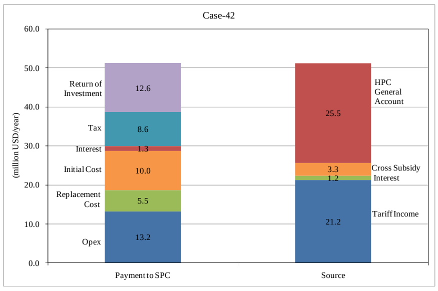
	Pipe Network	Wastewater Treatment Plant + Sludge Recycling Facility
Management	Public	SPC
Construction Cost	162 million US$	291 million US$



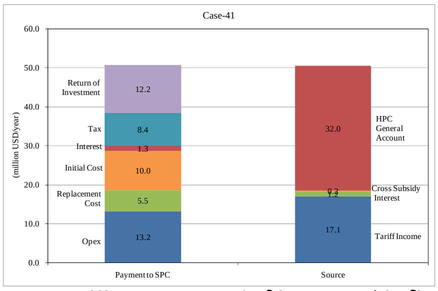
Financial Analysis: Case (Subsidy: 30%)



Tariff: 840 VND /m³(0.04 US$/m³)

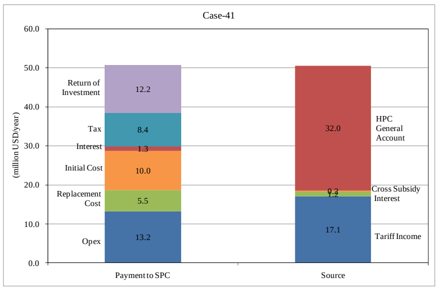


Tariff: 5145 VND /m³(0.245 US$/m³)

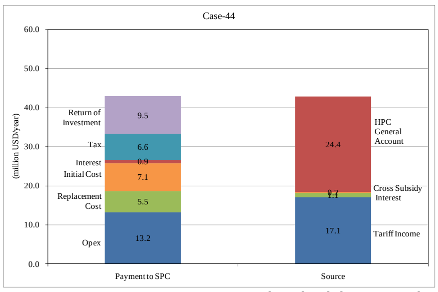


Tariff: 8190 VND /m³(0.39 US$/m³)

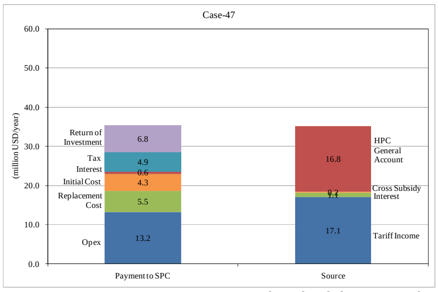
Financial Analysis: Case (Tariff: 5150 VND /m³)



(Subsidy: 30%)

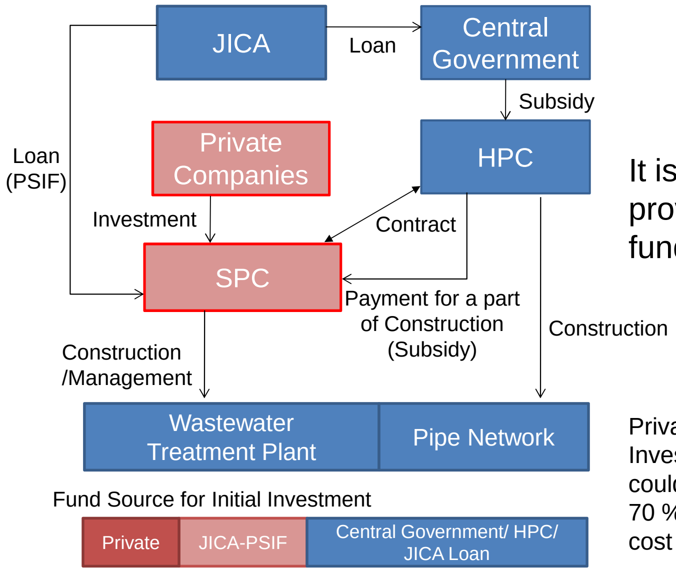


(Subsidy: 50%)



(Subsidy: 70%)

Draft Proposal of Hanoi PPP Model



It is proposed to provide low interest fund from JICA.

Private Sector Investment Fund (PSIF) could cover maximum 70 % of total investment cost of SPC

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

Thank you for your attention

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

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_2 & CH_4 emission in land fill site

Gas	Global warning potential
CO_2	1
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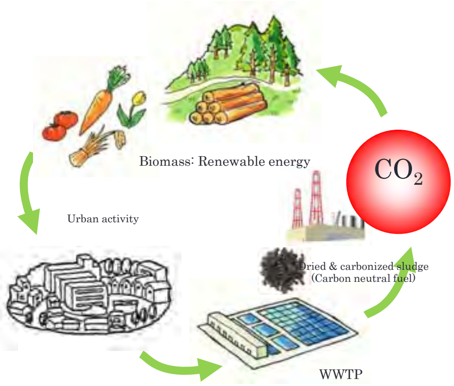
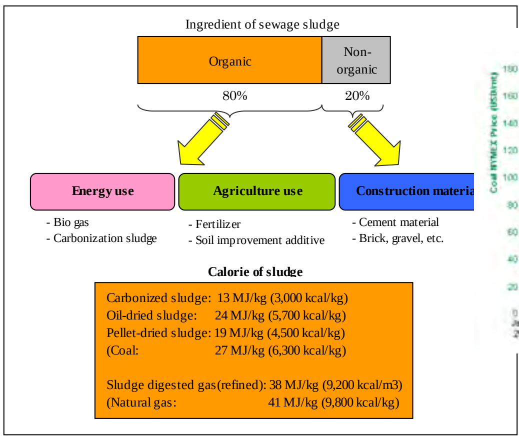


Sewage sludge reuse (2/2)

contains calorie of approx. 60 % of coal

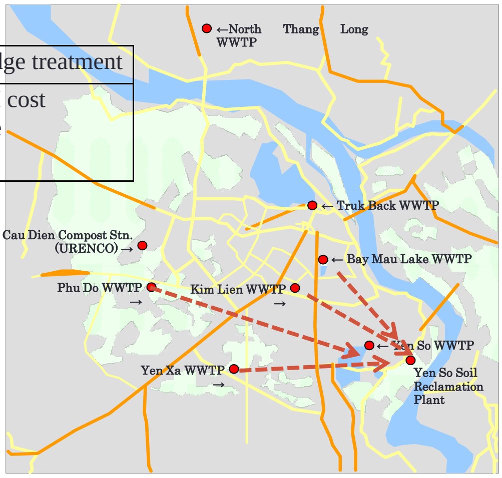


- Right: Coal price, New York Merchandize EX.50-80 USD/ton
- Left: Calorie of fuel sludge, Japan

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 sewage sludge treatment

Step 1	Step 2	Step 3
	5 WWTP	6 WWTP
	Septage	Septage
Yen Xa WWTP	Yen Xa WWTP	Yen Xa WWTP

Natural treatment to artificial treatment due to sludge increase

Solar drying/Fuel use or Land fill ⇨ Fuel use

Concept of project programming (2/2)

Phasing	Alternative 1	Alternative 2&3
Long term	(Dried & Carbonized Fuel) Kim Lien Truc Bac North Thang Long Phu Do Septage Sludge Yen Xa WWTP Sludge Yen So SC	(Dried & Carbonized Fuel) Kim Lien Truc Bac North Thang Long Phu Do Septage Sludge Yen Xa WWTP
Phase 1	(Solar Drying Bed & Yen So Sludge Center) Yen Xa WWTP Sludge Yen So SC	(Dried & Carbonized Fuel) Yen Xa WWTP
Phase 2	(Dried & Carbonized Fuel) Kim Lien Truc Bac North Thang Long Septage Sludge Yen Xa WWTP Sludge Yen So SC	(Dried & Carbonized Fuel) Kim Lien Truc Bac North Thang Long Septage Sludge Yen Xa WWTP

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 15th July

Part-1

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

Part-2

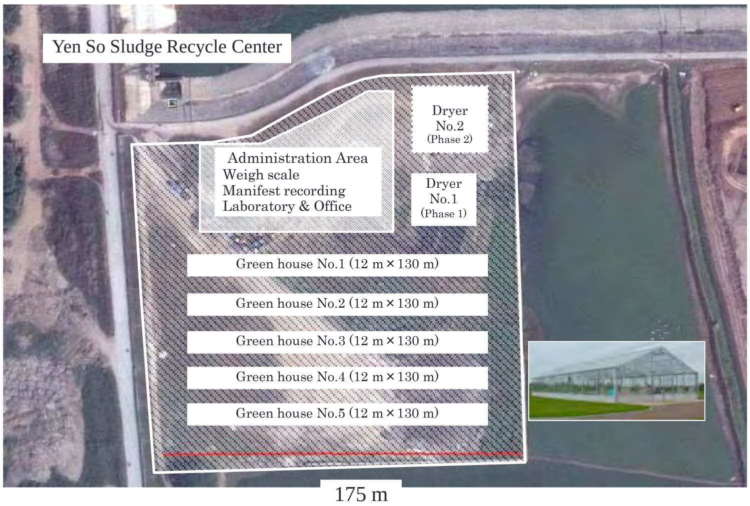
- Sludge Examination Plan

Continued to 3rd 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, 6dats solar-dried

Applicability of Solar Drying Technology (3)

Examples in Overseas

Solar Green House, EU

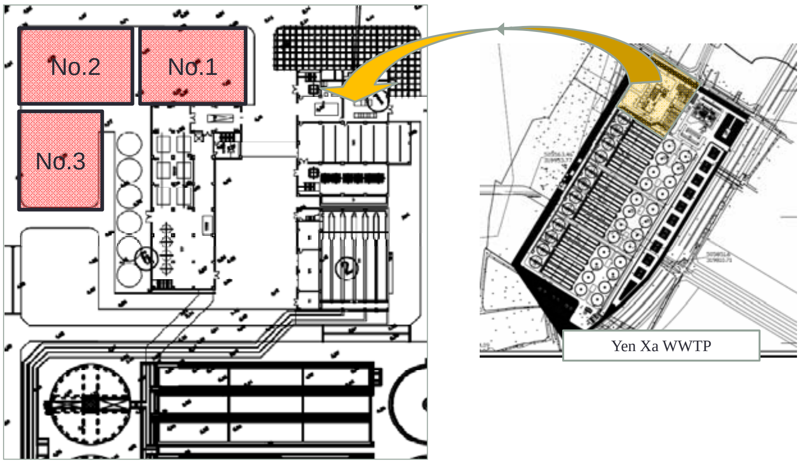
Solar Drying, Nong Khaem WWTP, Bangkok

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

Selection of SRC Site & Treatment Process(1)

Project Programming (1)

Yen So Sludge Recycling Center

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

Yen Xa WWTP

7 WWTP + Septage	Mechanical Dryer			No.4
			No.3	No.3
Yen Xa 270,000m^3/d		No.2	No.2	No.2
		No.1	No.1	No.1
Project Phase		Phase-1	Phase-2	Long Term
Wastewater Flow(m^3/day)		270,000	485,450	606,200
Produced Sludge (m^3/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^3/day)	Off
Solar Green House	On (108 m^3/day)	On (54 m^3/day)	On (108 m^3/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	Solar Drying "natural energy" + Mechanical Drying	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	**Sufficient distance from residences, however EIA required**	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	**Low**	Moderate
OM cost	**Low**	Moderate
Recommendation	**Recommendable**	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）	
Elements Analysis						
1	T- C	%	15.64	23.85	22.39	IET/ĐCMT 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(*)	mg/kg	10,853.52	3,644.52	9,352.81	EPA 3052-1996 SMEWW 3125-2005
Other Parameter						
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)

3rd 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

Oven

Carbonized Sludge

Sludge Examination Plan (8)

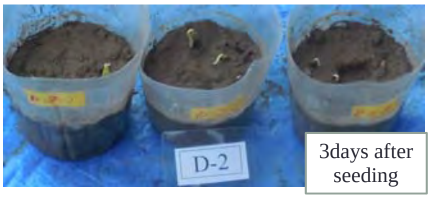
Germination Test

Test samples of mixed soil of
- Dried sludge
- Carbonized sludge

Seeding

Sludge Examination Plan (9)

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



3days after seeding

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

Thank you

3rd Working Group

(23 September 2011)

Working Group Meeting (23rd 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

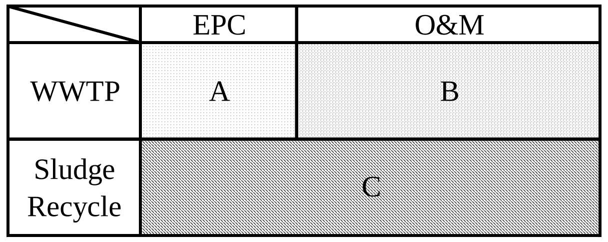
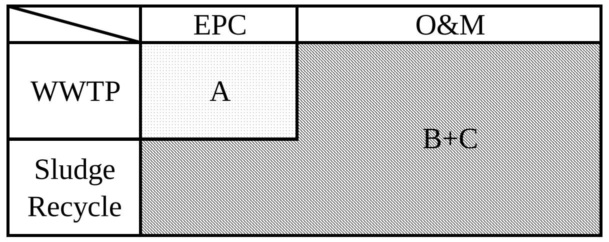
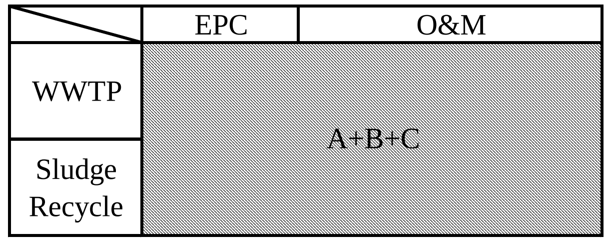
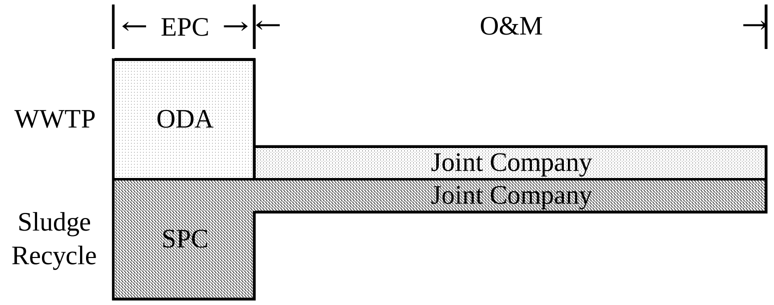
4) Confirmation of Scale of Sludge Recycling Facility

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

<table>
<tr><th>Option</th><th>Option-1
A / B / C</th><th>Option-2
A / B+C</th><th>Option-3
A+B+C</th></tr>
<tr><td>Outline</td><td>(A) Construction of WWTP,
(B) O&M of WWTP,
(C) Construction and O&M of Sludge Recycling Facility,

Each work is done separately.

</td><td>(A) Construction of WWTP
(B) O&M of WWTP + Construction and O&M of Sludge Recycling Facility are jointly done.

</td><td>(A) Construction and O&M of WWTP + Construction and O&M of Sludge recycling Facility are jointly done.

</td></tr>
<tr><td>Fund</td><td colspan="3">
</td></tr>
<tr><td>Merit</td><td>・ Ordinary ODA Loan system and familiar to all.</td><td>・ HPC have only to select 1 operator for whole O&M.
・ Better & sustainable sludge recycling can be secured.
・ HPC can get PSIF and TA through SPC.
・ HPC can establish JC for IOMS with SPC, and Training Center by Grant through SPC.</td><td>In addition to Option-2:

・ Through DBO, lifecycle cost is much lower than Option-1 because Quality of Construction and O&M can be secured from both sides.
・ It streamlines the bidding process and shortens period up to Operation.</td></tr>
<tr><td>Demerit</td><td>・ It takes longer time than DBO.
・ Operator cannot secure quality of construction.
・ Lifecycle cost is much higher than DBO.
・ SPC for Sludge Recycle cannot be feasible and no PSIF & T/A (Grant) for the Project.
(Sludge recycling contractor shall be the same as WWTP operator from the points of better & sustainable recycling.)</td><td>・ There is no big change from the standard procedures.</td><td>・ Sludge recycle have to be done completely under ODA process and it needs discussion internally in HPC.
・ If FS for Sludge recycle is necessary, contractor have to make it and HPC shall make the direct appointment.</td></tr>
<tr><td>Evaluation</td><td></td><td></td><td></td></tr>
</table>

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: less than 5 years	「Design-Build-Operation」 Contract of O&M: around 20 years
O & M	Public (HSDC)	Contract with private company separately (less than 5 years)	Contract with private company separately (around 20 years)		
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	・ It is familiar to HPC because of conventional way.	・ It is not difficult to change the contract conditions and O&M companies flexibly because of short-term O&M contract.	・ O&M work from long-term view makes the reduction of life cycle cost. ・ It is expected to trim down the organization because it is not necessary to continue putting in the expert in the public sector.	Similar to Option-2-A	・ It is possible to consider the construction and long-term O&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. ・ It is possible to shorten the amount of time to completion of construction because the ordering work shall be done only once.
Demerit	・ It takes time at each stage of design, construction and O&M, and the procedure of bidding and contract is troublesome. ・ Option-1 is existing specification order system, so cost reduction by the idea of private sector is not expected.	・ O&M company will not maintain the facilities from long-term view, so drastic renewal works will be required. ・ Private sector should check the condition of facilities at every time O&M company changes. ・ Private sector should put in the expert for a long period, so cost reduction from long-term view is not expected.	・ It is necessary to study the details of contract conditions due to the long-term contract of O&M.	Similar to Option-2-A	・ It is necessary to study the details of contract conditions due to the very long-term contract of design, construction and O&M.
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
(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 Appraval	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

<table>
<tr><th></th><th>Consultant for F/S</th><th>Consultant for Tender Document Preparation and C/S</th><th>SPC</th></tr>
<tr><td>1</td><td colspan="2">Local Consultant
(To be selected by bid)</td><td>Private Companies
(To be selected by bid)</td></tr>
<tr><td>2</td><td colspan="2">ODA Consultant</td><td>Private Companies
(To be selected by bid)</td></tr>
<tr><td>3</td><td colspan="2">Local Consultant
(appointed by HPC/MPI)</td><td>Private Companies
(To be selected by bid)</td></tr>
<tr><td>4</td><td colspan="3">Private Companies
(direct appointment)</td></tr>
</table>

Outline of Sludge Recycle Project

<Investment Cost>

(million US$)

Items	Solar Drying Bed (Capacity＝54m^3/day)	Mechanical Sludge Dryer (Capacity＝54m^3/day)	Total (Capacity＝108m^3/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
Option-A Yen Xa(270,000m^3/day) Capacity = 108m^3/day					↓Beginning treatment Yen Xa sludge →Amount of sludge = 108m^3/day					36
Option-B Yen So in first Capacity = 108m^3/day		↑Beginning treatment Yen So Sludge			↓Beginning treatment Yen Xa sludge					36

<Expected Daily Average of Sludge Generation>

WWTP	Sludge Generation (m^3/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%

4th Working Group

(11 November 2011)

Agenda of Working Group Meeting on 11th 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)

<u>Attachment</u>

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.

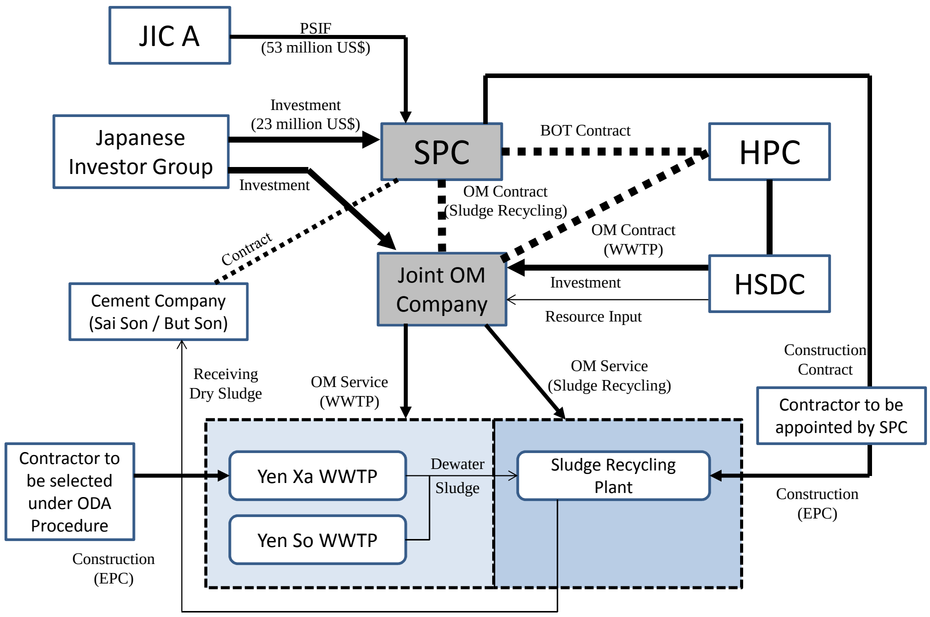
Approach of the Study

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	Contractor to be selected by Open tender under ODA procedure	HSDC
2) Yen Xa WWTP		Joint Company
3) Sludge Recycling Facility	SPC to be selected by procedure of BOT law	

Proposal of Japanese Private Company Participation

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

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

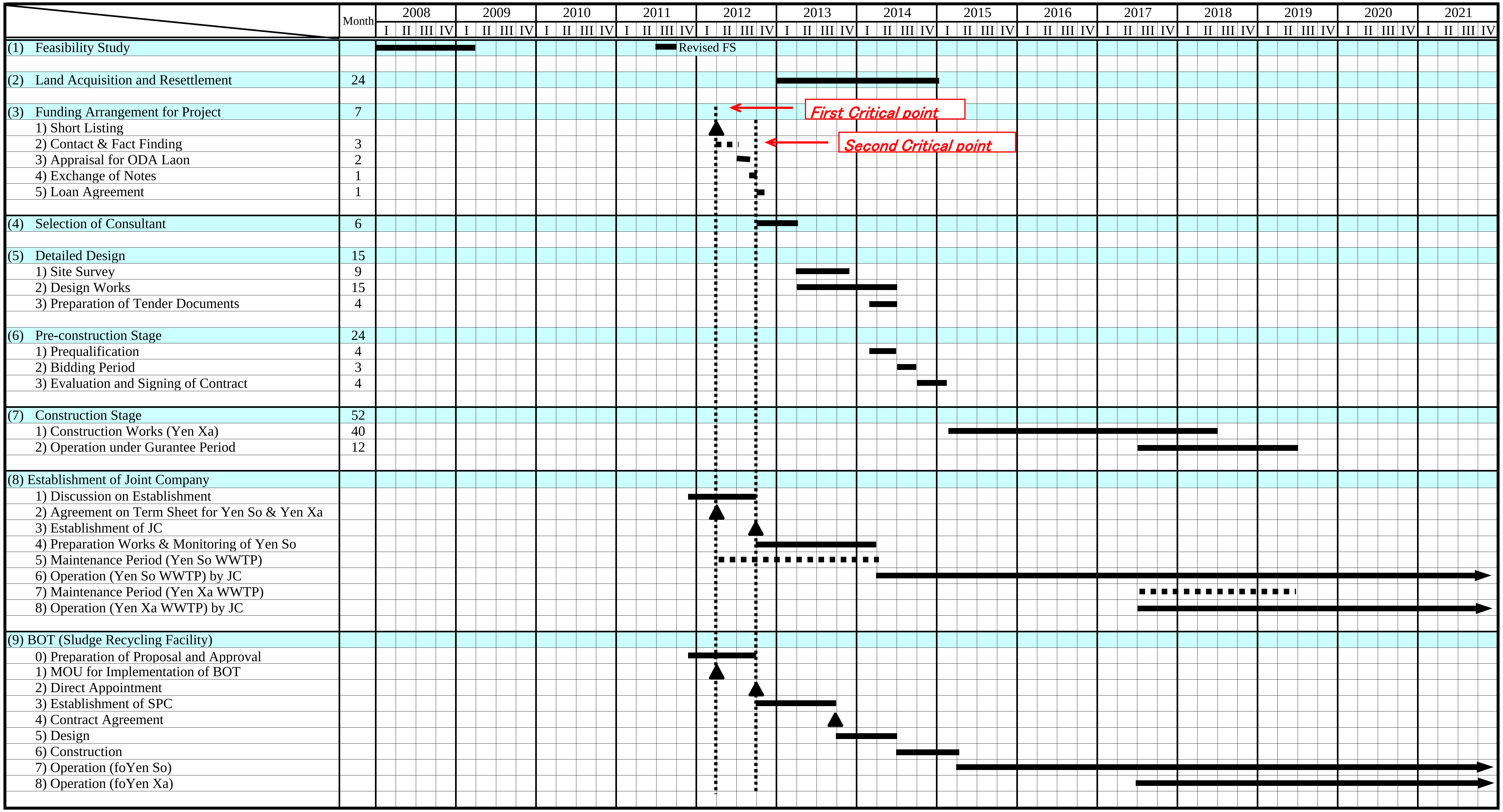
Option	VN : JP	Remarks
1	35 : 65	Japanese side has majority (Around 10 years later, Japanese share will be reduced to minority)
2	51 : 49	Vietnamese side has power to appoint legal representative of the company, and Japanese side has power of dismiss.
3	65 : 35	Vietnamese side has majority Certain important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



Month
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
I II III IV
(1) Feasibility Study
Revised FS
(2) Land Acquisition and Resettlement 24
(3) Funding Arrangement for Project 7
First Critical point
Second Critical point
1) Short Listing
2) Contact & Fact Finding 3
3) Appraisal for ODA Laon 2
4) Exchange of Notes 1
5) Loan Agreement 1
(4) Selection of Consultant 6
(5) Detailed Design 15
1) Site Survey 9
2) Design Works 15
3) Preparation of Tender Documents 4
(6) Pre-construction Stage 24
1) Prequalification 4
2) Bidding Period 3
3) Evaluation and Signing of Contract 4
(7) Construction Stage 52
1) Construction Works (Yen Xa) 40
2) Operation under Gurantee Period 12
(8) Establishment of Joint Company
1) Discussion on Establishment
2) Agreement on Term Sheet for Yen So & Yen Xa
3) Establishment of JC
4) Preparation Works & Monitoring of Yen So
5) Maintenance Period (Yen So WWTP)
6) Operation (Yen So WWTP) by JC
7) Maintenance Period (Yen Xa WWTP)
8) Operation (Yen Xa WWTP) by JC
(9) BOT (Sludge Recycling Facility)
0) Preparation of Proposal and Approval
1) MOU for Implementation of BOT
2) Direct Appointment
3) Establishment of SPC
4) Contract Agreement
5) Design
6) Construction
7) Operation (foYen So)
8) Operation (foYen Xa)

Attachment-3

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	**Contractor to be selected by Open tender under ODA procedure**	**HSDC**
2) Yen Xa WWTP		**Joint Company**
3) Sludge Recycling Facility	**SPC to be selected by procedure of BOT law (Joint Company will have OM sub-contract)**	

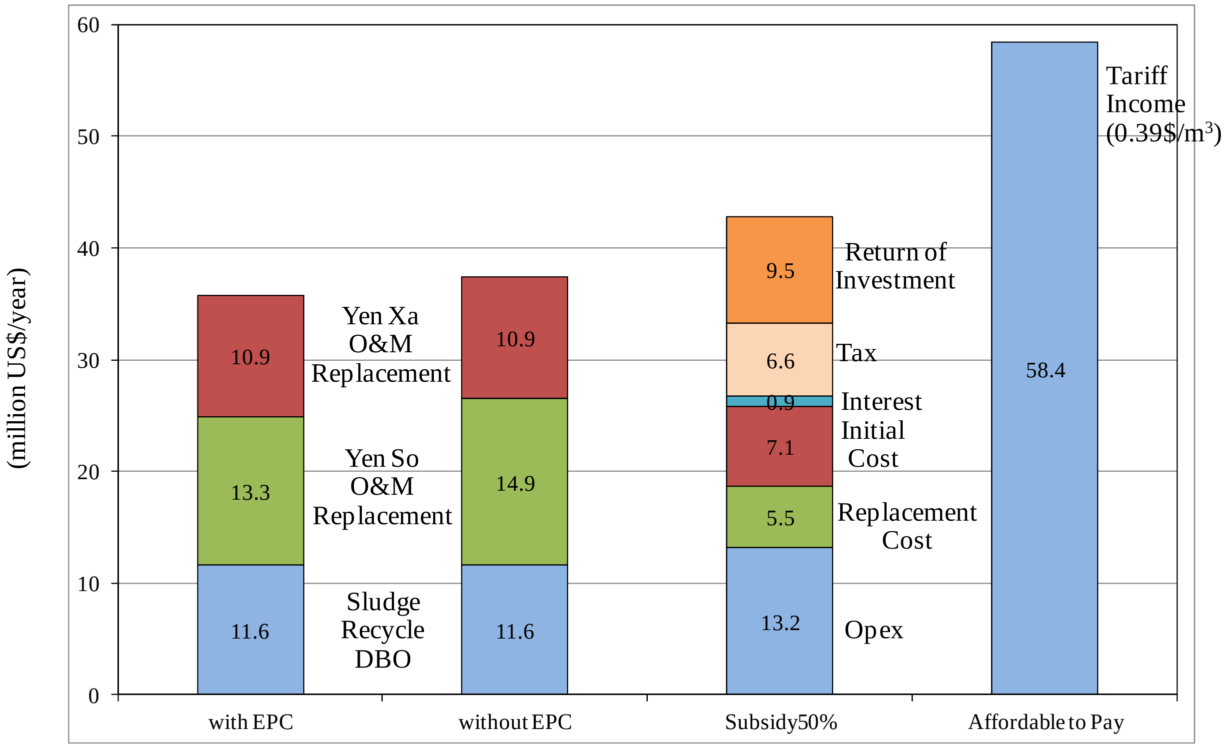
To give advantage to the Yen Xa WWTP Project for selection of ODA loan project, it is recommendable that Japanese private company will participate in OM of Yen Xa WWTP and BOT project for Sludge recycling facility. As the conclusion of the Study so far, the Study Team propose the Project Scheme as shown 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)	**Joint Company** to be established by HPC/HSDC and **Japanese Private Company**
Yen Xa WWTP	Contractor to be selected by Open Tender (Same **Japanese Private Company** is preferable)	
Sludge Recycling Facility	Contractor to be appointed by **SPC**, which will be established by **Japanese Private Company**	

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.



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(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 m3/day)
- OM of Yen Xa WWTP (Operation from 2014, Total capacity: 270,000 m3/day)
- OM of Sludge Recycling Facility (Operation from 2016, Total capacity: 237 m3/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^3)

・OM of Yen So WWTP (11.1 – 14.5million US$/year, 0.161 – 0.202US$/m^3)

Amount to be charged to SPC

・Sludge Recycling Facility の OM (3.2 million US$/year, 40 US$/m^3)

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 m3/day of dewatered sludge, which are generated from WWTPs in Hanoi
- To reduce volume of sludge: 237 m3/day of dewater sludge (80% moisture contents) to around 60 m3/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^3)
・OM cost to be charged from Joint Company (3.2 million US$/year, 40 US$/m^3)

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 Japanses 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)

November 11th, 2011

(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.

Attachment-4
Presentation Material (PPT) of Sludge Recycling Facilities

(2) Introduction of Sludge Recycle Method

Sewage Sludge components can be used.

80%
Organic (C,H,N,P)

20%
Inorganic (Si,Cl,Al)

Use for Green Farm	Use for Energy	Use for Construction Material
Fertilizer Soil Conditioner	Solid Fuel Methane Gas	Cement Material Brick, Aggregate

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

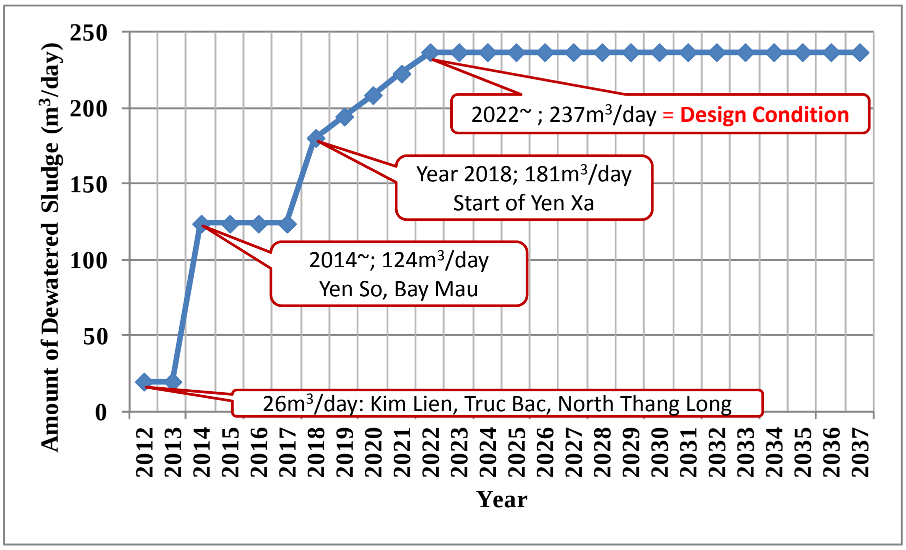
3

(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	**Not recommendable** (Considerable for future use)	**Recommendable** as most stable consumer	**Recommendable as sub-consumers**, if sludge products have acceptable quality.

6

(6) Specification of Sludge Products

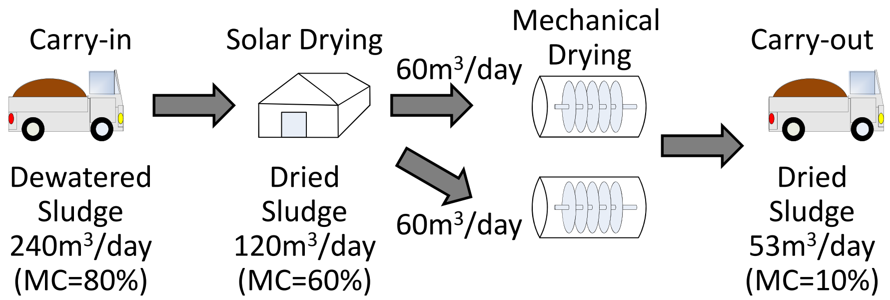
Request from Cement Companies

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

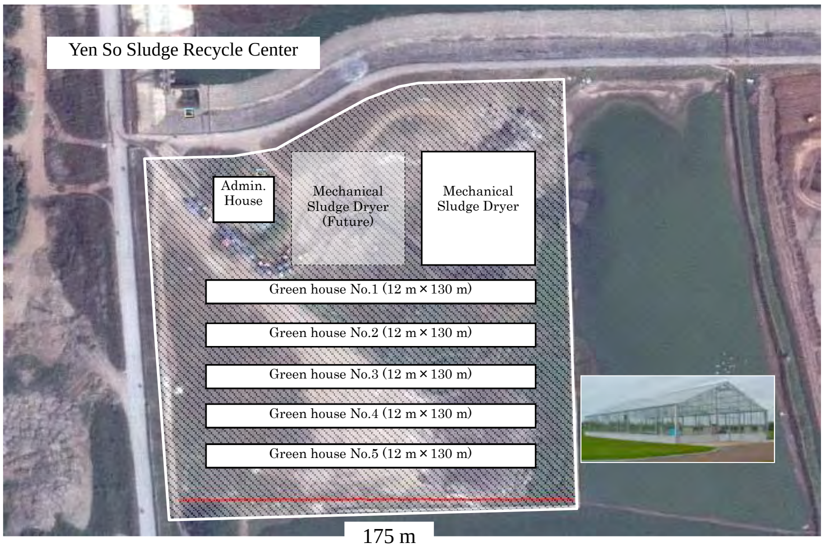


Process	Merit	Demerit
1) Solar Drying	Lowest cost, Save energy	Impossible to make MC=10%
2) Mechanical Drying	No need for extensive site	More expensive
3) Hybrid (Solar & Mechanical)	Save energy, Low cost	Little bit difficult O&M
4) Carbonization	No need for extensive site	Most expensive

(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%

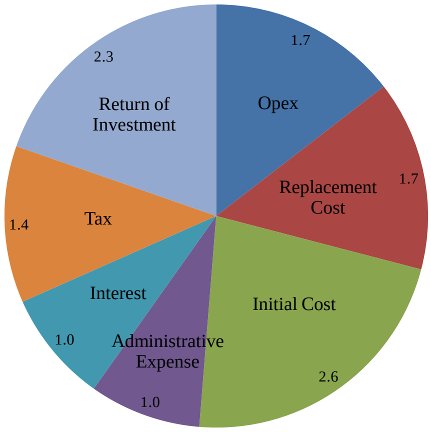
10

(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
Total	64.5

Annual Service Charge
(Total:11.6million US$)



(unit: million US$)

11

Thank you for your attention

5^{th} Working Group

(10 January 2012)

Agenda of Working Group Meeting on 10th 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

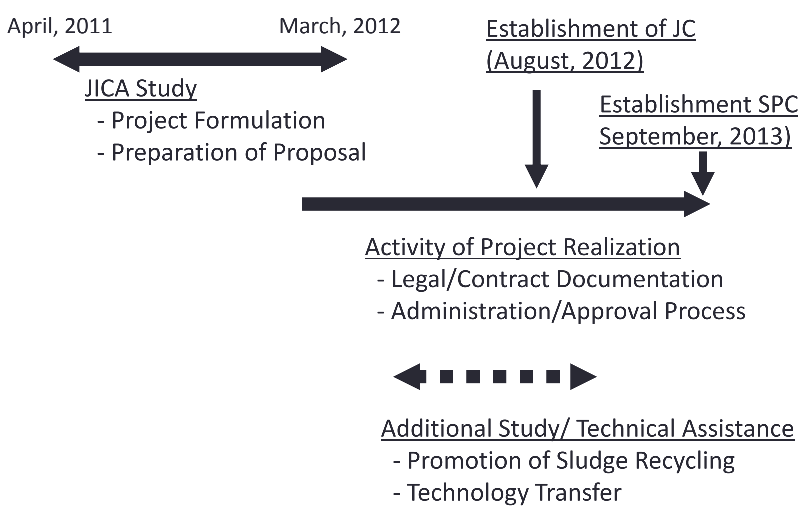
Tentative Schedule of BOT Project

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 (10TH 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)
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Tentative Schedule of Establishment of Joint Company (In case of the Loan Agreement in September 2012)

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August 2012	Issuance of Business Registration and Investment Certificate by HPC (Establishment of Joint Company)

3

(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**

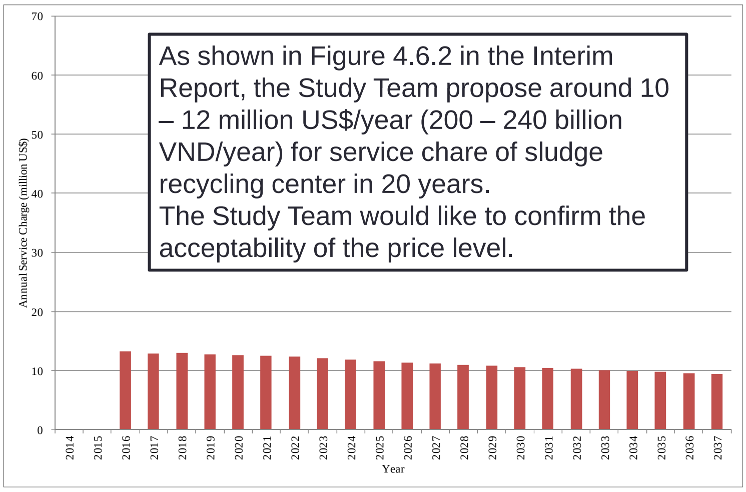
Feasibility of BOT Project depends on level of service charge for sludge recycling

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

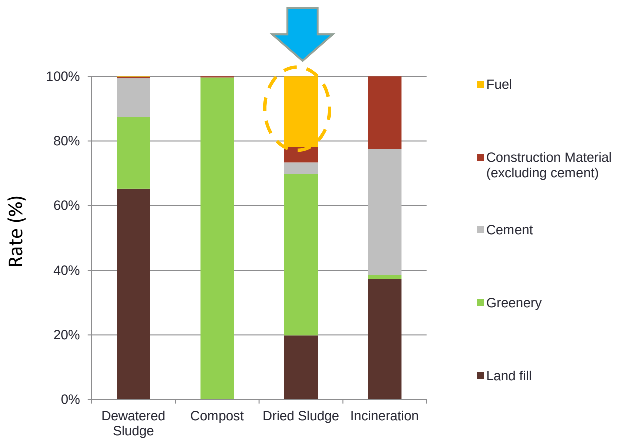
Potential Demand of Dry Sludge in Hanoi

	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

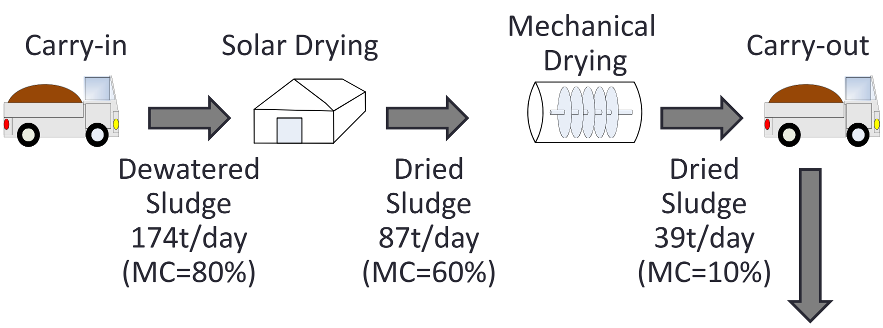
Percentage of End Use Method in Japan after Sludge Treatment



2004, Japan Sewage Works Association

2

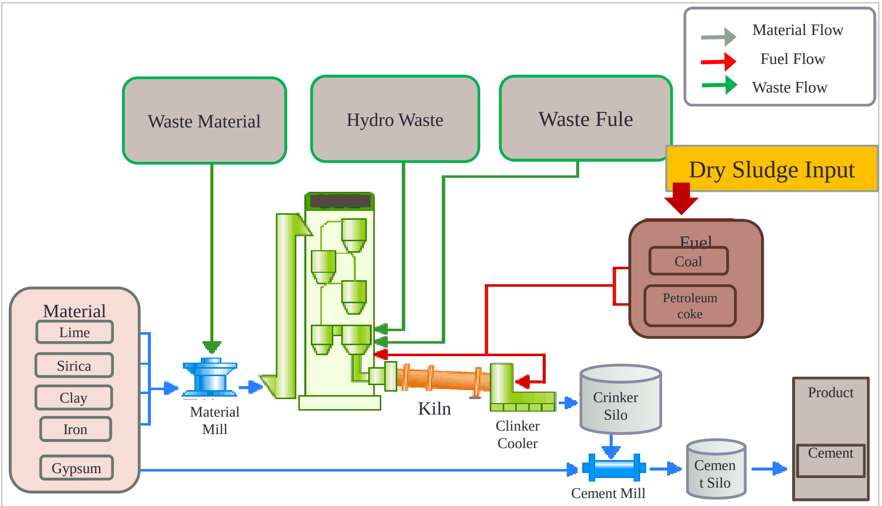
1) Proposed Sludge Drying Process under the BOT Project



- 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



Completed

However, there is still no agreement with cement company

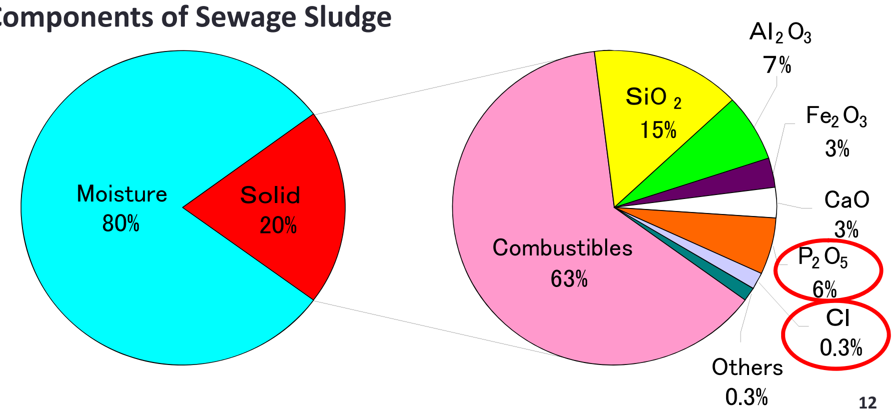
Outline of Cement Companies

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%

Potential Problem cased 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



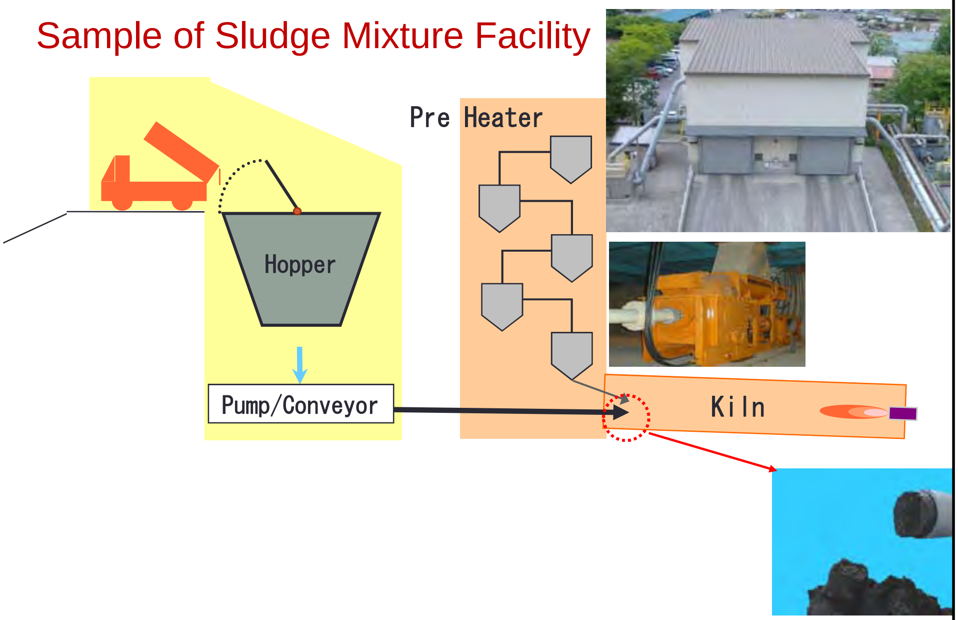
Solution of Potential Problem

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



14

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

15

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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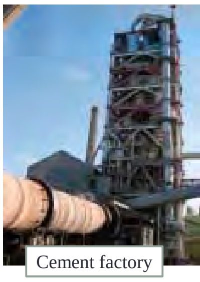
Achievement of the Target Scenario in Long Term

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

Dried sludge

Eco mark


Pavement (Mortar block)


Cement factory


Flower mat
(Compost)

18

Sludge Recycling Facilities (BOT)

January 10th, 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.

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(2) Introduction of Sludge Recycle Method

Sewage Sludge components can be used.

80%
Organic (C,H,N,P)

20%
Inorganic (Si,Cl,Al)

Use for Green Space	Use for Energy	Use for Construction Material
Fertilizer Soil Conditioner	Solid Fuel Methane Gas	Cement Material Brick, Aggregate

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

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(3) Potential Demand of Sludge

	Power Company	Cement Company	Floriculturist
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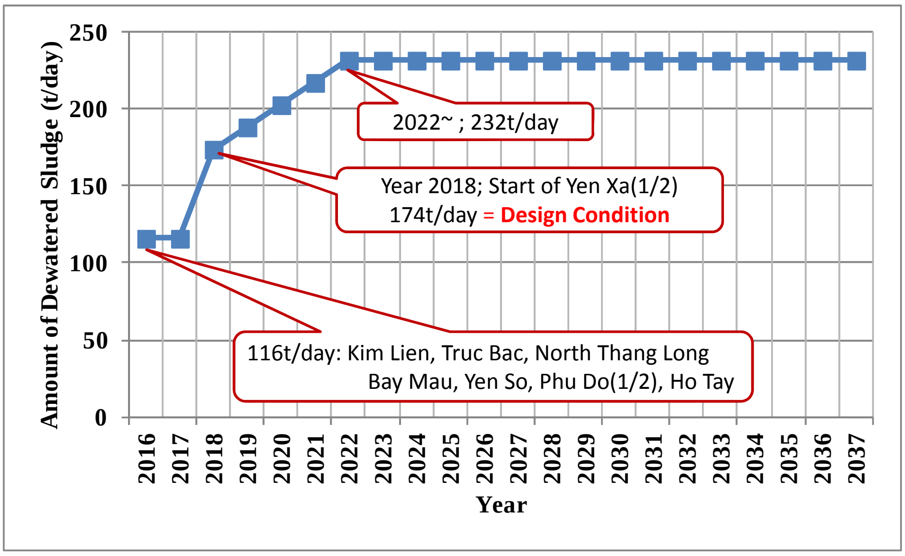
(4) Amount of Dewatered Sludge in Hanoi



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(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.
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Evaluation	**Not recommendable** (Considerable for future use)	**Recommendable** as most stable consumer	**Recommendable as sub-consumers**, 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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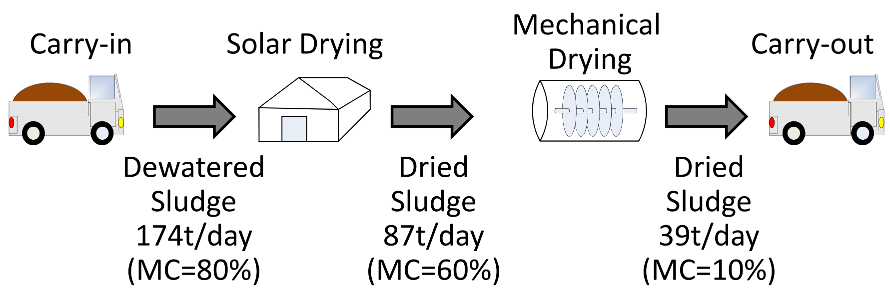
(7) Sludge Drying Process

Hybrid Process of Solar Drying & Mechanical Drying

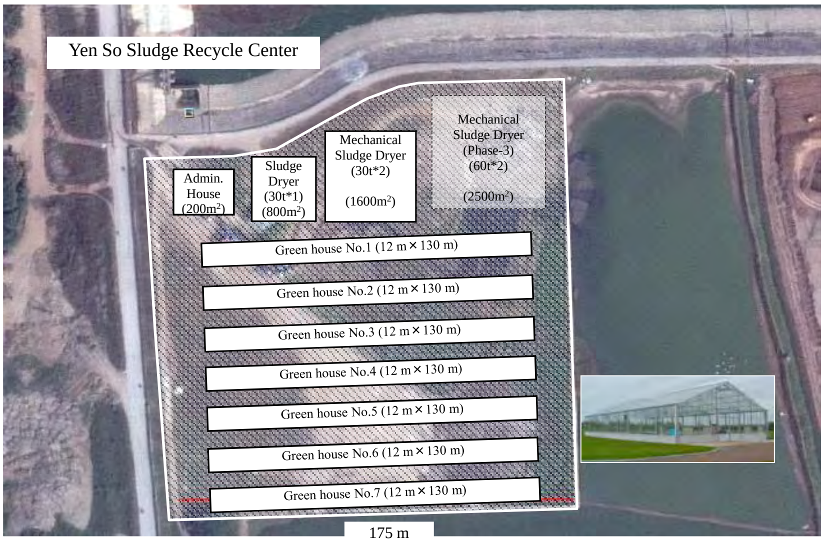


Process	Merit	Demerit
1) Solar Drying	Lowest cost, Save energy	Impossible to make MC=10%
2) Mechanical Drying	No need for extensive site	More expensive
3) Hybrid (Solar & Mechanical)	Save energy, Low cost	Little bit difficult O&M
4) Carbonization	No need for extensive site	Most expensive

(MC: Moisture Content)

8

(8) Layout Plan of Sludge Drying Facilities



9

(9) Outline of Cement Companies

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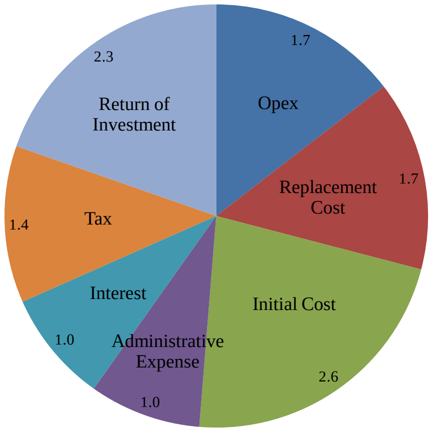
(10) Investment Cost and Service Charge

Investment Cost

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

Annual Service Charge
(Total:11.6million US$)



(unit: million US$)

11

Thank you for your attention

Workshop Seminar

(13 July 2011)

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

Contents

Definition of PPP

1

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.)

Definition of PPP in Vietnam

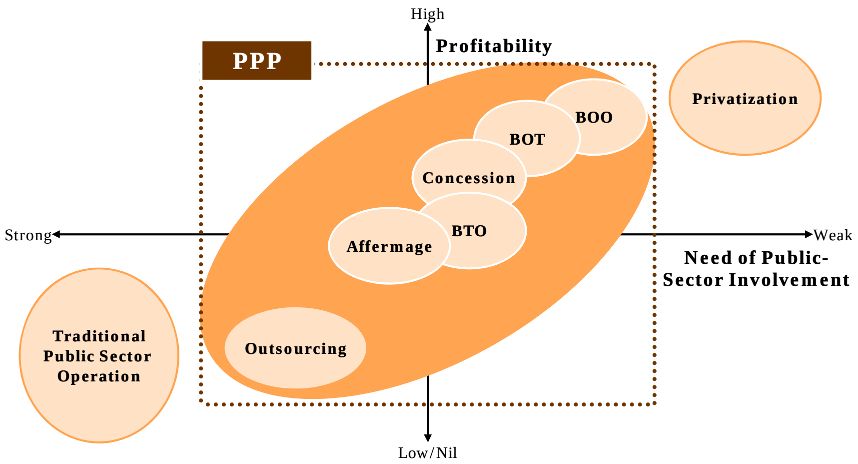
According to "Decision 71", PPP is defined as follows:

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.*

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.**

Why PPP?

2

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)

II

✓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.

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

Why PPP?

There are many different drivers of PPPs.

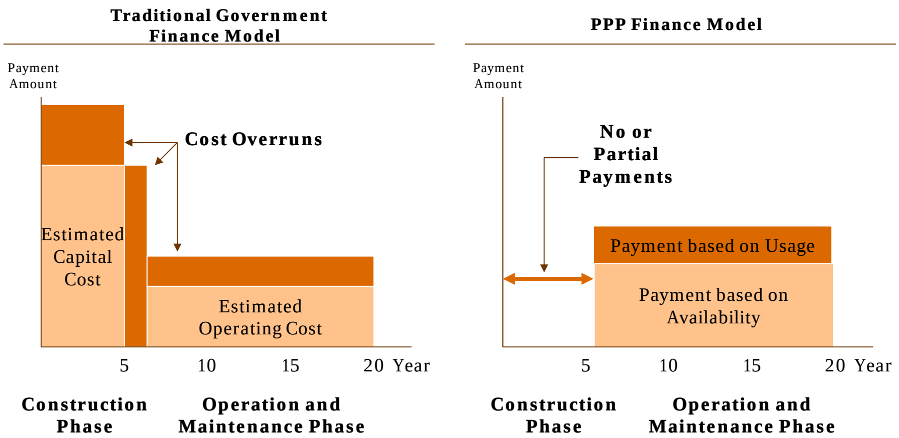
Need to control public sector borrowing but fill the gap between infrastructure needs and fiscal constraints

Obtain innovative ideas/technology and economic efficiency

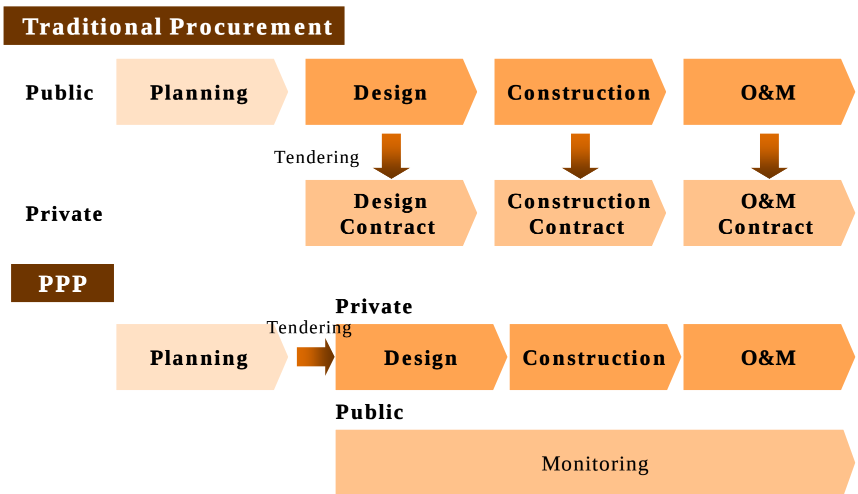
PPP

Accelerate the delivery of infrastructure services

Traditional Government Finance vs. PPP Finance



Differences in the ways to tender



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

Development of PPPs in Global

3

Development of PPP in Global

1970's — Before
1980's
1990's — Privatization | PFI
2000's — PPP in EU
2010's — PPP in Global

1 UK

Before Privatization
1. Expansion of Public Sector
2. Inefficient Public Works
3. Overemployment
4. Deterioration of Public Finance

from Privatization to PFI
1. Privatization of Public Entities
2. Maastricht Treaty (GDP3%, 60%)
3. Enlarging Private Sector
4. Advancing to PFI

PPP as Advanced Model of PFI
1. Diversification of Private Sector
2. Joint Company by Public & Private
3. Expansion of Targeted Fields

2 Latin America

Privatization by EU & USA
1. Rapid Privat. of Public Entities
2. Introduction of Excess Tariff
3. Failure of Privat. (late 90's)

Adjustment of PPP
1. Recommencement of PPP
2. Adjustment PPP to Each Country
3. Joint Company by Public & Private
4. Monitoring by GOV.

3 Japan

Privatization
1. Privatization of State Owned Companies (Rail, Tel, Tabboco)

Japanese PFI
1. Frame and Specification by GOV.

Comprehensive O&M Contract
1. Frame and Specification by GOV.

Introduction of Concession Contract
1. Changed PFI Law to involve Concession

4 Asia

Necessity of Change
1. Expansion of Public Sector
2. Inefficient Public Works
3. Overemployment
4. Deterioration of Public Finance
5. FDI for Growth

Introduction and Adjustment of PPP
1. Introduction of PPP
2. Adjustment PPP to Each Country
3. More Investment for Growth by PPP
4. Player at Mega Competition

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

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.

1st Generation	2nd Generation	3rd Generation	4th 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

1993-95 | 1996-2000 | 2001-2007 | 2007-2010

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.

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>>

Public	Shared	Private
• Outline planning permission • Discriminatory regulatory risk • Service scope	• Volume risk • Inflation risk • General regulatory risk • Force majeure	• Detailed planning permission • Design • Construction • Commissioning • Operating performance • Project finance • Technology obsolescence

②Latin 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

③Japan –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 8.2billion 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.

④Asia –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.

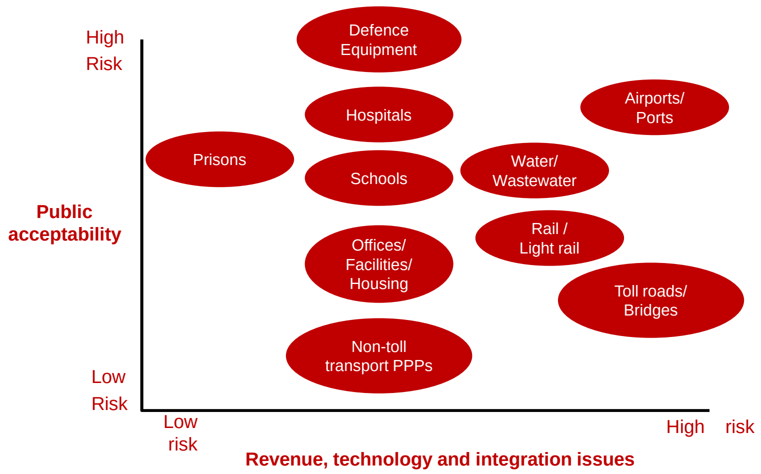
✓Off-balancing needs of the public sector could be an issue in near future.

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



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

Categorization of PPPs
Role of Public and Private Sectors

	State Utility	BT	Affermage	BTO/ Concession	BOT	BOO	*Privati-zation*
Ownership	*Public*	Public	Public	Public	Private*	Private	*Private*
Initial Investment/ Financing	*Public*	Public	Public	Private	Private	Private	*Private*
Operation	*Public*	Public	Private	Private	Private	Private	*Private*
Accountable for service provision**	*Public*	Public	Public	Public	Public	Public	*Private*

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

PwC 25

Categorization of PPPs
Source of revenue for the private sector

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

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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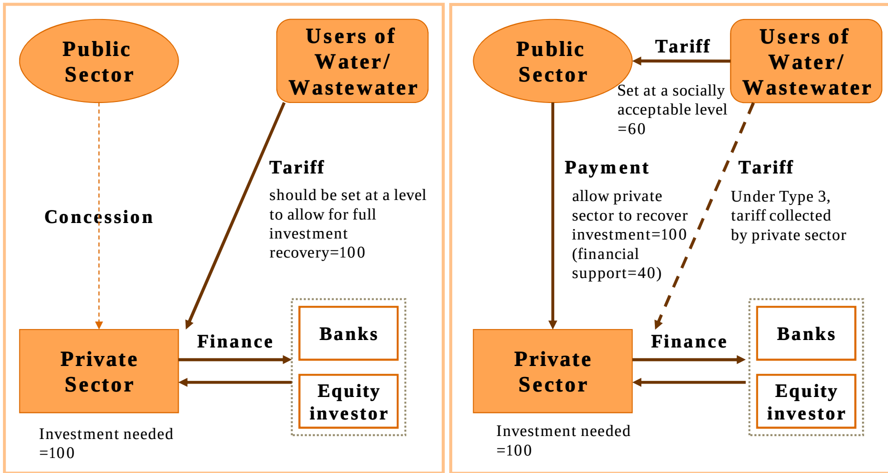
How to deal with demand risk?

Type 1
Full demand risk born by private sector

Type 2 & 3
Demand risk typically shared



Categorization of PPPs Rate Setting

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

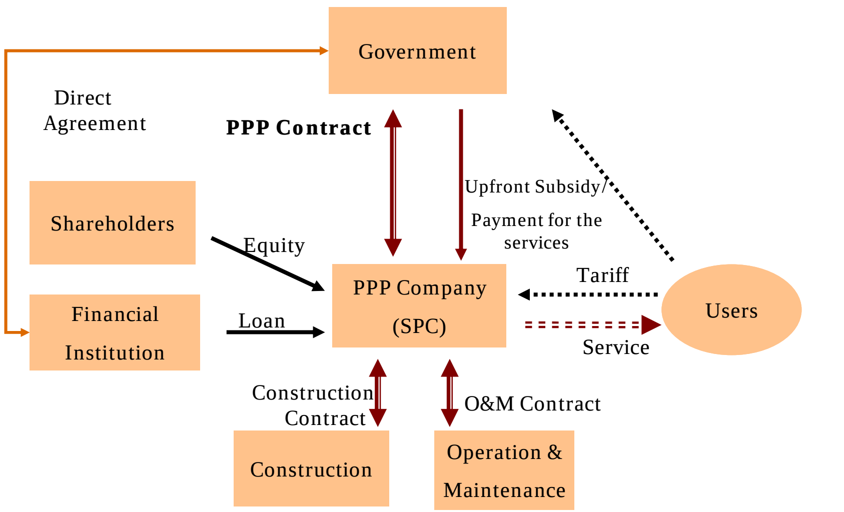
- Regulated
  - Public sector periodically regulates rate setting.
- Deregulated
  - Private sector periodically regulates rate setting.
- Defined by agreed formula between the public and private sectors
  - Rate setting is revised based on the agreed formula between the public and private sectors.

✓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

Typical Contractual Framework



Pros and Cons of PPPs for the Public Sector

6

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**

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

7

Case 1. Ulu Pandan NEWater PPP Project

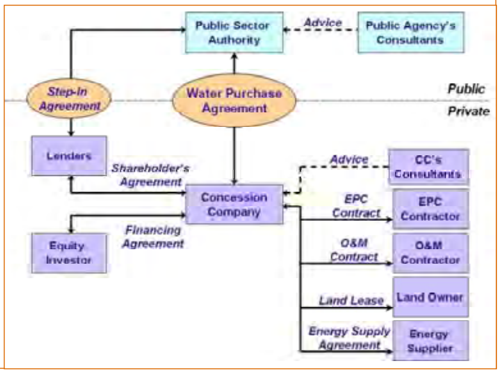
- **Location:** Within existing Ulu Pandan Water Reclamation Plant in Singapore
- **Public Agency:** Public Utilities Board
- **Contractor:** Keppel Integrated Engineering Ltd
- **Operational Period:** 20 years (2007-2027)
- **Background & Summary of the Project**:
  - NEWater is recycled, used water that has undergone stringent purification and treatment process using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. The plant is the forth and the largest NEWater plant in Singapore with a capacity of 148,000m³ per day, and has started its operation in 2007.

Achievement	
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/m3 for the NEWater services. The price has decreased once the contract was announced to \$1.15/m3, and dropped further in April 2007 to \$1.00/m3, 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.

Case 1. Ulu Pandan NEWater PPP Project

Project Description & Management Structure

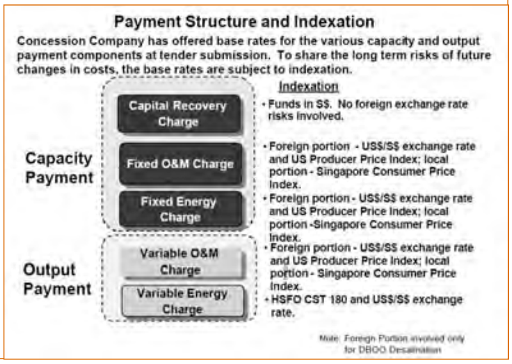
- The Ulu Pandan NEWater Plant is built on a scheme , in which private sector designs, builds, finances, owns and operates the facility for 20 years.
- Awarded the PPP contract in 2005, Keppel Seghers NEWater Development Company (SPV) has designed and built the Ulu Pandan NEWater plant, and started the 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.



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.



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.

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 km2 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.

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.)

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.

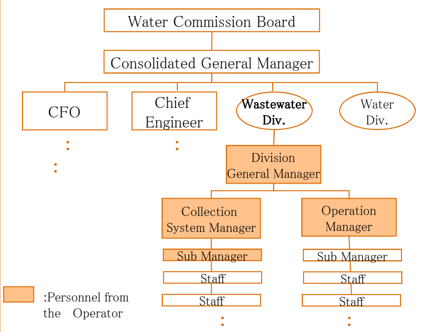
–The Contractor continues to utilize all the existing employees of the WA working in its Wastewater System.

–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.

ORGANIZATION CHART of the WA (IMAGE)



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

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*

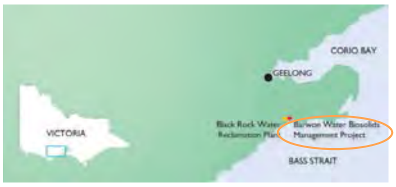
−Operate and maintain the wastewater system within various environmental regulations and requirements set forth by the Environmental Protection Agency, etc.
−Pump stations must not have any overflow incidents.
−Collection lines must be kept free of grease and other material to prevent sewage overflows

･*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 wil 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.

Recommendations

8

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 mange an 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.

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

13 July 2011

<u>PPP – Work Shop Document</u>

<u>2) Failures and Recover for Water Sector PPP in Malaysia, Manila, and Jakarta</u>

<u>Thất bại và thành công của ngành nước theo mô hình PPP tại Malaysia, Manila, và Jakarta</u>

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

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

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	privatization after
LargeLocal GOV(49)	connected to pipes	45%	85%
	unconnected	44%	45%
	resdual	11%	–
Small Local GOV(95)	connected to pipes	10%	30%
	unconnected	52%	70%
	resdual	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 BursaMalysia 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 servicies)
- 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 in1982.

《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

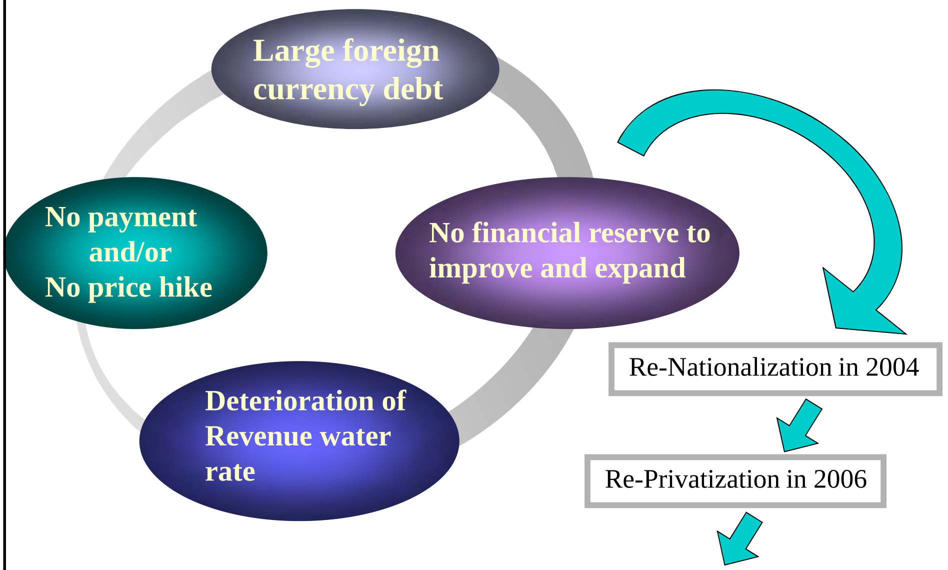
ORIX 12

MWSI vs. MWCI

MWSI	MWCI
• Old urban area (90% of Asset) • Large foreign currency debt equivalent to transferred Asset • No budget for capital expenditure ⇩ • Deterioration of facilities much faster than in normal situation • Deterioration of revenue water rate ⇩ • ***Bankrupt even in the next year !*** • Re-Nationalization in 2004	• newly-developed urban area (10% of Asset) • small foreign currency debt equivalent to transferred Asset • Enough budget for capital expenditure ⇩ • Improvement of revenue water rate ⇩ • ***Success Story of PPP until now !***

ORIX 13

Negative Cycle of MWSI

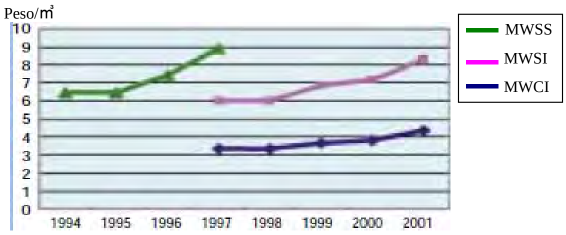


< Change of revenue water rate > Source:Foundation Fukuoka Asian urban studies place

		1997	1998	1999	2000	2001	2002	2003	2004	2005
給水人口(人)	MWSI	4300000	4310000	4770000	5250000	5540000	5560000	5700000		
	MWCI	3000000	3130000	3560000	3760000	3940000	4080000	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	2320000	2279000	2169000
	MWCI					1635000	1615000	1601000		
有収水量(c.m./d)	MWSI					797000	741000	718000	707000	691000
	MWCI	440000	594000	645000	706000	758000	751000	767000	825000	864000
新規接続数	MWSI	467328	468747	518099	571282	602434	443245			
	MWCI	325527	340037	380950	408894	427755	604814			
有収率(%)	MWSI	37	40	32	34.5	34	31	31	31	32
	MWCI	37	44.8	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	1.08
	MWCI					2.13	1.76	1.53	1.49	1.36
1000接続当り職員数(人/000con)	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>



Source: Japanese PFI society,UTCE corporation

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）

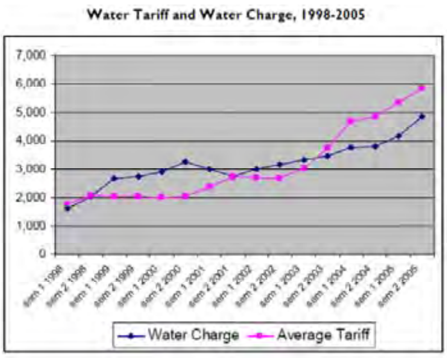
5. Negative cycle toward Bankruptcy

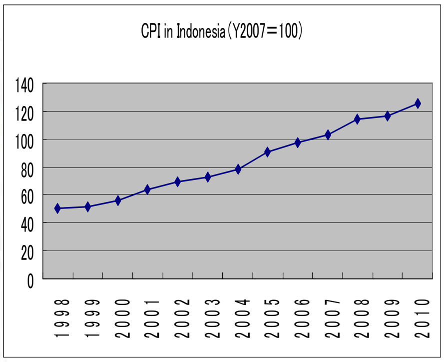
6. Revenue water flow rate

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,･･･)



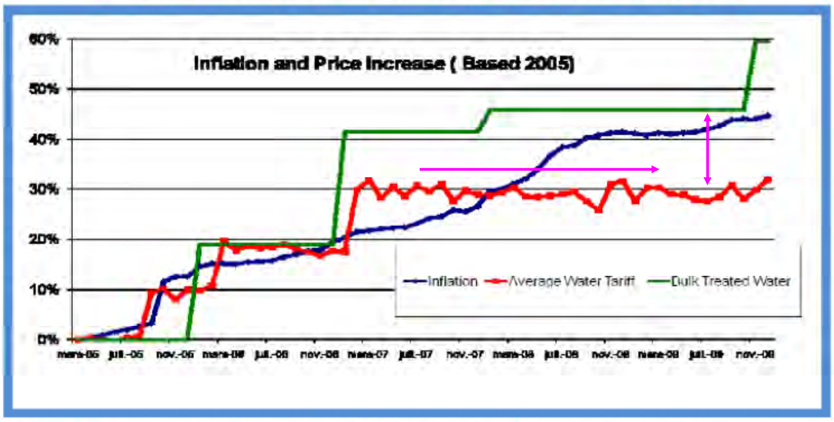


(Source: CURRENT SITUATION OF JAKARTA WATER PRIVATIZATION)

(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%**

Comparative evolution of CPI index, Average Water Tariff and Bulk Treated Water



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

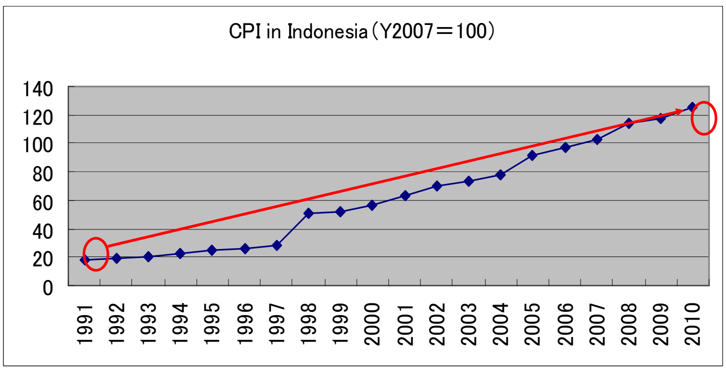
- Without enough tariff, Project is no longer feasible!

(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

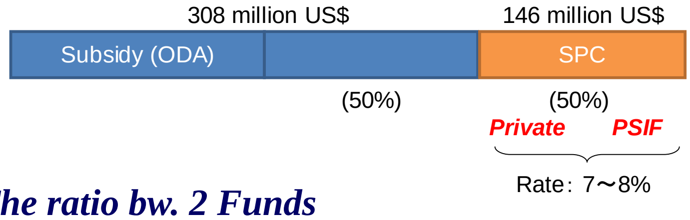
- *To avoid political interest*
  Tariff Decision by neutral Regulatory Body
- *To avoid revenue & expenditure gap*
  Proper Tariff Adjustment Mechanism
- *To avoid construction cost hike*
  & easy Land Acquisition
  Construction as early as possible

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$

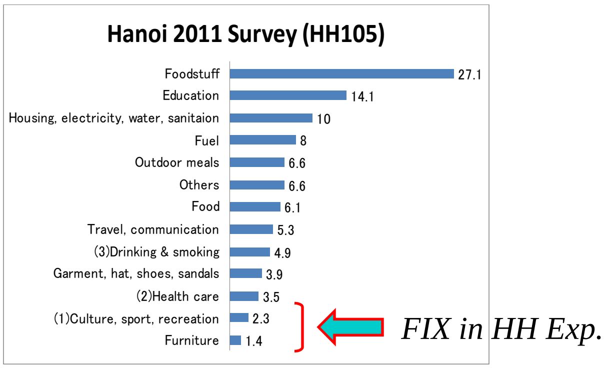


⇒ ***The ratio bw. 2 Funds***
to be decided by Tariff Level
& Availability of Ordinal Account of HPC

Proposal through the Study

➢ ***Immediate Construction & Sustainability 2 = Tariff***

⇒ *Affordability for people is most important!*

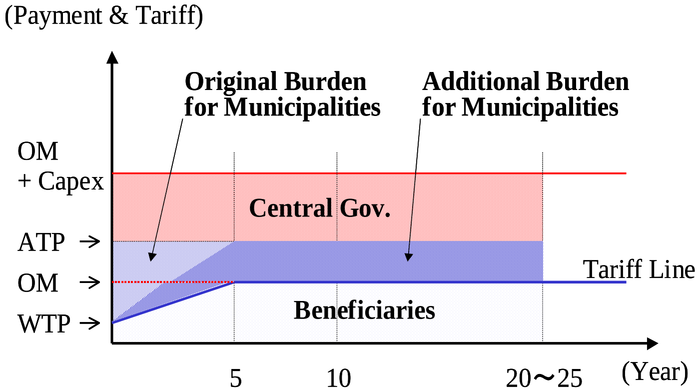


⇒ ***For Water & Sewerage: Ceiling 5% for HH Exp.***
Setting up in HH Exp. Map:
Avoid Gap against CPI hike & Easy Understanding

Proposal through the Study

➢ ***Immediate Construction & Sustainability 3 = Cost Sharing***

⇒ *Central Gov shall subsidy Excessive Part.*



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

Thank you for your attention!!

Answers, Custom Fit.

http://www.orix.co.jp/grp/en/

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

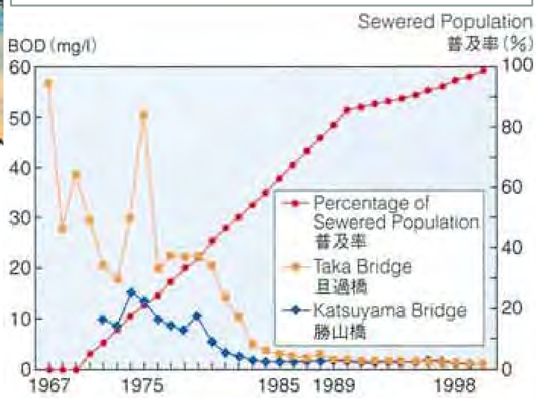
- **Institutions & Finance of Sewerage Works**
- **JICA Study Team**
  - **Y. Inoue, Nippon Koei Co., Ltd.**
- **July 13th, 2011**

- 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

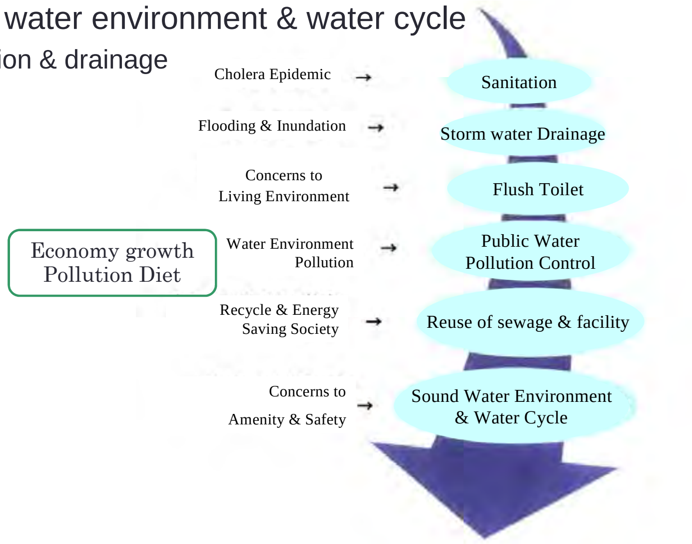
Role of Sewerage System (1)

Sewerage system development & pollution control contribute to water environment restoration

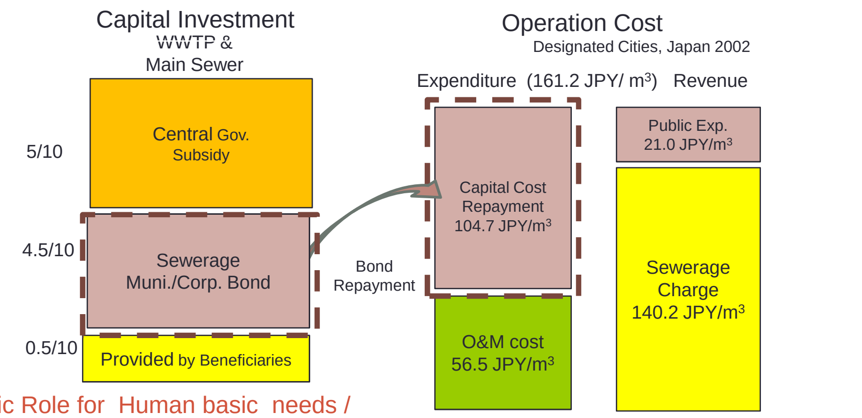


Role of Sewerage System (2)

- 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.

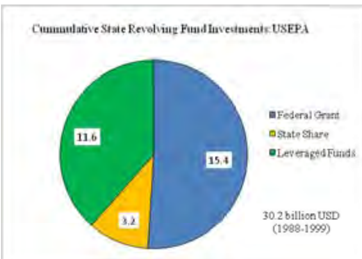
Sewerage project is operated as an independent cooperate account of municipality government.

Private Role for housing environment

Tax(City Planning & Beneficiary + Sewerage charge

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

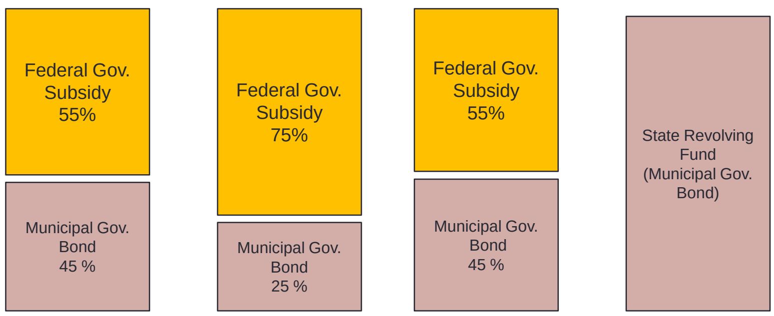
Clean Water State Revolving Fund

- 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.



1956 - 1971 Water Pollution Control Act Amendment

1972 - 1980 Federal Water Pollution Control Act

1981 - 1990 Clean Water Act
Twin Deficit of F. Gov.

1991 –today

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

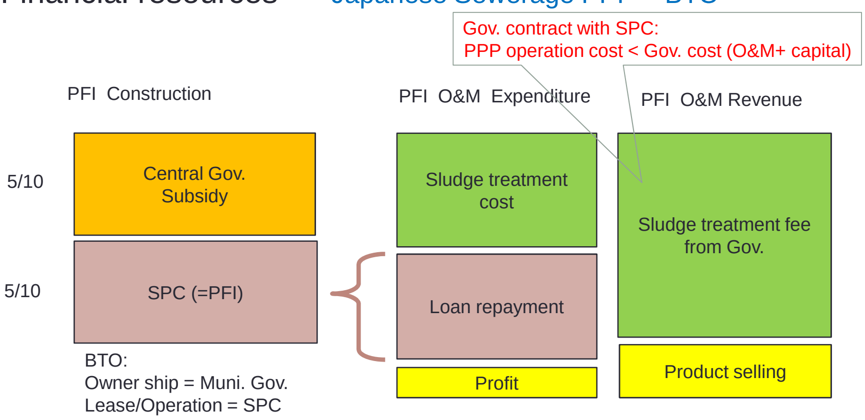
7 operations
7 constructions & bidding

No.	Project	Business	Product	User	Operation stars	Contract Term year
1	Yokohma City South WWTP	Exscabated 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	Kumamotoshi 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 Arakawaugan 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

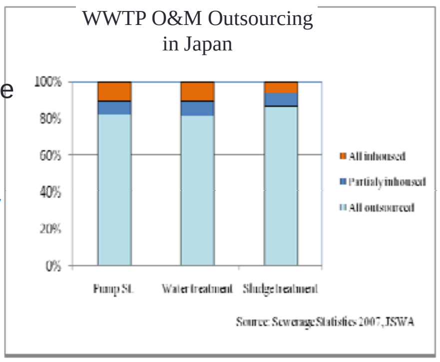
O&M outsourcing of Wastewater Treatment Plant

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 in1960s

- Beneficiaries Tax

  Charge to area of property (m^2)
  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.

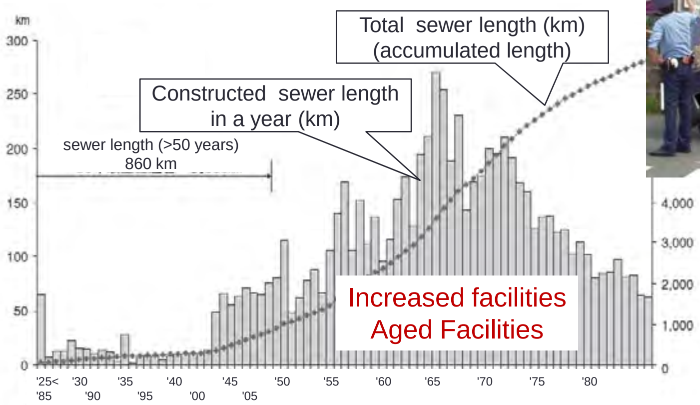
Modified to Present Sewerage Works

- 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

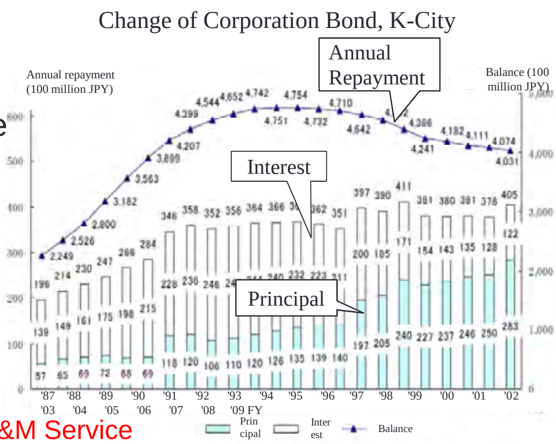
Facility Management

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.

Aqua-supporter Workshop

Sludge Digestion Tank

Aqua –supporter Site Visit

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_2 reduction

PI (Performance Indicator)

Category	Performance Indictor (PI)	Calculation Formula	Improvement
4. Management (13 items)			
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^3 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

The Introduction of Yokohama PPP Project

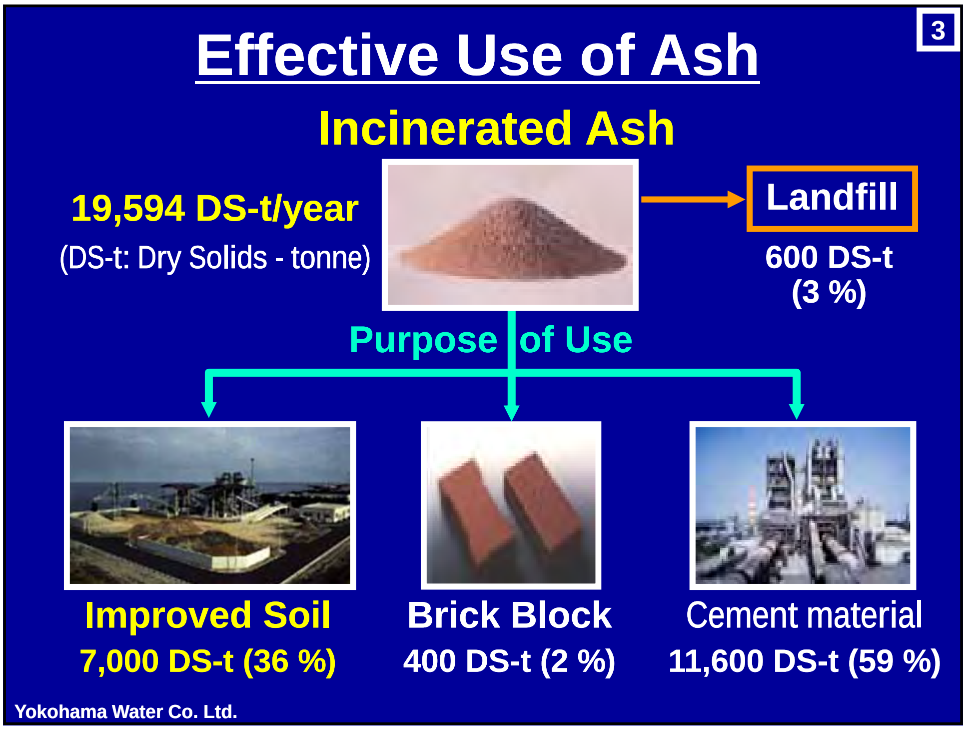
Kenji Nakanosono

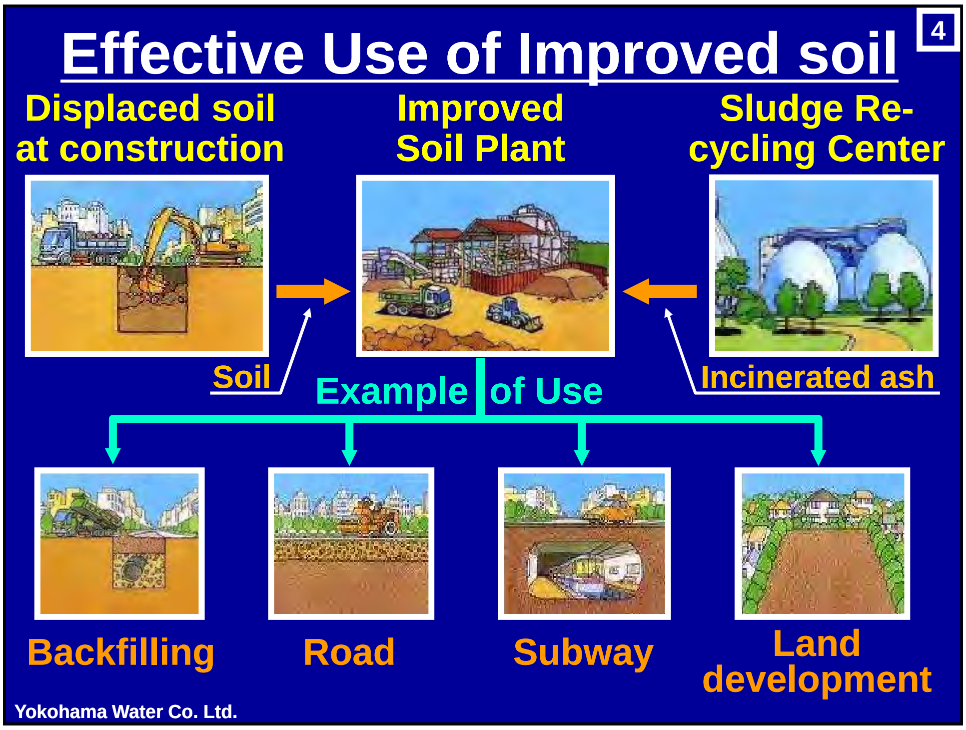
Yokohama Water

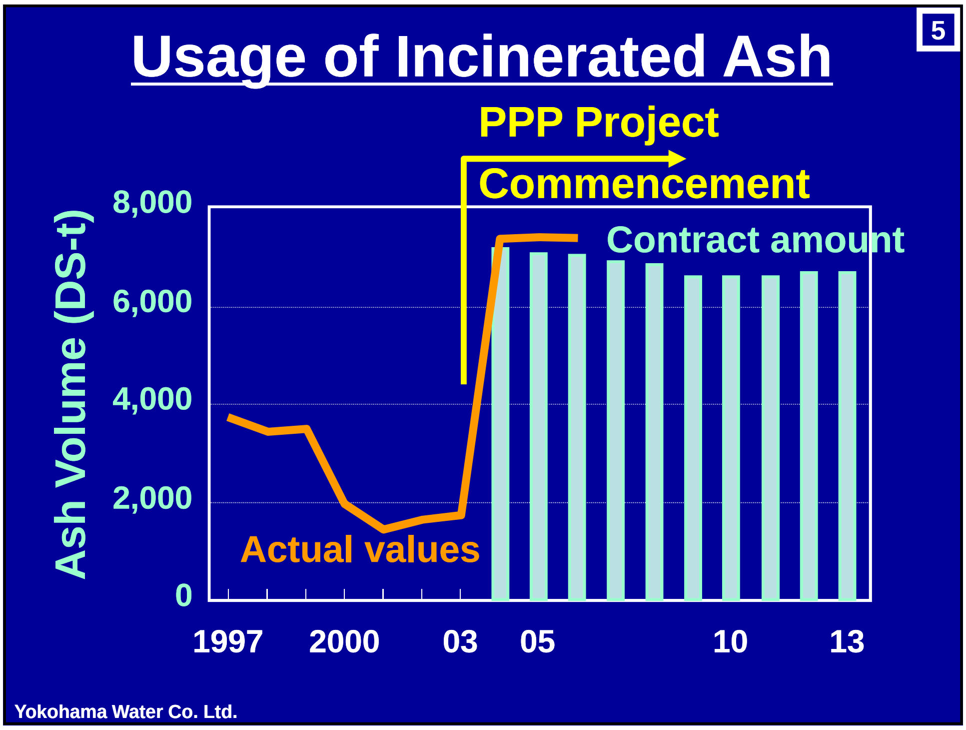
Schematic diagrams of sludge recycling

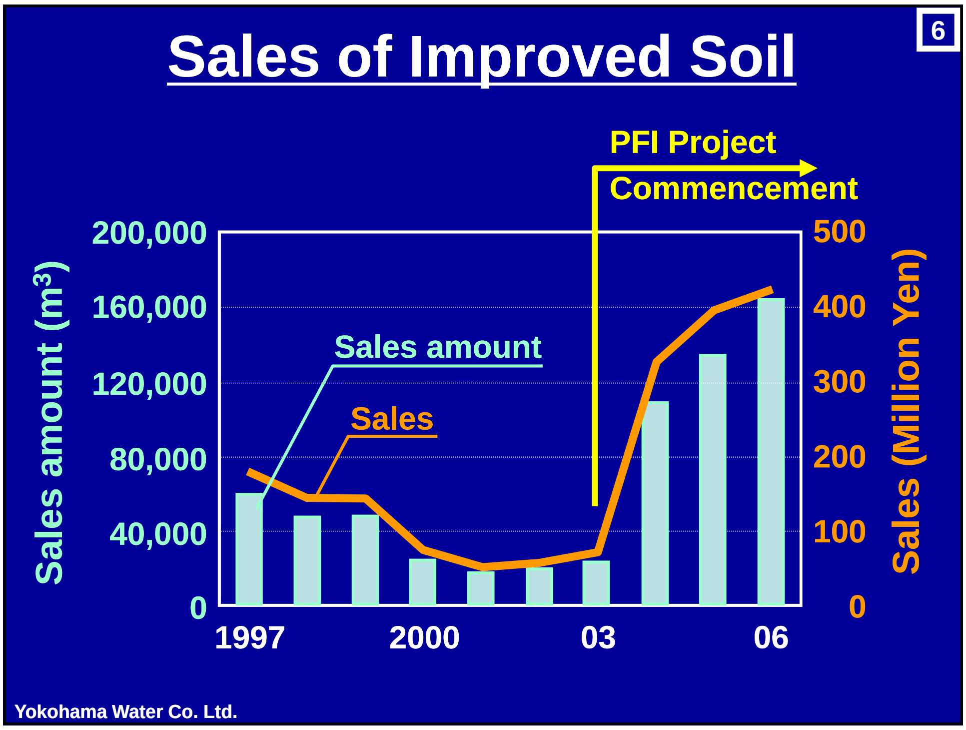
2

Yokohama Water Co. Ltd.


3
Effective Use of Ash
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.

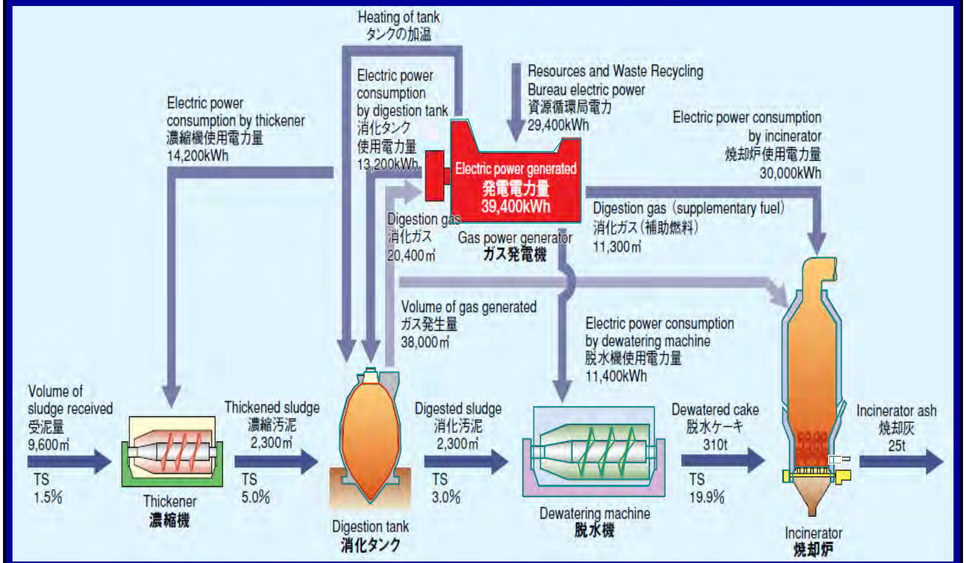

4
Effective Use of Improved soil
Displaced soil at construction
Improved Soil Plant
Sludge Re-cycling Center
Soil
Example of Use
Incinerated ash
Backfilling
Road
Subway
Land development
Yokohama Water Co. Ltd.


Usage of Incinerated Ash
5
PPP Project
Commencement
Contract amount
Ash Volume (DS-t)
8,000
6,000
4,000
2,000
0
Actual values
1997
2000
03
05
10
13
Yokohama Water Co. Ltd.


Sales of Improved Soil
6
PFI Project
Commencement
Sales amount (m³)
200,000
160,000
120,000
80,000
40,000
0
Sales amount
Sales
500
400
300
200
100
0
Sales (Million Yen)
1997
2000
03
06
Yokohama Water Co. Ltd.

7

Treatment Flow in Plant

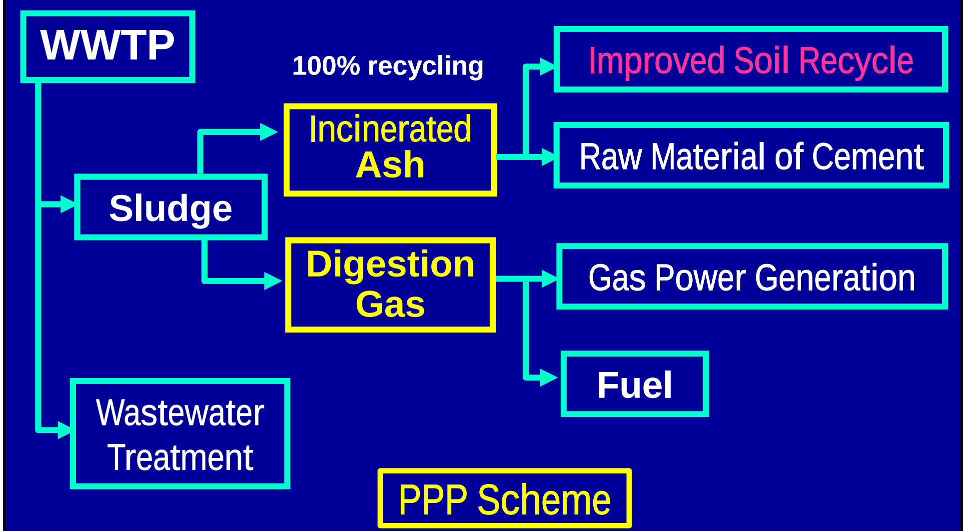


Yokohama Water Co. Ltd.

8

Yokohama's PPP Schematic

Wastewater Treatment Plant



Yokohama Water Co. Ltd.

APPENDIX-D

Draft Proposal of PPP Scheme for Project of Yen Xa Wastewater Treatment Plant
(July, 2011)

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

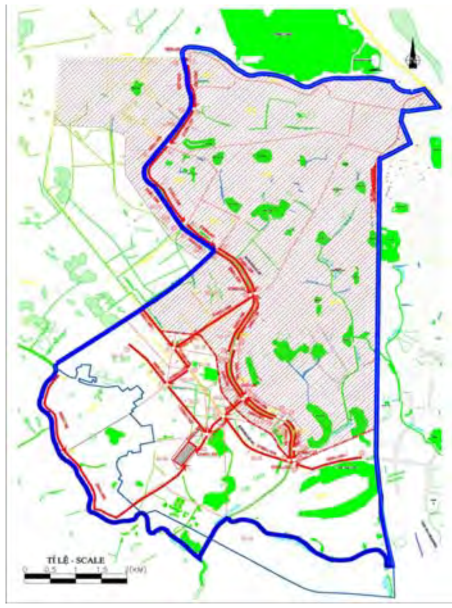
<u>Outline Project</u>

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^3/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^3/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
1) Pipe Network	184.2	18.4	20.3	**222.9**
2) Wastewater Treatment Plant	233.8	23.4	25.7	**282.9**
3) Sludge Recycling Facility	32.6	3.3	3.6	**39.5**
Total	**450.6**	**45.1**	**49.6**	**<u>545.3</u>**

（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$/m^3 (5,150VND/m^3), which could cover the operation and maintenance cost (including replacement of mechanical and electrical equipments in 20 years). The tariff would be increased gradually over 10 years since the commencement of the operation of Yen So Treatment Plan (by 5 years after completion of the construction works of Yen Xa). The proposed tariff level is around 10 times of current sewerage tariff, which is same as current water tariff level. As shown in Figure S1, required expenditure from HPC general account is estimated at around 25.8 million US$/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)

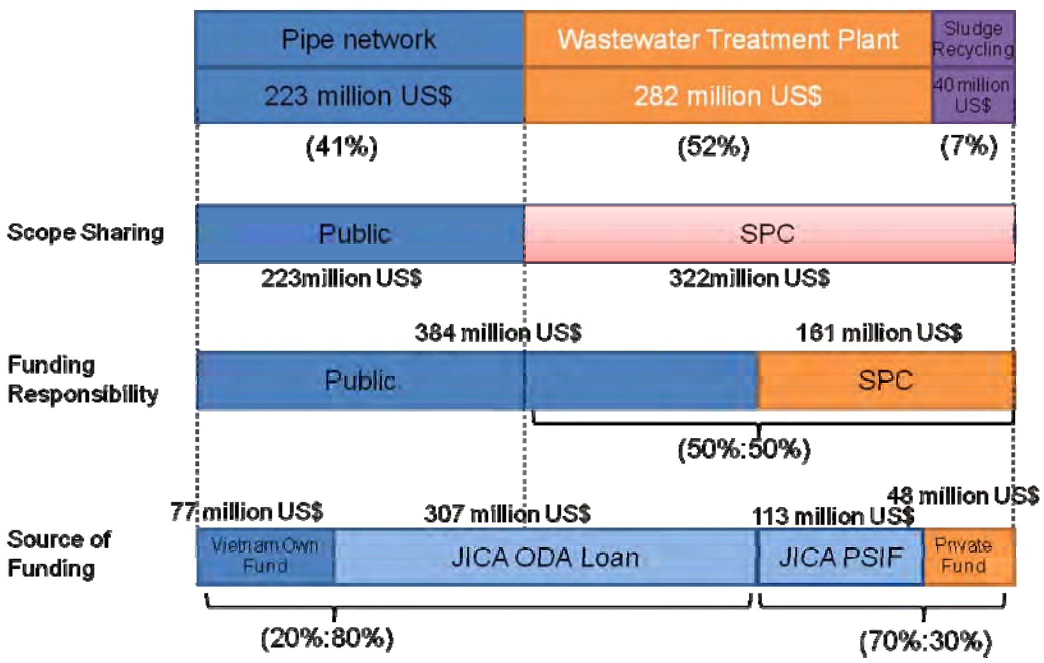


Figure S1 Scope Sharing and Funding Sources of the Project

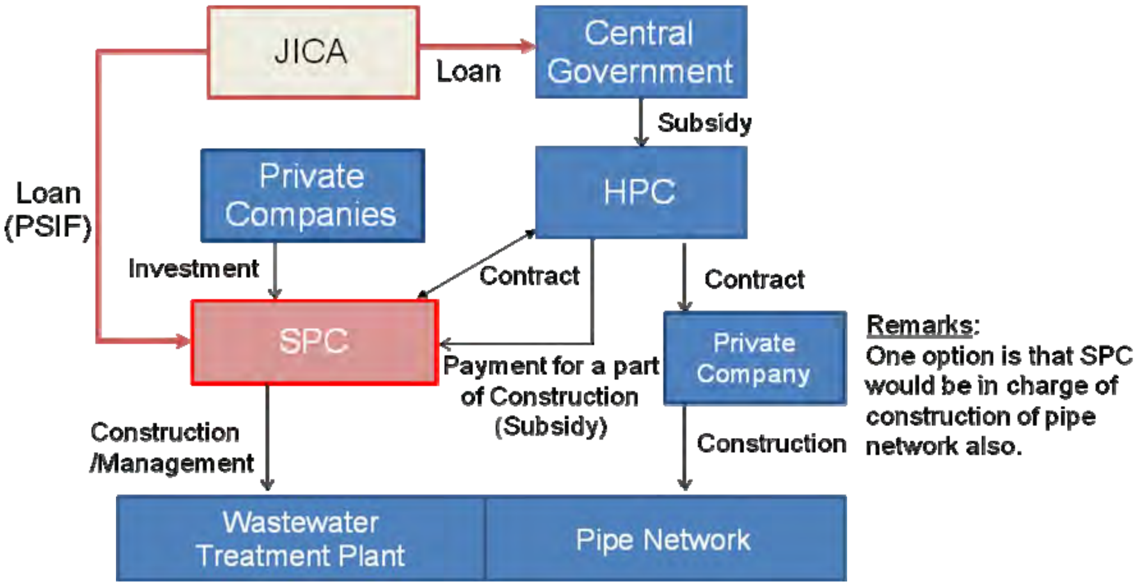


Figure S2 Draft Organization Chart of PPP Scheme for Construction of Yen Xa WWTP

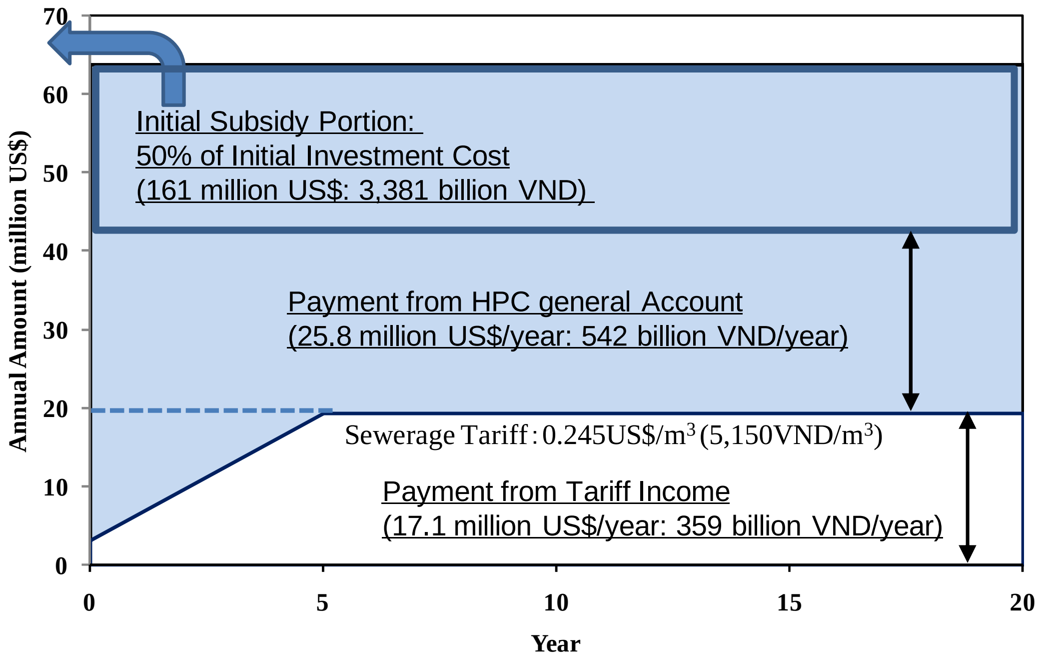


Figure S3 Allocation of Required Cost to Each Source for Yen Xa WWTP

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^3$ (5,150VND/m^3), 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.

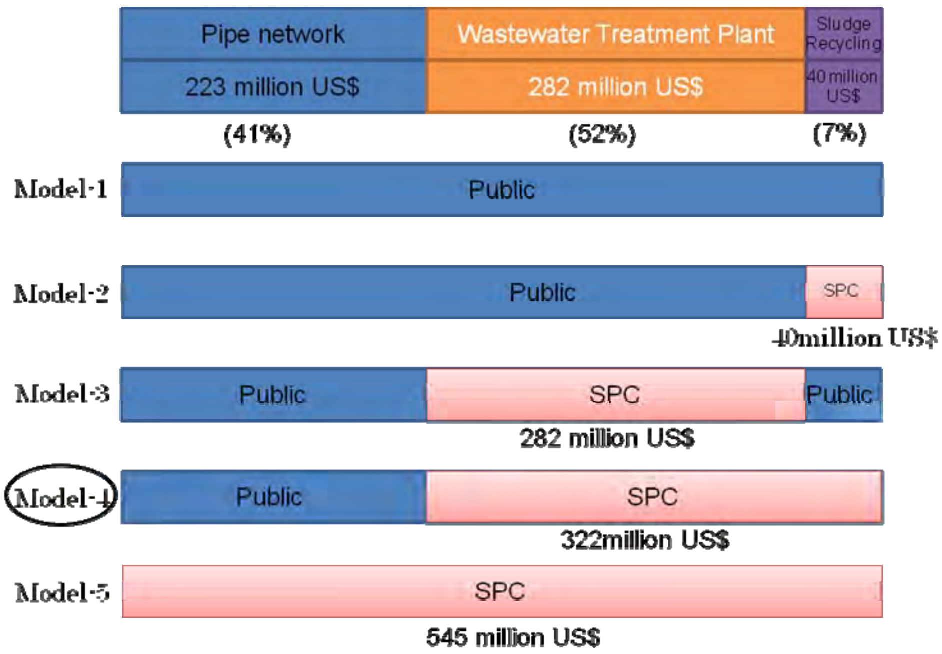


Figure 2-1 Scope Sharing and Costs of PPP 5 Models

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

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 million US$) in 2011	-
3	Municipality Bond	7-10%
4	Loan from Central Government	No data
Private Funding Source		
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 grand 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 ad 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

Figure4-1 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.

	Pipe Network	Wastewater Treatment Plant + Sludge Recycling Facility
Management	Public	SPC
Construction Cost	223 million US$	322 million US$

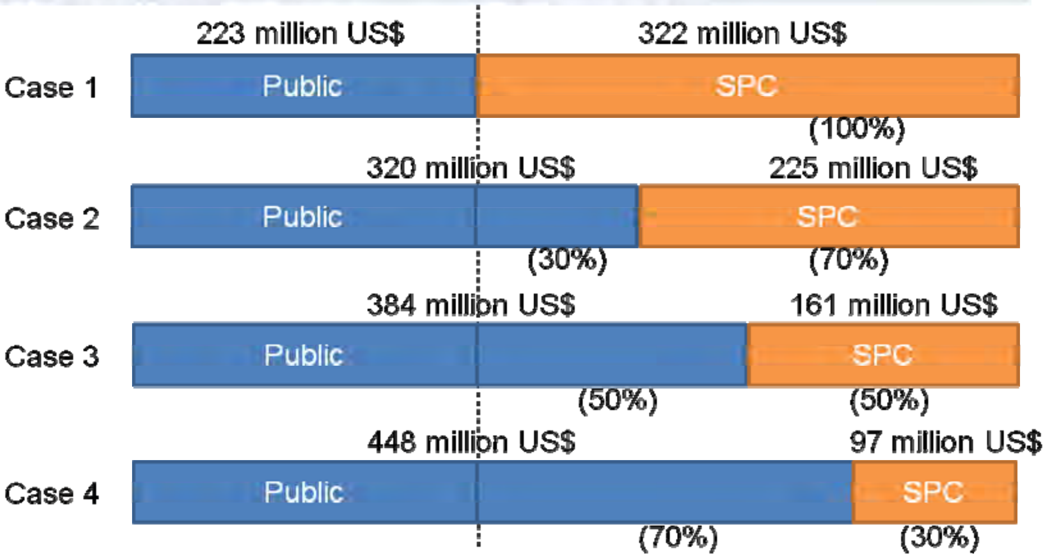


Figure 4-1 Alternatives of Subsidy Ratio for Initial Investment Cost

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$/year for the repayment and operation and maintenance to SPC. If the financial source is only tariff income in service area of Yen Xa WWTP, sewerage tariff should be 0.81 US$/$m^3$ (17,000 VND/m^3). 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 m3/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.

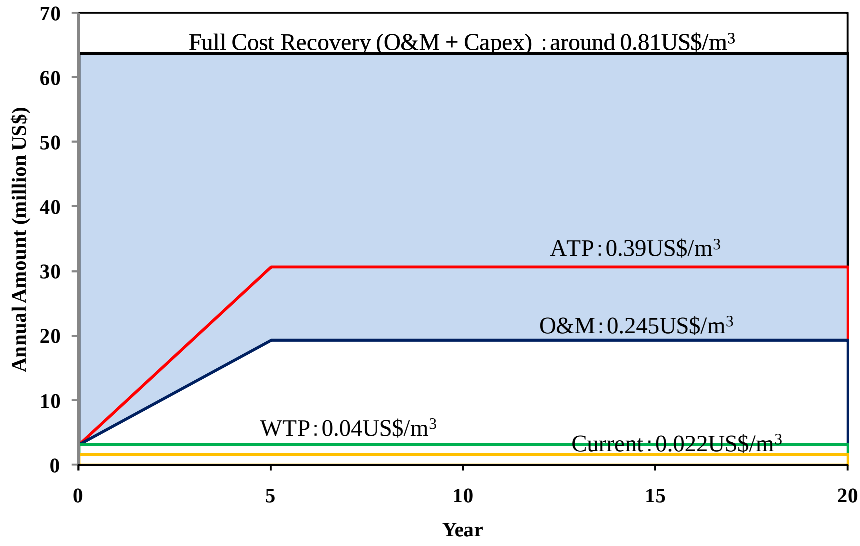


Figure5-1 Alternatives of Sewerage tariff level and Required Annual Payment

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^3 (840 VND/m^3)

   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^3 (5,150 VND/m^3)

   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^3 (8,190 VND/m^3)

   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 m3/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^3, 0.245 US$ /m^3, 0.39 US$ /m^3 Increasing up to target tariff level from 0.04 US$ /m^3 (840 VND /m^3) 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^3$ (5,150 VND/m^3) is shown in Figure 5-2

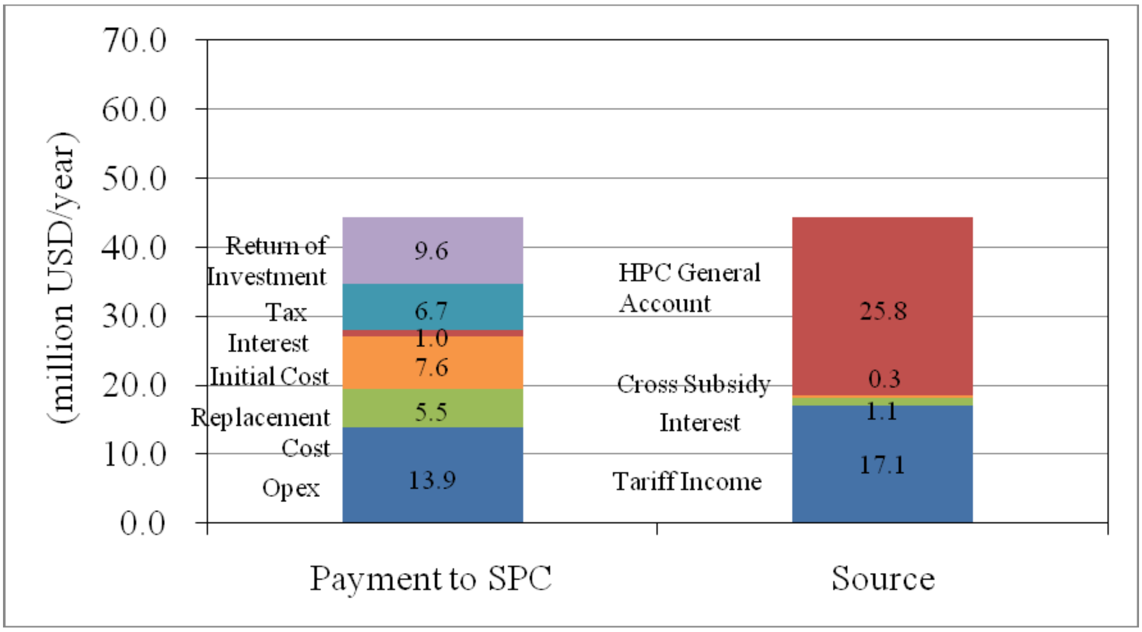


Figure 5-2 Result of Financial Analysis (PPP Model-4, Case-3 with Tariff 0.245 US$/$m^3$)

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

Table 5-3 Output Items of Financial Analysis

Items	Assumptions
Payment to SPC	
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.
Financial Source	
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^3$ 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^3 (US$ 0.04/ m^3) 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^3 (US$ 0.245/ m^3) Management Cost Recovery (1.1% of household Income)	45.2 (949)	33.6 (706)	25.8 (542)	18.0 (378)
VND 8,190 / m^3 (US$ 0.39/ m^3) 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^3$ (5,150VND/m^3), 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.

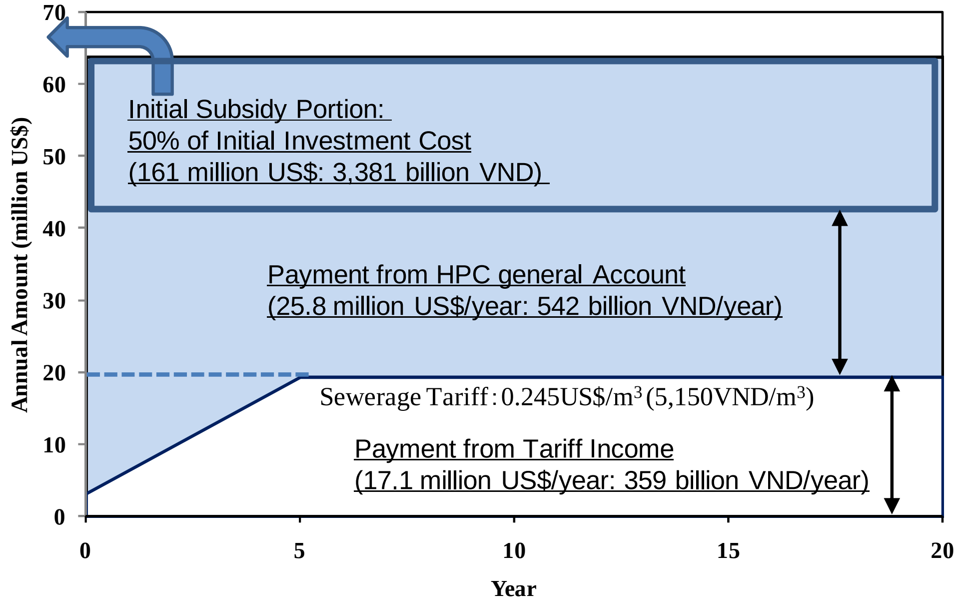


Figure 6-1 Allocation of Required Cost to Each Source for Yen Xa WWTP

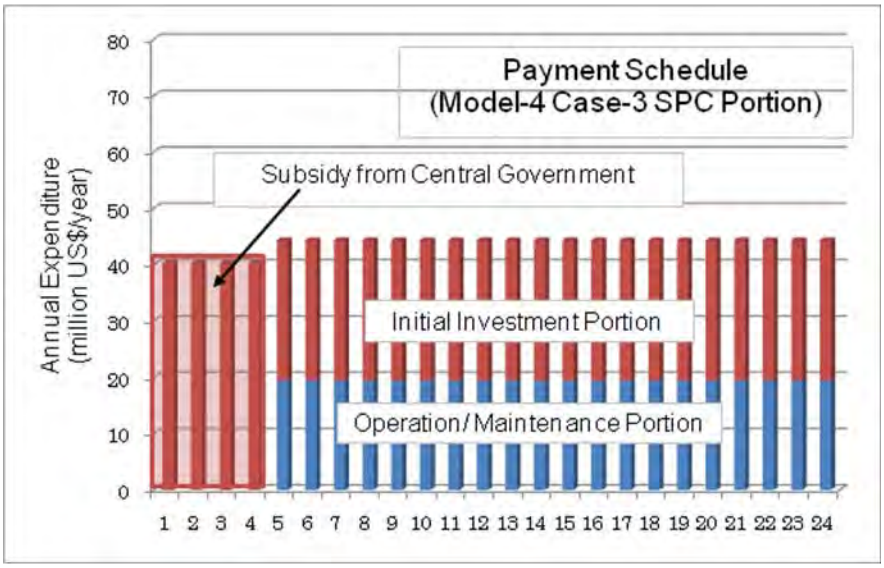


Figure 6-2 Expenditure Plan of HPC (Model-4 case-3)

(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.

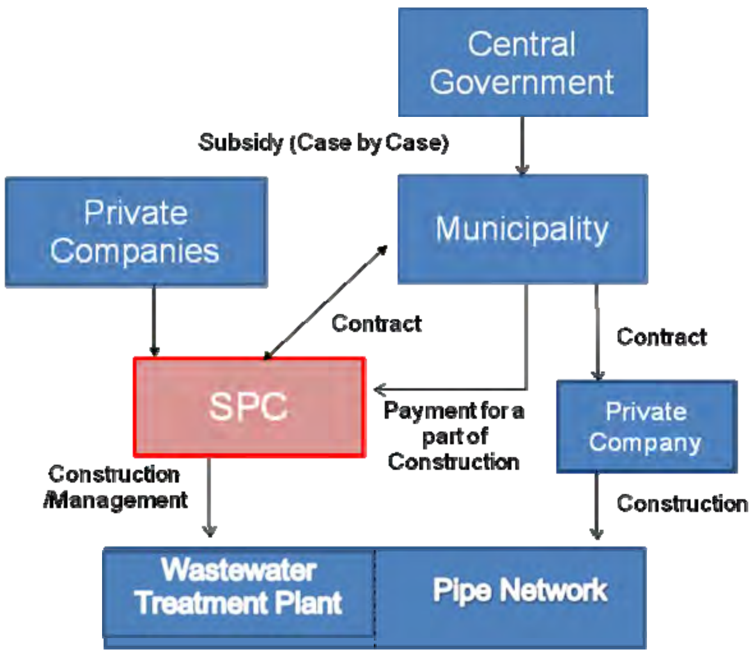


Figure 7-1 Sample of Organization Chart of PPP Scheme for Construction of WWTP

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..

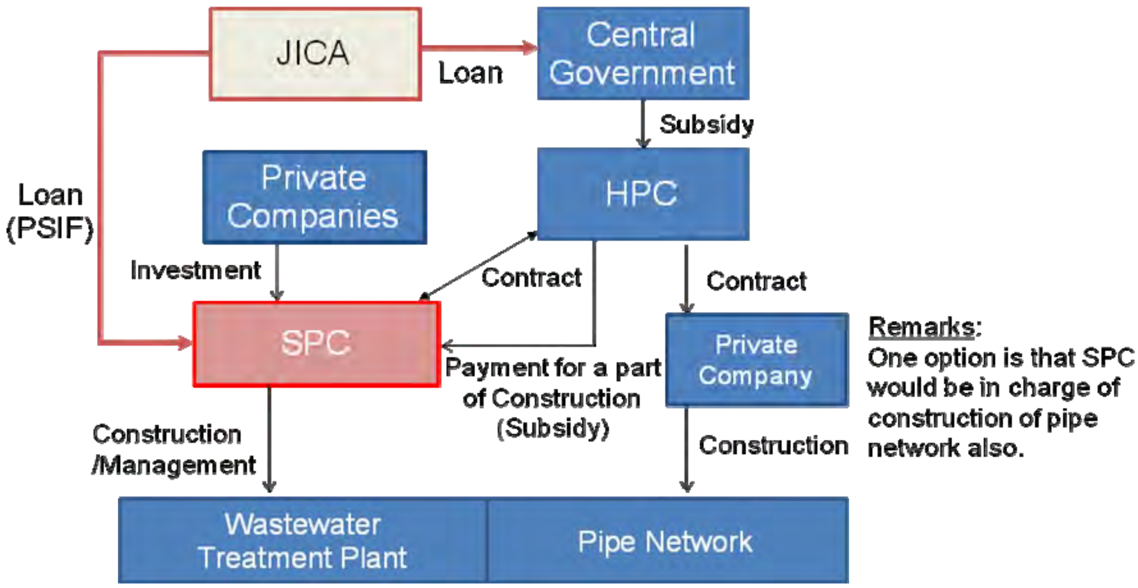


Figure 7-2 Draft Organization Chart of PPP scheme for construction of Yen Xa WWTP

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%)	
Public Portion (Pipe Network)	44.6	178.3	-	-	**222.9**
SPC Portion (Wastewater Treatment Plant, and Sludge Recycling Facility)	32.2	129.0 161.2 (50%)	112.8	48.4 161.2 (50%)	**322.4**
Total	**76.8**	**307.3**	**112.8**	**48.4**	**545.3**

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
1) Pipe Network	184.2	18.4	20.3	**222.9**
2) Wastewater Treatment Plant	233.8	23.4	25.7	**282.9**
3) Sludge Recycling Facility	32.6	3.3	3.6	**39.5**
Total	**450.6**	**45.1**	**49.6**	**545.3**

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.

Table 1.2 Procuder of Cost Estimate

Items		Construction Cost										EPC Cost of PPP Project (Step 5)
		F/S Report, 2008 (Step 1)			Modified with 2011 Price (Step 2)			Modified for PPP Project (Step 3&4)				
		Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Exchange to US$	
		(million JPY)	(million VND)	(million JPY)	(million JPY)	(million VND)	(million JPY)	(million JPY)	(million VND)	(million JPY)	**(million US$)**	**(million US$)**
Sewer Collection System	Civil Works	10,095	687,308	14,391	10,095	963,606	13,921	10,095	963,606	13,921	**167.4**	**184.2**
	Mechanical, Electrical	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	**63.9**	**233.8**
	Mechanical, Electrical	14,293	124,679	15,072	14,293	174,800	14,987	11,434	139,840	11,990	**144.2**	
Sludge Recycle Center (Solor Drying + Mechanical Drying)	Civil Works	-	-	-	-	-	-	-	-	423	**5.1**	**32.6**
	Mechanical, Electrical	-	-	-	-	-	-	-	-	2,045	**24.6**	
Integurated Control System	Civil Works	-	-	-	-	-	-	-	-	0	**0**	-
	Mechanical, Electrical	-	-	-	-	-	-	-	-	372	**4.5**	-
Total				36,691			35,545			34,060	**409.6**	**450.6**

Remaks: 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 Acqusition 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 1st 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_1	B_1	C_1 (=1.402*B_1)	D_1 (=A_1+ C_1/0.00397)	E_1 (=D_1)	F_1 (=E_1/83.15)	G_1 (=1.1*F_1)
WWTP	A_2	B_2	C_2 (=1.402*B_2)	D_2 (=A_2+ C_2/0.00397)	E_2 (=0.8D_2)	F_2 (=E_2/83.15)	G_2 (=1.1*F_2)
Sludge Recycle System	-	-	-	-	E_3	F_3 (=E_3/83.15)	G_3 (=1.1*F_3)
Integrated Control System	-	-	-	-	E_4	F_4 (=E_4/83.15)	G_4 (=1.1*F_4)

*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 fcility and the integrated control system are newly estimated in this Study.

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

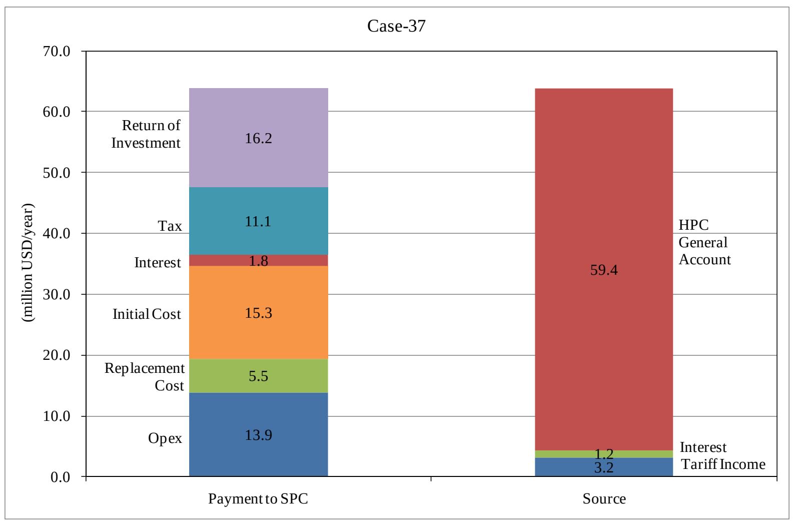
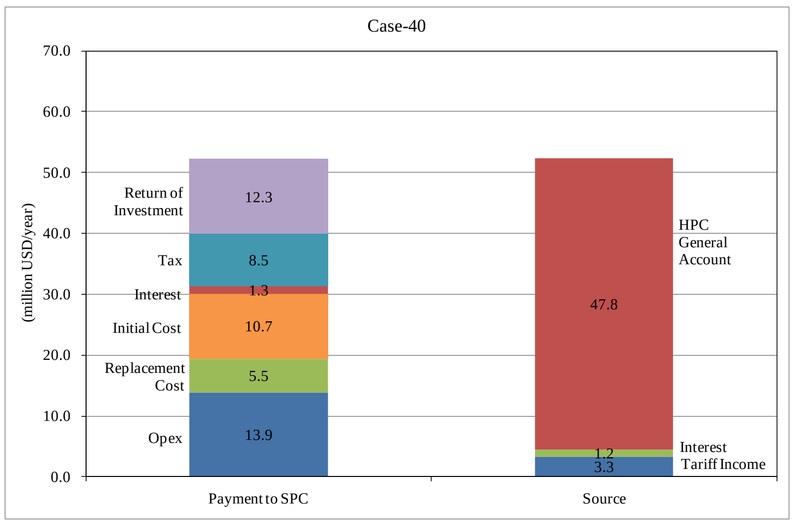
Appendix-2: Results of Financial Analysis (Model-4)

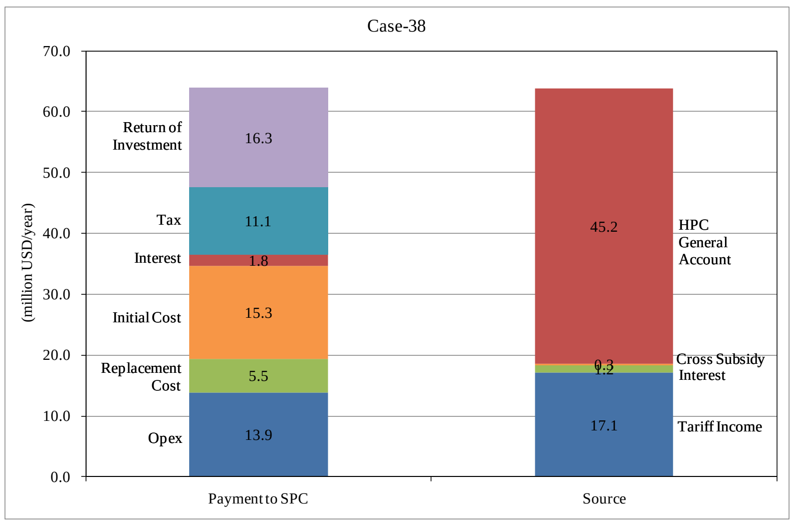
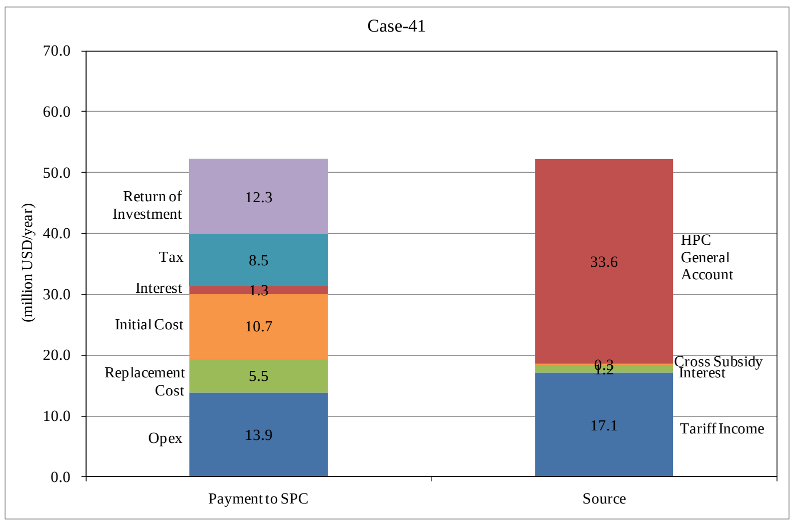
Model

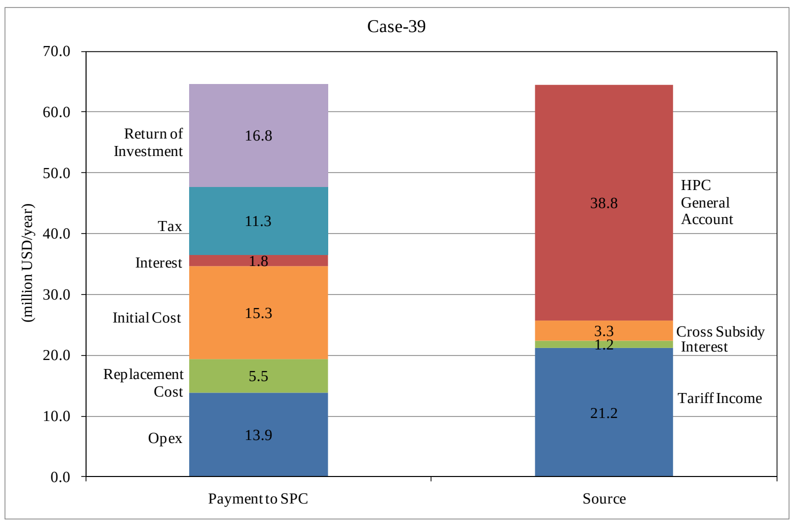
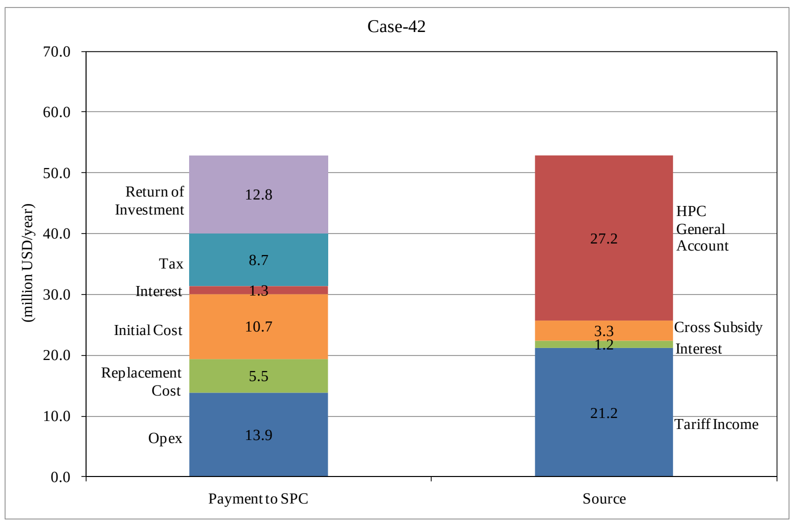
Pipe	WWTP	Sludge Recycle
Public	SPC	SPC

Cash Flow (US$MM) 2011 Price

<table>
<tr><th>Tariff</th><th>0% Subsidy</th><th>30% Subsidy</th></tr>
<tr><td>US$
0.04/m^3
VND
840/m^3
(0.19%)

WTP</td><td>
</td><td>
</td></tr>
<tr><td>US$
0.245/m^3
VND
5,150/m^3
(1.16%)

O&M</td><td>
</td><td>
</td></tr>
<tr><td>US$
0.39/m^3
VND
8,190/m^3
(1.80%)

ATP</td><td>
</td><td>
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<table>
<tr><th>Tariff</th><th>50% Subsidy</th><th>70% Subsidy</th></tr>
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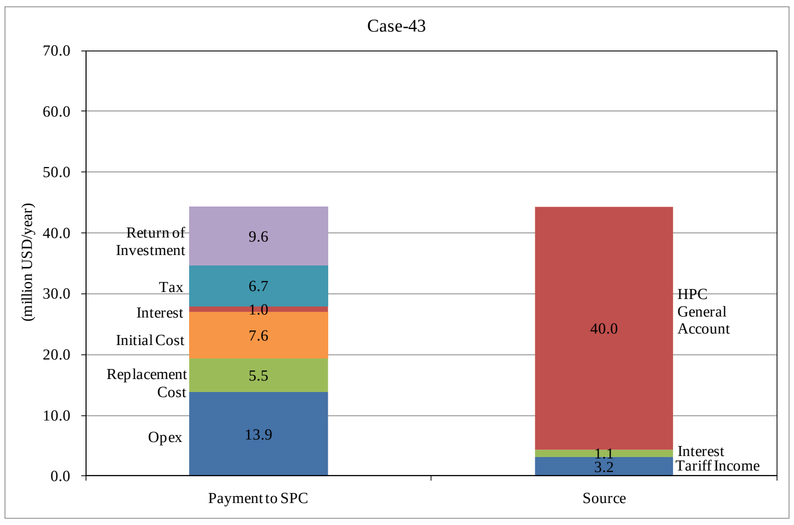
VND
840/m^3
(0.19%)

WTP</td>
<td>
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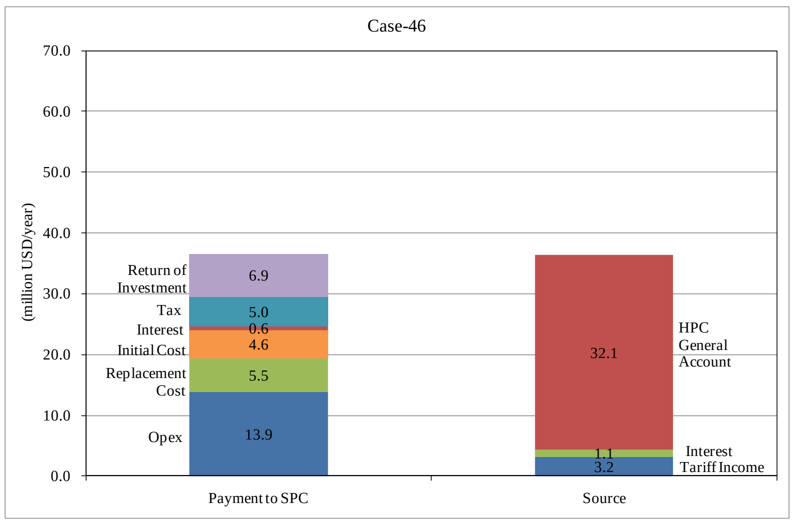
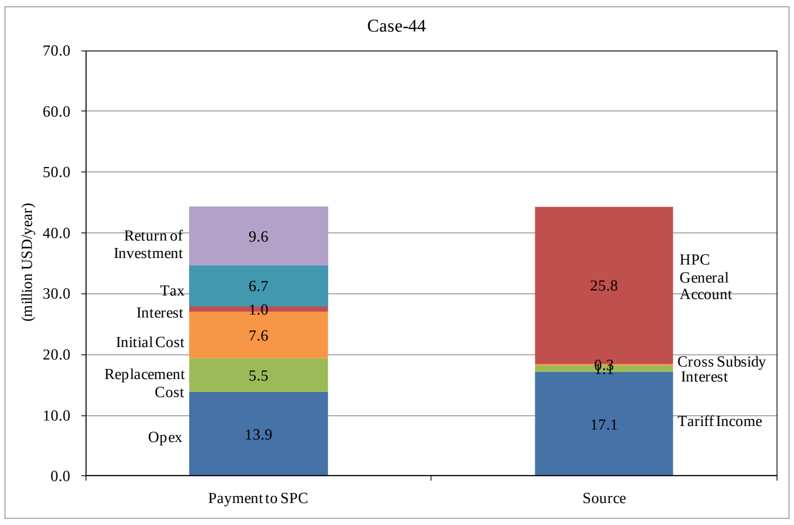
<td>
</td></tr>
<tr><td>US$
0.245/m^3
VND
5,150/m^3
(1.16%)

O&M</td>
<td>
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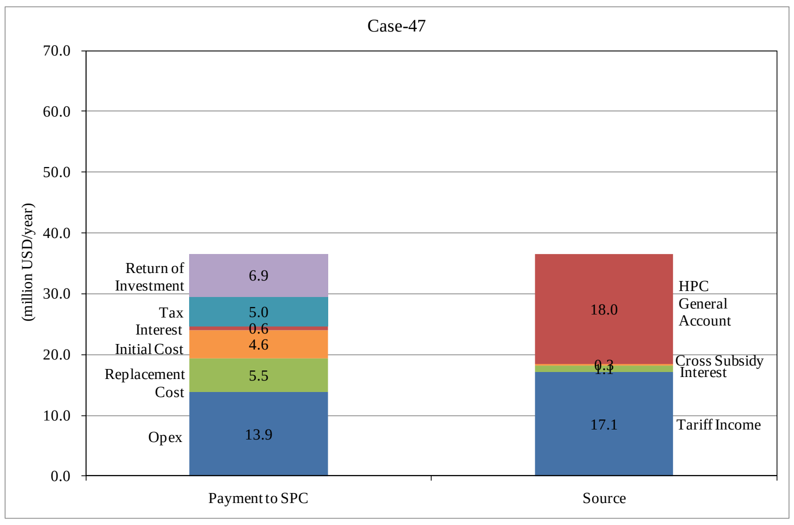
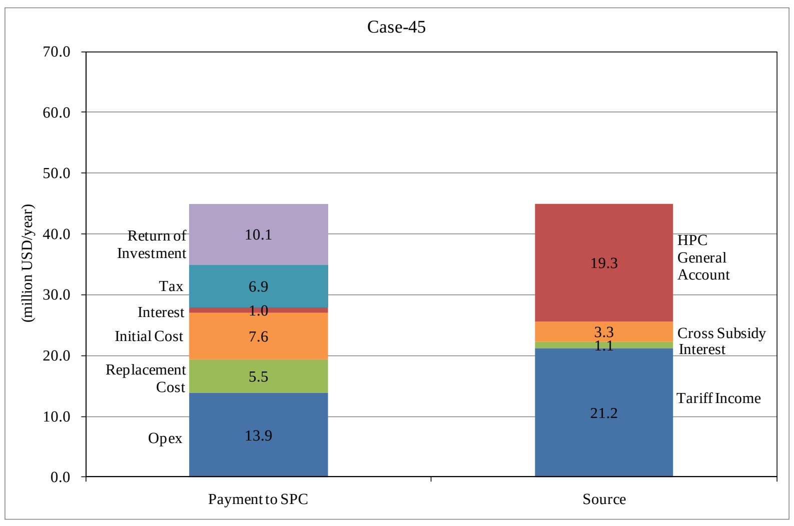
<td>
</td></tr>
<tr><td>US$
0.39/m^3
VND
8,190/m^3
(1.80%)

ATP</td>
<td>
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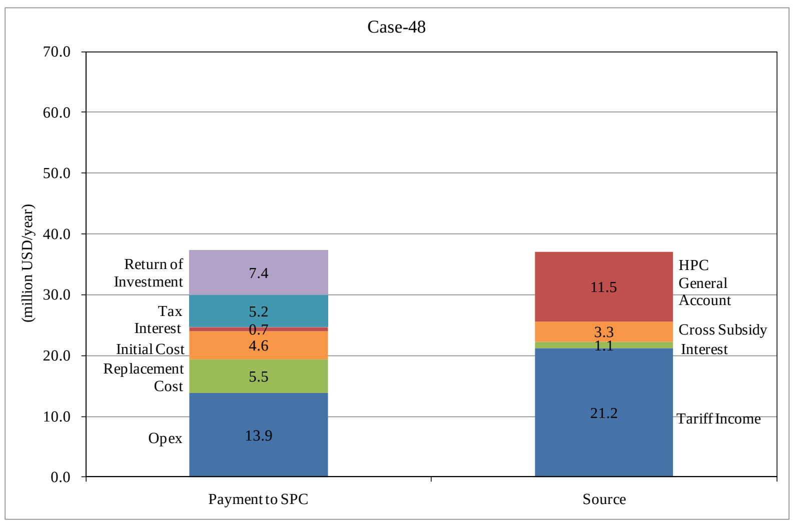
<td>
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APPENDIX-E

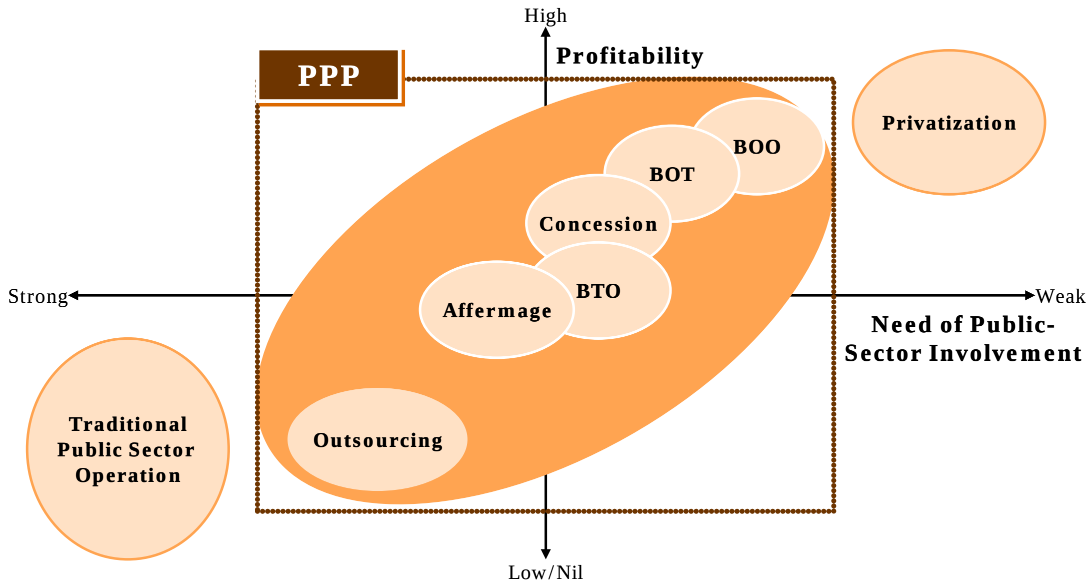
Basic Characteristics of PPPs and PPP Projects in the Sewerage Sector

Basic Characteristics of PPPs and PPP Projects in the Sewage Sector

1 Definition of PPP Projects

Definition of PPP (Public-Private Partnership) may slightly differ depending upon the background or major parties. For example, according to "System of National Accounts, 2008", which is a guide line for standard of international statistics, PPPs "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...." According to another source, however, PPPs are defined as various methods to implement public services using know-how of private sector entities, such as PFI (Private Finance Initiative, Concession, Affermage, Outsourcing etc.[1]. Under "DECISION ON Issuance of Regulation on Pilot Investment using Public-Private Partnership Model (No.: 71/2010/QD-TTg)" in Vietnam, which is legislated for the pilot projects utilizing PPP scheme, provides "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." . This definition would be similar to the second definition referred to above.

Considering the above, this report shall use the word "PPPs" in the sense that "projects relating to public infrastructure or public services to be implemented based on certain agreements and under cooperation of public sector and private investors. Under such context, various methods of "cooperation" as illustrated below are included in PPP, and the basic approach of consideration is to select the best method suitable for a project.



[1] Strategy and methodology of privatization (Yumiko Noda, 2004)

2 History, Current Situation, and Necessity of PPP Projects

2.1 History of PPP Projects

Origins of PPPs trace back to 1980's, when European countries such as United Kingdom promoted PPPs as a method of privatization of public projects. Until 1970's, it was general in the developed countries that public entities owned by governments owe responsibility to develop public infrastructure (such as water, roads, electricity, etc.). It was pointed out, however, that those entities were not efficiently doing works, employing too many employees, slow service, and high tariffs. In U.K., where in 1970's economic stagnation and weaker international competitiveness reached so crucial level, Prime Minister Margaret Thatcher vigorously promoted privatization of infrastructure projects. Commonwealth countries including Australia and New Zealand adopted similar initiatives. But in some cases, a mare privatization of government owned enterprises did not lead to improvement of service quality or decrease in service tariff. In other cases, impartiality or safety of service recipients are put a lower priority than pursuit of corporate profits.

Under the above circumstances, improvements in the privatization schemes were investigated where (for example) ownership of entities remains in Government, but private sector know-how can utmostly be transferred to such entities. Based on such investigation, U.K. started in 1992 Private Finance Initiative ("PFI"), where a private sector consortium procures all of financing, design, construction, operation and maintenance of a public project in a lump under the business plan/scheme prepared by the public sector. For a PFI project, there is always a "PFI agreement" between the public sector body in charge of the project and the private sector consortium to implement the PFI project. The PFI agreement clearly provides for level of services which the public sector body requires, details of monitoring by the public sector body to monitor the actual level of service performed by the private sector consortium, and risk allocation between the two parties. The PFI agreements intend to control and secure that the underlying projects can be implemented with full importation of private sector know-how and also in accordance with original plan and requirements of the public sector. PFIs can be positioned as a measure to manage both i) to reduce the (financial) burden of the public sector by utilizing the know-how of the private sector and ii) to provide better public services, and have been introduced in European countries (which were trying fiscal reconstructions), Australia, Canada, New Zealand, South Africa, and Asian countries such as Korea and Japan.

The Blair regime in U.K., beginning from 1997, developed the concept of PPP, where not only PFI, but also concession, BOT, BOO, outsourcing, etc. are broadly included as measures to implement projects under partnership between public and private sectors. The concept of PPP has been spreading over to many countries in the world.

In the following sub-sections, the histories of importation of PFIs or PPPs in U.K., Latin America, Japan, and developing countries in Asia are described.

(1) United Kingdom

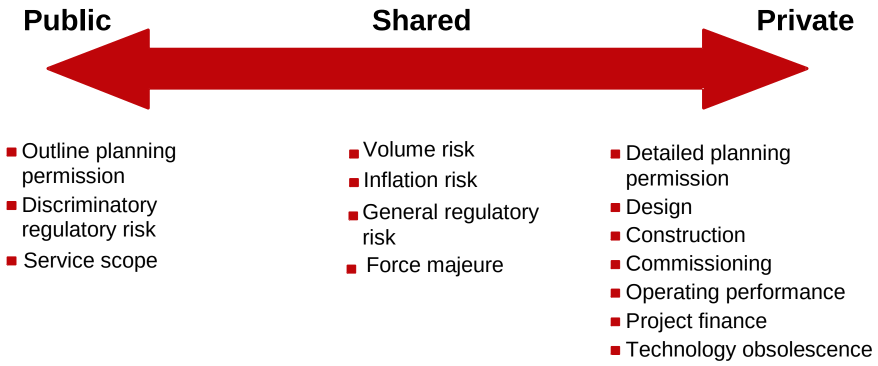
As mentioned above, in UK, PFIs were promoted as a measure to correct economic and fiscal stagnation deemed to be caused by the "large government" policy adopted until 1970's, and have been developed into PPPs in later 1990's and 2000's.

	1st Stage	2nd Stage	3rd Stage	4th Stage
Typical type of contracts	Rigid contracts	More flexibility	Complex partnerships	Range of contract options
Scope	Single asset	Plural assets	Including higher technologies/ know-how	Greater risk aversion
Finance	Procurement of finance by private sector	Independent equity	Secondary market sales	Operating businesses
	1993-1995	1996-2000	2001-2007	2007-2010

One of the characteristics of UK PPPs is that major type is "service provision" type, where the private sector recovers its costs and investments from the service charge paid by the public sector (i.e., not directly from the charges paid by the users/recipients of the facilities/services). In this type of PPPs, public sector pays for the services (outputs) provided by the private sector (i.e., not for the facilities/works (inputs)), therefore it is possible for the public sector not to pay the pre-determined service fee if the services provided do not reach the pre-determined service level. This means that public sector passes through to private sector the risk that necessary services are not obtained for certain reasons.

Another characteristic of UK PPPs is that there have been few unsuccessful projects. This is said to be attributable to the clearness of risk allocation between public sector and private sector in the PPP agreements.

EXAMPLE OF RISK TRANSFER IN PPPs



In U.K., it is said that 15 to 17% of VFM (Value for Money) in average has been obtained, and 89% of the projects constructed under PFI contracts have been completed as scheduled. The effect of PFI would be obvious if the data are compared with the data of “non-PFI” projects, where approximately 30% of projects have been completed as scheduled, and approximately 27% have been completed within the original budget. Satisfaction of the public sector side which has been received the services under PFIs is high, since 77% of persons in charge of PFI projects in public sector side answered that the effect of introduction of PFIs had been on or above expected level. Such success has led to the inflow of many non-U.K. investors in this market.

(2) Latin America

In the countries in Latin America, privatization of public services (such as roads, water, etc.) was vigorously promoted in 1990’s. The first water PPP in Latin America was implemented through the concession contract which the Argentina Government executed in 1991. Since then, the Argentina Government led the privatization of water projects until financial crisis in 2001. The PPP projects in Latin America, however, faced with various issues due to excessive transfer of responsibility and risks to private sector, and immature system of the bidding and contractual arrangements. For example, in Bolivia, a private company executed a concession contract rapidly raised the water tariff, and then was forced to withdraw from the project due to the resistance of residents who were not willing to pay the tariff. Many of PPP contracts in 1990’s in Latin America resulted in deadlocks or terminations.

Revision of PPP scheme took place after 2000 by each country, reflecting the above mentioned experiences in 1990’s and its own business culture, and revised scheme was developed which could fit each country. The examples are i) to introduce the concept of “cross-subsidy” among the projects of which profit abilities vary or in the project in which the income levels of each service area vary, ii) to establish a joint venture company to implement a project by a public body and a private company, or iii) to provide partial fiscal support to a (less profitable) concession project. By such measures, i.e., to introduce necessary controls or to strengthen involvements by the public sector, PPP projects in Latin America countries have been changing to be more sustainable.

(3) Japan

PFI in overseas countries got more attention in Japan in the latter half of 1990's when it faced with the concern of fiscal crisis like European countries but still needed more public works to stimulate the economy. Under such a situation, the "Act on Promotion of Private Finance Initiative" ("PFI Law") was enacted in 1999. Since then, more than 400 PFI/PPP projects have been implemented, and thus the Japanese PFI/PPP market has grown quickly.

A major characteristic of PFIs/PPPs in Japan is that the Government has maintained certain level of involvements to the projects, and thus (unlike Latin America PPPs) has avoided transferring excessive risks to the private sector. Even compared with UK PPPs, less risks are transferred to the private sector. For example, the risk of decline in the value of the assets is generally taken by the Government, while this risk is generally transferred to the private sector in UK PPPs.

Japan, in spite of such differences, has been as successful as U.K. in reducing the costs of the projects by introducing PFI/PPP scheme. It is reported that the 234 PFI/PPP projects which were implemented from 1999 to 2009 brought approximately 8.2 billion yen of VFM in total.

(4) Developing Countries in Asia

Importation of PPPs in the developing countries in Asia started (or resumed after the Asian Crisis) from 2000's, and thus promotion of PPPs in these countries are regarded as a relatively new policy.

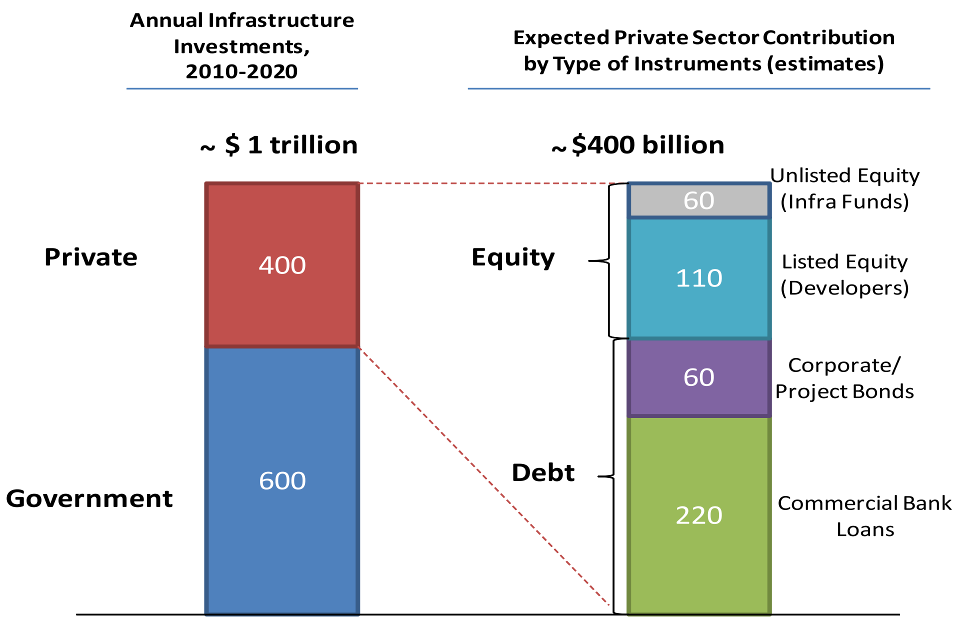
There have been already successful examples of PPPs in some sectors including power and water. The legal or structural framework, however, would need to be developed further in the area of risk allocation, cost recovery system, land acquisition, and possible adoption of viability gap funding ("VGF").

In addition, it should be noted that direct importation of framework or methods of overseas PPPs may lead to various confusions experienced by Latin America countries due to drastic changes. Each country should make proper discussion and analysis in order to establish appropriate framework and methods of PPPs considering its own economic and political background

For such discussion or analysis, the history of PPP importation in Japan may be a good reference for establishment of new framework and methods, since it has been successful in reducing budgetary expenses and expanding PFI/PPP market although its framework and methods of PPPs have been different from those in U.K..

2.2 Current Situation of Infrastructure Projects and Necessity of PPPs

According to the estimation by Asia Development Bank ("AD B") about the demand of infrastructure investments, USD 1 trillion per year of new investments shall be required in Asia. On the other hand, ADB estimates that only 60% of such investments shall be able to be afforded by government budgets. There is a huge gap of investments and budgets.



Source: Barrow, Michael (June 2010), ADB, "Private Financing of Infrastructure in Asia"

ADB Workshop on APEC Growth Strategy, Sapporo, Japan

According to the Ministry of Planning and Investment of the Vietnam Government, the demand for infrastructure investments is USD 12 billion per year, while USD 6 to 7 billion per year is affordable from government budgets. In order to smoothly implement necessary infrastructure projects, to fill in the gap of investments and budgets by utilizing private funds is essential.

3 Merits and Issues of PPPs

(1) Merits of PPPs

Generally, infrastructure development using PPP scheme has the following merits compared with traditional "public work" methods:

- Better quality of services can be expected by introducing know-how, management skills, innovation, and new technologies in the private sector;
- Reduction in life cycle cost can be expected since a single private entity (consortium) shall take seamless responsibility of finance, design, construction, and operation;
- Continuous efforts for operation improvements can be encouraged by adopting the method of "output-based" payments where the public sector's payments for services differ depending on the level and quantity of the services.
- Risks which private sector can better manage can be transferred to private sector;
- Risk of decline in the value of the assets can be transferred to private sector; and
- "Single window responsibility" can be implemented since public sector executes the PPP contract with a single private entity.

(2) Issues of PPPs

While the above merits can be expected, the following are the issues of PPPs which should be more carefully considered by development countries. For success of PPP projects, clarification of relevant processes, as well as clear provisions in PPP contracts would be necessary:

- Public Sector needs to have a necessary skills to properly monitor the performance of the private entities to implement PPPs;
- Governments need to be carefully use PPPs so as not to impair their fiscal flexibility by making excessive long term commitments for PPPs:
- Transfer of risks to the private sector is not for free and is inevitably accompanied by payments for such risk taking; and
- Financing costs for private financing are usually higher than the costs for public financing.

4 Examples of PPP Projects in the World

The following illustrates the examples of PPP projects in the water sector implemented in the world.

4.1 Ulu Pandan NEWater DBOO Project

(1) Outline

In this project, a private sector company was delegated design, construction, financing, ownership, and operation of an NEWater Plant. Reduction of water tariff accompanied by the reduction of life cycle costs was accomplished. In addition, the project company is managed steadily by continuing to make profit.

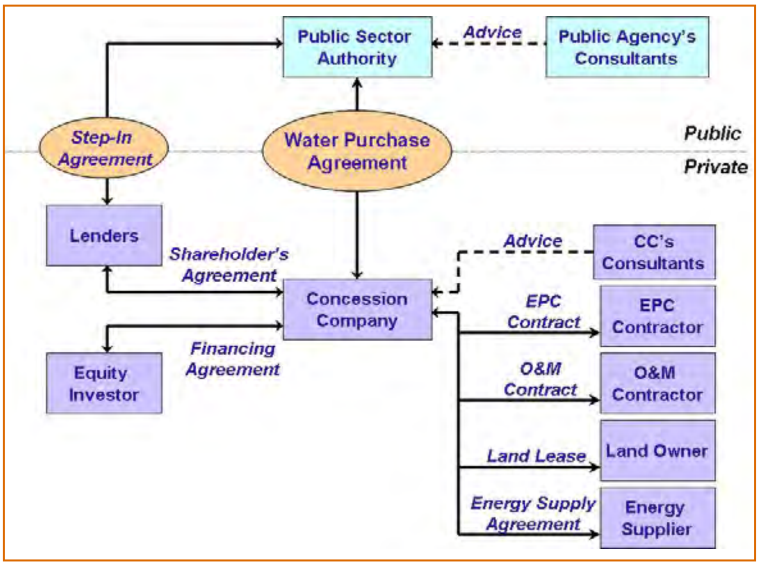
Public Agency	Public Utilities Board （PUB）
Contractor (Private Sector Company)	Keppel Seghers NEWater Development Company
Operational Period	20 years
Background and Summary of the Project	NEWater is recycled, used water that has undergone stringent purification and treatment process using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. The plant is the forth and the largest NEWater plant in Singapore with a capacity of 148,000m3 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/m3 for the NEWater services. The price has decreased once the contract was announced to $1.15/m3, and dropped further in April 2007 to $1.00/m3, 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.

(2) Project Scheme

The Ulu Pandan NEWater Plant is built on a Design-Build-Own and Operate (DBOO) 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.

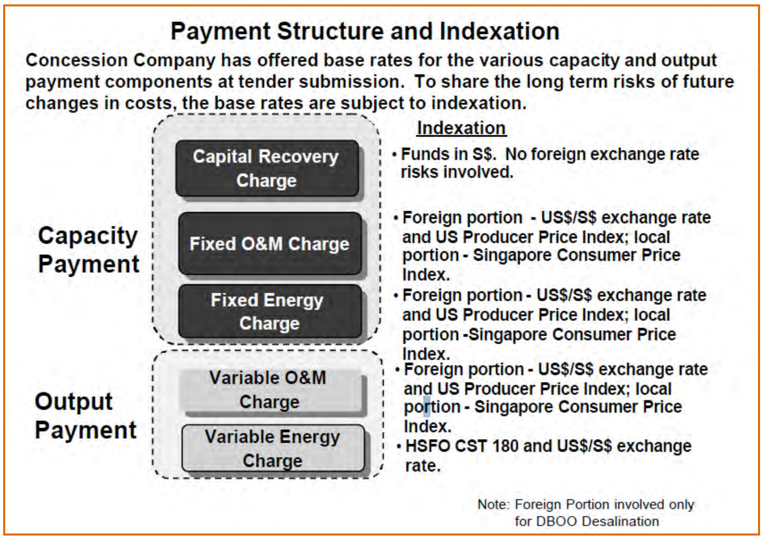
PUB purchases the NEWater from the SPV. SPV shall recover the initial investment from the payments by PUB, instead of sewage tariff from the residents ("Service Purchase Structure").



Source：PUB "PUB Singapore's Experience in Public-Private-Partnership (PPP) Projects "
2008 CAPAM Biennial Conference 19 – 22 Oct 2008

"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.



Source：PUB "Desalination and Ulu Pandan NEWater DBOO Projects –PUB's Experiences"
Capacity Building Workshop, Bangkok, 25-27 July 2006

Other key features contributing to the success of this project are as follows:

- 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 was executed 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 are also the provisions to allow private financiers to identify other potential service providers who can take over the operations.

4.2 Shanghai Zhuyuan No.1 Wastewater Treatment Plant

This project is a project to design, construct and operate a wastewater treatment plant in Shanghai in China. Drastic reduction in life cycle cost was achieved. In addition, quality of services is regar4ded high since the quality of water treated in the plant always meets the required level of services.

(1) Outline

Public Agency	Shanghai Water Authority and Shanghai Sewage Company
Contractor (Private Sector Company)	Shanghai ZhuyuanYoulianNo.1 Wastewater Treatment Ltd. CO
Operational Period	20 years
Background and Summary of the Project	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 km2 and about 23.5 million inhabitants. The Youlian Consortium (Youlian Development Company 45%, Huajin Information Investment Company 40%, and Shanghai Water Authority 15%) 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. In 2005, Youlian Development Company transferred its share (45%) to InterChina Holdings Grope and withdrew from this project
Achievement	The Consortium enabled to reduce the service fee compared to the former treatment cost by the government by 42%. 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.

(2) Project Scheme

In this project, the contractor invests, constructs, operates (20 years), and maintains the WWTP facilities under Build-Operate-Transfer (BOT) scheme. The government pays a service fee to the contractor’ s service (“Service Purchase Structure”).

Source：Lijin Zhong(2008) “Public-Private Partnerships in China’ s Urban Water Sector”

4.3 Barwon Water Biosolids Management Project

(1) Outline

This project is a project to design, construct, finance and operate a sludge (biosolids) treatment plant in Australia. Although operation commencement was delayed due to technical problems, the public sector did not incur additional costs due to contractual arrangement where such a risk was transferred to private sector.

Public Agency	Barwon Region Water Corporation ; BRWC
Contractor (Private Sector Company)	Plenary Environment (Barwon) Pty Ltd
Operational Period	20 years
Background and Summary of the Project	BRWC owns water reclamation plants, which produce sludge (biosolids) approximately 54,000 tons per year. In the project, the contractor Designs, Builds, Finances, and Operates (DBFO) facilities to receive biosolids produced and delivered from those water reclamation plants to process them into fertilizers and fuels for beneficial used. 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.)

(2) **Project Scheme**

In this project, the revenue of contractor (SPV) is from the service charge paid by BRWC. BRWC's monthly payment is comprised of 2 parts, i.e., one paid based on the availability ("Availability Payment") and the other paid based on the actual volume of sludge treatment ("Variable Payment"). Availability Payment is paid for the reservation of the treatment capacity for 24 hours, and can be reduced if the plant is not capable of treating the sludge. Availability Payment is also reduced if performance indicators set based on the treatment quality and environmental impact are not met. Variable payment is made based on monthly volume of sludge treatment and effective utilization of biosolids.

The operation has been delayed due to commissioning issues with the contractor's technology for the biosolids drying process. Under the PPP contract, however, this technology risk was transferred to the contractor and has not resulted in the BRWC bearing any financial implications.

4.4 Performance Management Contract for a Waterworks Authority

(1) **Outline**

This project is outsourcing operation of existing wastewater treatment plants, and operation and maintenance is the scope of work of the contractor. Although all work from design to operation is not delegated to a single private entity, certain level of optimization of operation has been achieved using know-how of private sector.

Public Agency	Not disclosed (A water agency in a country in the Asia Pacific Area)
Contractor (Private Sector Company)	Not disclosed (A water operator)
Background and 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.
Achievement	-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.)

(2) Project Scheme

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 payments by the WA to the contractor include the following:

- Monthly management fee (fixed);
- Operation and maintenance costs planned and pre-agreed between the WA and the contractor;
- Repair and replace costs planned and pre-agreed between the WA and the contractor; and
- Incentive arrangements (e.g., penalty if the performance of the contractor does not meet the guaranteed level).

3.5 Analysis of PPPs in the Wastewater Sector

Examples of PPPs in various countries referred to above shows that adoption of PPP scheme would bring certain achievements, such as reduction in life cycle cost by optimization of project management, long term maintenance of service quality, and reduction of risks by transferring risks to the private sector. Key success factors of PPP Projects would include i) proper and clear risk allocation, ii) introduction of measures to enhance the viability of projects (for example, adoption of "Service Purchase Type" contracts where the demand risk is borne by the public sector side), and iii) continuous monitoring of performance of the private sector side based on the performance indicators pre-agreed and clearly written in contracts.

In addition, taking into account the fact that the profitability of wastewater sector is generally not high, we think that the following factors would be important to implement a wastewater PPP project with promoting participation and cooperation of private sector companies:

- Balanced revenue with consideration of subsidies

  The profitability of the wastewater sector is generally not high. In addition, wastewater tariff usually has to be set at low level in developing countries. Therefore, the structure where the wastewater tariff is the primary source of contractors (private entities or SPCs) may not work. As shown in the examples above, balanced revenue sources (i.e., realistic tariff from the users of wastewater treatment services plus subsidies from government or municipality) for compensation of initial and operation costs incurred by SPCS need to be considered.

- Proper risk sharing

  It is necessary to list up all important risks associated with implementation of the project, and to determine who among the parties shall take each risk. This shall eliminate the uncertainty of the project for a long term. The principle of risk sharing is that a risk should be taken by a party who can best manage the risk.

- Clearness of payment mechanism and monitoring methods

  In order to obtain services meeting expected service level, PPP contracts need to clearly provide for the expected level of service (output), mechanism determining the payments for services (e.g., penalty if the services fail to achieve certain level), and method to monitor the performance of the contractor.