

目 次

	ページ
1. 業務の目的と背景	1
2. ハノイ市の下水・排水処理施設の運営・維持管理体制	3
3. 既存処理場の運転・維持管理業務の効率化	4
4. PPP の導入を含む運営管理体制の提案	6
5. 下水道料金設定に関する提言及び財政計画	10

添付資料：プレゼンテーション資料

略 語

BOD	生物化学的酸素要求量 (Biochemical Oxygen Demand)
BT	Build -Transfer
COD	化学的酸素要求量 (Chemical Oxygen Demand)
DOC	ハノイ市建設局 (Department of Construction)
EFP	環境保護費 (Environmental Protection Fee)
HAPI	ハノイ市計画投資局 (Hanoi Authority for Planning and Investment)
HPC	ハノイ市人民委員会 (Hanoi People' s Committee)
HSDC	ハノイ下水・排水公社 (Hanoi Sewerage and Drainage One-Member State Company Limited)
HSDPMB	Hanoi Sewerage and Drainage Project Management Unit
IOMS	包括運転維持管理契約 (Integrated Operation and Maintenance Services)
JICA	独立行政法人国際協力機構 (Japan International Cooperation Agency)
JSWA	日本下水道事業団 (Japan Sewage Works Agency)
OJT	On-the-Job Training
PDCA	Plan-Do-Check-Action
PPP	Public-Private Partnership
VND	ベトナム国通貨単位 (Vietnamese Dong)
WTE	Wastewater Treatment Enterprise
WWTP	下水処理場 (Wastewater Treatment Plant)

1. 業務の目的と背景

ベトナム国(以下「ベ」国)の首都ハノイ市では、近年の急速な工業化及び都市化の進展に伴い、工業・生活排水量が急増している。このような状況下、我が国はベトナム国ハノイ市において、有償資金協力である「ハノイ水環境改善事業」、「第2期ハノイ水環境改善事業」等を通じ、キムリエン、チュックバック、北タンロンの3下水処理場の建設や管渠の設置を含む下水道システムの整備を支援してきた。また、近い内に民間企業が投資するイェンソ処理場、円借款で建設予定のバイマウ処理場等の幾つかの下水施設が建設される予定である。

現在これらの下水施設は、ハノイ下水・排水公社(以下「HSDC」)により維持管理されている。今後、公共と民間の両方の資本による事業を通じてさらなる下水道システムの拡充が進められる予定であり、施設の運転維持管理を担うHSDCの能力向上の他、財政面での持続性が確保されるような料金・財政計画の策定や新たな運営管理体制の構築等が不可欠である事から国際協力機構(JICA)は以下の目的で本調査を実施した。

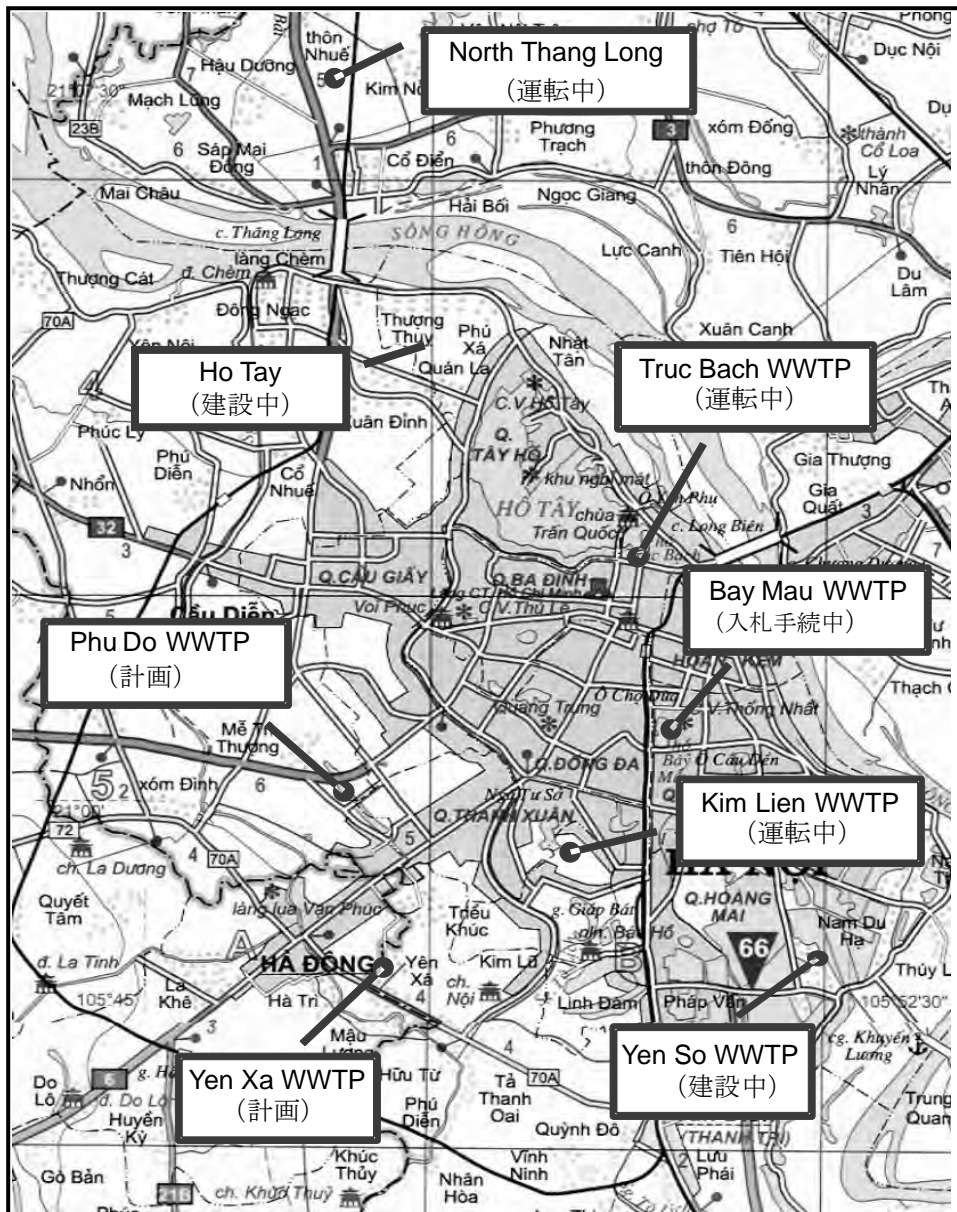
- ① ハノイ市の既存処理場の運転・維持管理業務の効率化のための提言・助言
- ② 建設中及び建設予定のイェンソ及びバイマウ処理場を主なターゲットとしたPPPの導入を含む運営管理体制の提案
- ③ ハノイ市全体の下水料金設定に関する提言及び下水料金を導入した場合の財政計画

表 1-1 ハノイ市の既設・新設下水処理施設概要

項目	既設処理場		
	キムリエン	チュックバック	北タンロン
処理能力 (m ³ /日)	3,700	2,500	42,000
処理人口	15,700	—	110,000
供用開始年	2005	2005	2009
建設資金源	円借款	円借款	円借款
維持管理主体	HSDC		

項目	新設予定処理場				
	バイマウ湖	イェンソ	イェンサ	プド	ホータイ
処理能力 (m ³ /日)	14,000	200,000	270,000	84,000	15,000
進行状況	入札中	建設中	計画	計画	建設中
建設資金源	円借款	民間資本	円借款予定	未定	民間資本
維持管理主体 ¹⁾	未定				

出典：Strengthening of Operation and Maintenance of Sewerage Facilities in Hanoi



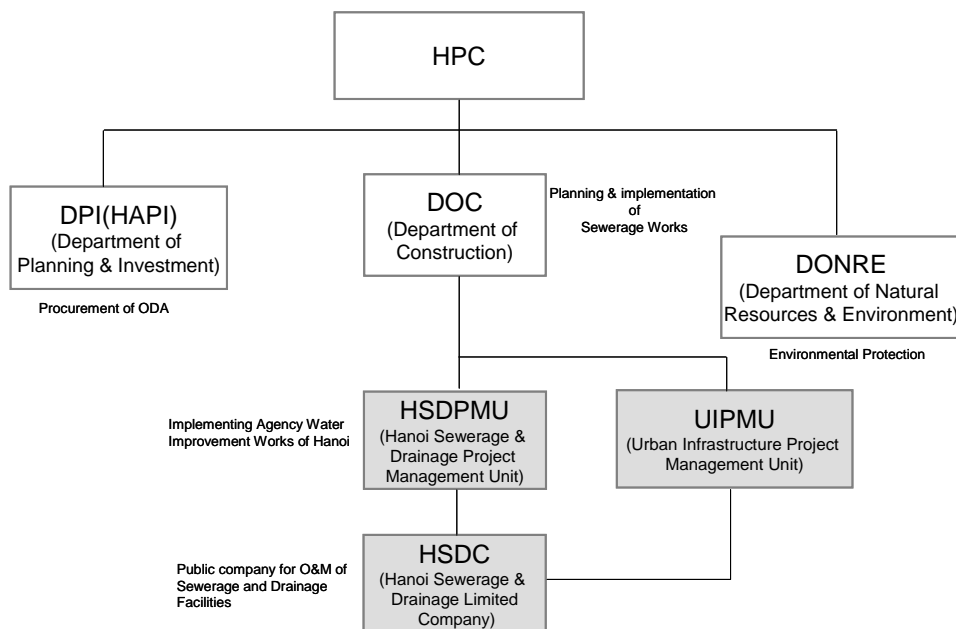
出典 : Strengthening of Operation and Maintenance of Sewerage Facilities in Hanoi

図 1-1 ハノイ市下水処理施設の位置図

2. ハノイ市の下水・排水処理施設の運営・維持管理体制

ハノイ市の下水・排水事業は HPC (Hanoi People's Committee)内部で、事業計画及び資金計画は HAPI (Hanoi Authority for Planning & Investment) が、技術管理と建設管理を DOC (Department of Construction) が所管している。DOC では建設段階までの管理を HSDPMB (Hanoi Sewerage & Drainage Project Management Board) が担当し、運転維持管理は HPC は出資した HSDC に委託している。

また、HSDC の組織の中では、下水管路及び処理施設の運営・維持管理は、HSDC 傘下の公企業である WTE (Wastewater Treatment Enterprise) が行なっている。

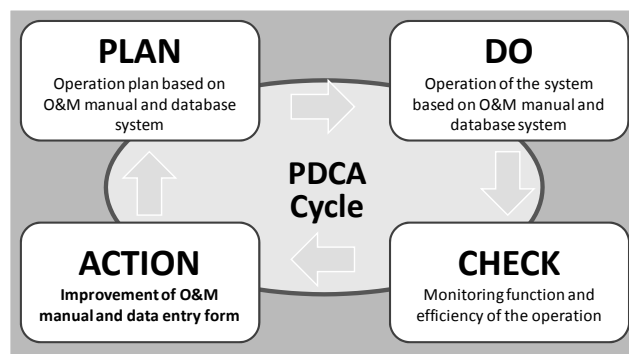


出典：Strengthening of Operation and Maintenance of Sewerage Facilities in Hanoi

図 2-1 ハノイ市下水排水事業実施体制

3. 既存処理場の運転・維持管理業務の効率化

HSDC は、運転維持管理マニュアルに基づいて 3 処理場を管理している。JICA 調査団は、運転維持管理業務の効率化のアプローチとして、プロジェクトサイクルマネジメント手法である PDCA サイクルを HSDC の日常業務に定着させる方針で調査に臨んだ。PDCA は、Plan・Do・Check・Action の略語で、事業活動上の計画－実施－監視－改善のサイクルを表す。組織レベルの PDCA とは、管理者が方針を決定し (P)、それに基づき活動し (D)、成果をモニターし (C)、モニター結果を作業にフィードバックする (A) ことであり、継続的改善を目指すには必須の手法である。



出典：JICA 調査団

図 3-1 PDCA サイクル

既存の運転維持管理マニュアルは、竣工時に建設会社が提出しハノイ人民委員会 (HPC) が承認したものであり、運転維持管理に必要な項目をかなり網羅している。HSDC は、作業効率改善のために、既存のマニュアルにおいて下記の補強すべき点があることを認識しており、JICA 調査団に検討を依頼した。

- (1) 運転維持管理マニュアルに運転維持管理データを評価するためのクライテリアを追加
- (2) 処理効率悪化時の対応策
- (3) 運転維持管理技術用語集

これらの依頼を受けて調査団は HSDC との協働作業により、以下の項目を補足する運転維持管理マニュアル追補版を作成した。

- a) 運転管理指標の追加：HSDC が、現在測定し記録している各測定値の許容範囲及び逸脱時の対策と、さらに処理を安定化するために必要な運転管理指標の追加を追補版運転・維持管理マニュアルで提案した。
- b) 処理効率悪化時の対応策：HSDC より要望された処理悪化時の対応策を追補版運転・維持管理マニュアルに記載した。
- c) 技術用語の定義：運転技術用語と電気専門用語について、初心者のための運転・維持管理技術用語として取りまとめた。

調査団は、マニュアル追補版に加えて、運転維持管理データベースシステムの改善提案と PDCA サイクルを実践する On-the-Job Training (OJT) を実施した。運転維持管理データベースシステムは、長期的目標をコンピュータ化した運転・保守・資機材・図書を一元管理する統合監視制御システムとし、調査期間内の達成目標を運転データから処理水質悪化時の要因分析を可能とする、すなわち処理工程の状況と処理水質の相関関係の把握を可能とするレベルに設定し、これに適したデータフォーマットを提供した。PDCA サイクルを実践する OJT としては、北タンロン処理場余剰汚泥の濃縮プロセスのためのプラント内のプロセスフローの変更を試みた結果、期待通りの成果が上がり HSDC に PDCA の内の Check と Action について技術移転した。これらの作業の成果に対し、ラップアップミーティングで本調査のハノイ側ワーキンググループから運転維持管理データベースのコンピュータ化のソフトウェアの詳細と導入費用について情報の要求があった。

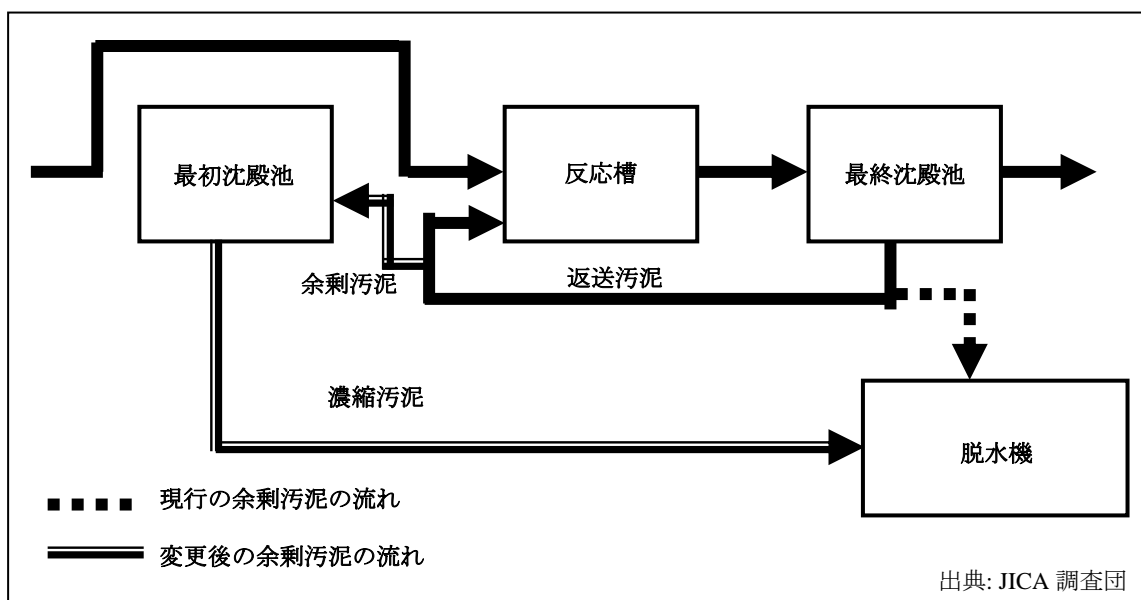


図 3-2 PDCA の OJT として実施した汚泥処理プロセスの変更

表 3-1 運転維持管理データベース導入ステップ

ステップ	目的	説明	計画レベル
1	データの蓄積	運転維持管理データフォーマットの改良(既存の維持管理データシートの改良)	短期目標
2	データベースの構築	汎用ソフトによる簡易型データベースの構築	中期目標
	運転維持管理データの標準化	データベース構築のための入力データフォーマットの標準化	
3	データベースのネットワーク化	遠隔管理システム構築のための Internet VPN 又は IP-VPN による各処理場のデータベースのネットワーク化	長期目標

出典: JICA 調査団

4. PPP の導入を含む運営管理体制の提案

ハノイ市では我が国の有償資金協力で整備したキムリエン・チュックバック・北タンロンの3下水処理場(合計処理能力 48,200m³/日)が稼働中である。次いで 2012 年にマレーシア GAMUDA 社が BT で建設したイエンソ下水処理場が稼働し、ハノイ市の合計下水処理能力が 248,200m³/日に増加する。更に 2015 年頃にはバイマウ下水処理場が稼働する予定であり、この結果、ハノイ市の下水処理能力は現在の5倍の能力に相当する 252,200m³/日に増加し、ベトナム国内最大となる。本調査では、近い将来に処理能力が5倍に拡大するハノイ市下水道施設の運営管理について、長期的事業継続性の観点に基づき、PPP 導入の検討を含めた運営維持管理体制に係る分析と提案を行った。

調査団は、本課題に対し日本国内で採用例が増加している包括運転維持管理契約 (Integrated Operation and Maintenance Service, 以下 IOMS) に目標を設定した。IOMS は 2010 年現在 251 処理場で採用されている運転維持管理方式である。日本国内では、従来の運転維持管理は自治体が運転管理会社に単年度の単価契約で発注して行われている。IOMS は近年導入され、その合理性が認められている運転管理会社への発注方式であり、複数年の性能発注ランプサム契約である。複数年契約ランプサム契約にすることにより、契約者の裁量によるコスト縮減を見込むことができる。事実、国内の例では運転維持管理契約と発注者側管理費用の合計の 8~12%の縮減が実現できている。その理由は、契約者が運転経費(電力費・薬品費・人件費)の縮減による利益を目指すことと、発注側の管理業務が低減することによる経費減が生じることである。日本の IOMS は、表 4-2 に示すように計画期間と機材の修繕・補修、更新費用により 4 段階に区分され、最も採用頻度の高いのは IOMS Level-2 である。

表 4-1 従来型運転維持管理と IOMS の対比

	従来型運転維持管理契約	包括運転維持管理契約 (IOMS)
契約方式	<ul style="list-style-type: none"> ✓ 単年度契約 ✓ 作業数量の検測と作業品質(処理水質)の検証に基づく数量精算 	<ul style="list-style-type: none"> ✓ 性能要件(パフォーマンスインディケータ)と契約終了時施設引渡要件を規定した性能発注 ✓ 複数年ランプサム契約
修繕・補修及び更新	<ul style="list-style-type: none"> ✓ 契約に含まれる修繕・補修及び更新を行い数量精算する。 ✓ 契約に含まれていない修繕・補修及び更新は、協議の上、追加契約又は別契約で実施する。 	<ul style="list-style-type: none"> ✓ 修繕・補修及び更新費用は、発注者の承認のもとに実施し、予備費から支払われる。

出典：JSWA

表 4-2 日本国内での包括維持管理契約の契約レベル

段 階	契約期間	契約に含まれる機材更新費用
従来型	単年度	数量と単価が契約に明記される。
包括契約 IOMS level-1	短期 (2～5 年)	ランプサム契約で、修繕・補修費用は含まない。
包括契約 IOMS level-2		ランプサム契約で、小額の修繕・補修費用を含む。
包括契約 IOMS level-3		ランプサム契約で、中程度の修繕・補修費用を含む。
包括契約 IOMS full scale	長期 (5 年以上)	ランプサム契約で、大規模の修繕・補修、更新費用を含む。

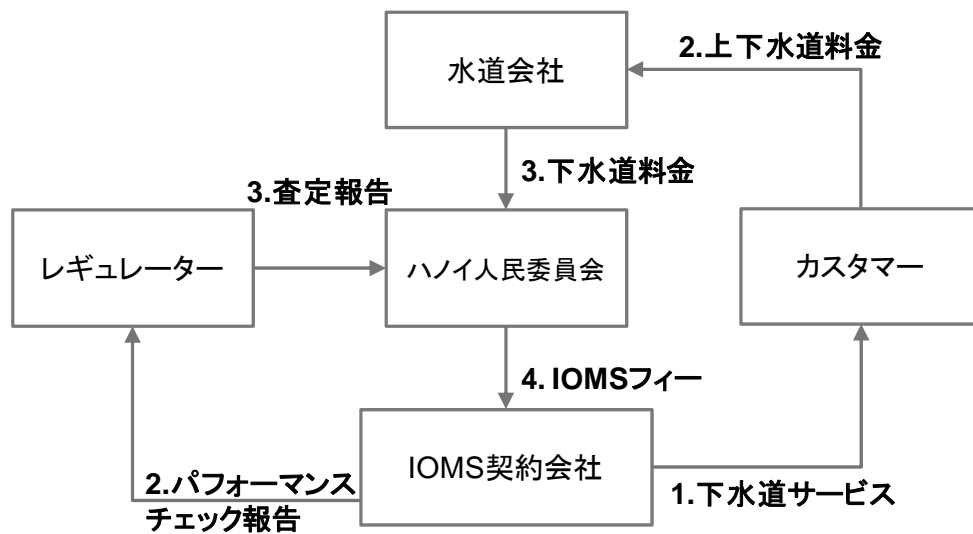
出典：JSWA

IOMS の導入目的は、運転維持管理費用の縮減である。前述の国内事例で実現した 8～12% の縮減は、運転管理を受託した会社の、経験に基づく運転の合理化、適切な維持管理による機器延命化の結果であるが、同時に、緊急時対応能力によるものである。HSDC は、5 年間の下水処理場運転経験を有するが処理場自体は竣工から最大 5 年しか経過していないため老朽化していない環境での経験であり、IOMS の利点を引出すには現時点では能力不足である。一方、入札で経験のある企業に委託する場合には、HSDC の能力アップにつながる。このため、調査団は表 4-3 に示す比較検討の結果、ハノイ側に HSDC と経験を有する邦人民間企業との合弁会社（以下、Joint Company）による操業を提案した（Option 2）。設立目的は、HSDC の有するハノイでの下水事業の実務経験と民間企業の技術能力とのシナジー効果による下水道施設の合理的運転維持管理の実現である。

表 4-3 IOMS 受託体制の比較検討

	Option 1 HSDC	Option 2 HSDC と経験ある民間 会社の JV	Option 3 経験ある民間会社
受託者	HSDC	HSDC と経験ある民間 会社の JV	経験ある民間会社
IOMS 遂行能力	IOMS の経験が不足し ている	十分な遂行能力が 期待できる	十分な遂行能力が 期待できる
O&M 費縮減可能性	期待できない	期待できる	十分期待できる
HPC へのなじみの良さ	HSDC は HPC 出資の 会社であり、なじむ	HSDC は HPC 出資の会 社であり、なじむ	HSDC を無視すること になり、なじまない
既存法制度への適応性	問題ない	問題ない	問題ない
評価	現時点では経験不足 から不適当	HSDC の現地での業務 経験と民間会社の専 門能力によるシナ ジーが期待できる	HSDC のこれまでの経 験を活かすことがで きないため、不適当

出典: JICA 調査団



出典: JICA 調査団

図 4-1 想定される IOMS での事業の流れ

IOMS を実施する際の事業の流れを図 4-1 に示す。IOMS 契約会社は契約に基づく運転維持管を行い、自らのパフォーマンスを契約上のパフォーマンスインディケータ (Performance Indicators, PIs) に照合しレギュレーターに報告する。レギュレーターは、IOMS 契約書のパフォーマンスを査定し HPC に報告する。HPC は査定報告に基づき IOMS 契約会社に対価を支払う。IOMS 契約会社が業務の指標とするパフォーマンスインディケータは、通常、環境規制値を下回るように設定される。これは、IOMS 契約会社が何らかの理由で処理水質がパフォーマンスインディケータ外したとしても環境規制値内の収まるための余裕を含んで設定されるためである。表 4-4 にハノイの下水処理施設で適用するパフォーマンスインディケータ案を示す。

表 4-4 ハノイの下水処理 IOMS のためのパフォーマンスインディケータ(案)

Items	環境規制値	パフォーマンスインディケータ(案)
BOD5 (mg/L)	50	40
COD (mg/L)	100	80
SS (mg/L)	100	80
Nitrogen (mg/L)	30	24
Phosphorus (mg/L)	6	5

出典: JICA 調査団

既存 3 処理場に加えてバイマウ、イエンソ、イエンサ、ブド、ホータイの新設 5 処理場が稼働した際の運転維持管理についてハノイ市側と協議した結果に基づき、本調査では新設 5 処理場に IOMS を採用したケースを試算した。試算によると、直接経費を約 10%縮減して得ることのできる利益は年間約 VND170 億(約 0.63 億円)である。この縮減額を HPC と Joint Company で折半するとしても、新設 5 処理場の運転維持管理費を 3.3%縮減可能である。ま

た、その際の Joint Company の 10 年間の内部収益率は 10%以上 20%未満を達成し得る結果となった。この場合の資本金は VND 47,000 million (約 1.7 億円)で、調査団は HPC と本邦民間企業が資本金を等分負担することを提案した。

これら一連の IOMS 導入に関する提案は、本調査のワーキンググループの基本的な合意を得て、今後は HPC 内部で下水道料金制度の導入と並行して継続的に検討していくことになった。

表 4-5 IOMS 導入による直接経費縮減効果(2022 年時点)

費目	A. 従来型運転維持管理		B. 合弁会社が IOMS で O&M した場合		差額 (B-A)	
	million VND	%	million VND	%	million VND	%
直接経費	461,239	89.7%	426,769	83.0%	-34,470	-7.5%
用役費	183,653	35.7%	165,288	32.1%	-18,365	-10.0%
薬品費	87,157	16.9%	78,441	15.3%	-8,716	-10.0%
補修費	72,517	14.1%	65,265	12.7%	-7,252	-10.0%
汚泥廃棄費	52,773	10.3%	52,773	10.3%	0	0.0%
小額機器更新費	20,944	4.1%	20,944	4.1%	0	0.0%
人件費	29,952	5.8%	29,952	5.8%	0	0.0%
現場事務所費	10,472	2.0%	10,472	2.0%	0	0.0%
その他	3,771	0.7%	3,633	0.7%	-137	-3.6%
間接経費	29,981	5.8%	27,740	5.4%	-2,241	-7.5%
予備費	23,062	4.5%	21,338	4.1%	-1,724	-7.5%
営業利益	0	0.0%	21,338	4.1%	21,338	4.1%
経費合計	514,282	100.0%	497,186	96.7%	-17,096	-3.3%

出典: JICA 調査団

5. 下水道料金設定に関する提言及び財政計画

2010年現在、ハノイ市の所有する既存3処理場と関連する管渠の年間運転維持管理費用は、調査団推定で VND20,000 百万/年である。イエンソ処理場が運転を開始すると、本処理場の運転維持管理には VND142,858 百万/年が直接経費として必要となる。従って、ハノイ市の下水道事業支出は現在の約8倍になり、継続性維持のためには適切な料金システムの導入が不可欠な状況である。

表 5-1 新設下水処理場の年間運転維持管理費（直接経費）

単位 VND 百万/年

	イエンソ	バイマウ	イエンサ	ブド	ホータイ
年間運転維持管理費	142,858	26,620	192,022	75,660	26,620

出典: JICA 調査団

ハノイ市の下水道事業では、初期投資としての施設建設費は全額政府が負担し、施設運転維持管理は水道料金に課せられる環境保護費（Environmental Protection Fee, 以下 EPF）によって賄われている。EPF は水道料金の 10% が徴収され、雨水排水・下水道等々の料金徴収を行わない事業に振り当てられている。2010 年のハノイ市の平均家庭収入は約 VND8 百万/月（約 4 万円）なのに対し、平均水道料金は毎月 VND80,000 程度であり、EPF として VND8,000/月が徴収されている。一方、本調査が下水道整備地区及び整備予定地区で実施した下水道への支払い意思額は、住民を対象としたものが月額 VND 21,212/世帯（所得の 2.5%）、商工業を対象としたものが月額約 VND280 万/事業所であった。

次に調査団は、将来既存3処理場と新設5処理場が稼働した際の下水道事業の運営費用を算出し、下水道料金の試算を行った。本検討では、水道使用量当りの下水道運営費及び下水道料金を下記の4ケースについて5段階で試算した。水道使用量を用いた理由は、下水量を水道使用量の80%と仮定していることと、水道料金請求書で水道料金に下水道料金を加算し一括して徴収する計画であることである。

ケース	下水量	料金徴収区域
1	190L/人日 ^{注1} x 80%	処理場のサービス区域
2	190L/人日 ^{注1} x 80%	ハノイ市全域
3	153L/人日 ^{注2} x 80%	処理場のサービス区域
4	153L/人日 ^{注2} x 80%	ハノイ市全域

注1： 現在、処理場の計画・設計等に使用されている水道使用量

注2： 上水道の会社から提供された水道使用量

出典: JICA 調査団

試算における段階

- a. 住民の支払い意思額を徴収
- b. 8処理場の運転維持管理費を賄う設定の徴収額
- c. 8処理場と下水管の運転維持管理費を賄う場合の徴収額

- d. 8 処理場の下水管の運転維持管理費及び機器更新費を賄う場合の徴収額
- e. 8 処理場の下水管の運転維持管理費、機器更新費及び減価償却額を賄う場合の徴収額

表 5-2 は、ケース 3 の試算結果である。2010 年時点で月間平均水使用量は約 18m³/世帯であり、表 5-2 の料金を各世帯が負担する際の月額額は表 5-3 に示すとおりになる。

表 5-2 水道使用量当りの下水道料金試算

単位: VND/水道使用量 m³

段 階	一般家庭	一般家庭以外
a. 住民の支払い意思額を徴収	1,111	2,221
b. 8 処理場の運転維持管理費を賄う設定の徴収額	3,577	7,153
c. 8 処理場と下水管の運転維持管理費を賄う場合の徴収額	4,371	8,742
d. 8 処理場の下水管の運転維持管理費及び機器更新費を賄う場合の徴収額	5,939	11,878
e. 8 処理場の下水管の運転維持管理費、機器更新費及び減価償却額を賄う場合の徴収額	15,207	30,414

計算条件 1: 平均水道使用量= 153L/人日

計算条件 2: 下水道料金徴収地区=下水道整備地区

計算条件 3: 稼働する下水処理場はチェックバック、キムリエン、北タンロン、パイマウ、イエンソ、イエンサ、ブド、ホータイ

出典: JICA 調査団

表 5-3 世帯当り下水道料金 (VAT と徴収手数料を除く)

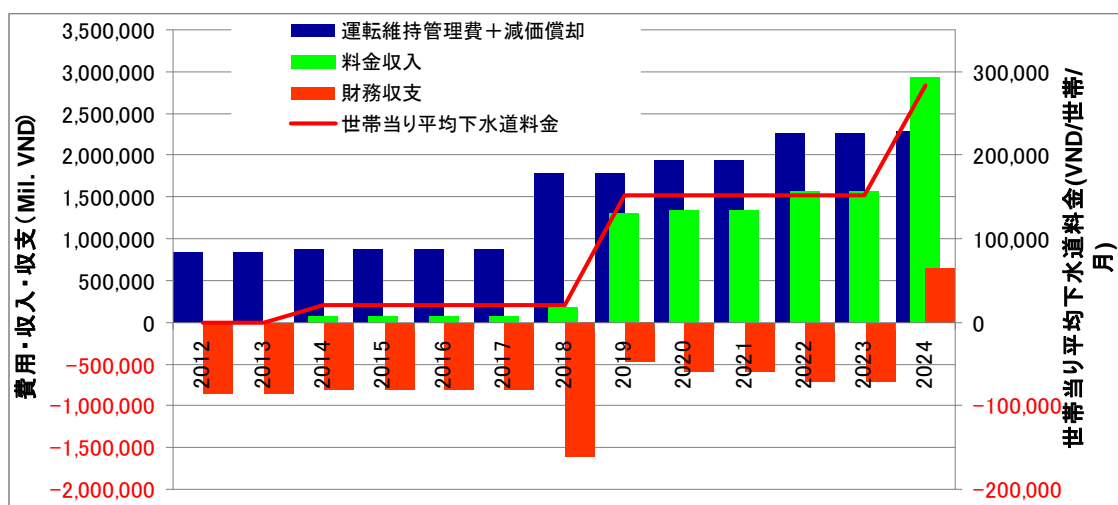
段階	世帯当り下水道料金 (VND/月)	平均世帯収入に占める 下水道料金の比率
a	21,000	0.3%
b	64,400	0.9%
c	78,700	1.0%
d	106,900	1.3%
e	273,700	3.4%

出典: JICA 調査団

上記を総括し、調査団はハノイ側ワーキンググループに以下の提案を行った。

- 1) 2012 年にイエンソ処理場が運転を開始すると、ハノイ市の年間の下水道施設運転維持管理に係る支出は約 VND200 億から約 VND1,600 億に増加する。下水道施設を継続性を持って維持するためには、適切な下水道料金制度の導入が不可決である。
- 2) 下水道料金は、商業的観点から下水道整備地区から徴収する案と、公共的な環境保護の観点から市全域から徴収する案がある。両者を住民合意の容易さ及び料金徴収の容易さの観点から比較検討すると、下水道整備地区から徴収する案が適切である。

- 3) 料金制度導入は 2012 年から準備を開始し、2014 年からの徴収開始を目指す。
- 4) 下水道料金制度導入当初(2014 年)は、料金レベルを住民の支払い意思額のレベルからスタートし、10 年間で処理場と管渠の運転維持管理費を賄うレベルに引き上げるのが適切と考える。この場合、料金収入を超える運転維持管理費は、政府補助による補てんが必要である。(図 5-1 参照)
- 5) イェンソ処理場とそれ以降の新設処理場の運転維持管理は、IOMS 導入により費用縮減すべきである。
- 6) 初期投資の減価償却と機器更新のための再投資の取り扱いについて、政府の環境政策に沿いつつ、事業継続性の観点から議論を深めるべきである。



出典: JICA 調査団

図 5-1 2014 年に支払意思額からスタートし、10 年間で運転維持管理費を賄う額に引き上げる下水道料金導入ケース

上記提案に対し、ハノイ側ワーキンググループは基本的に合意した。調査団は、料金制度の導入までに残る下記に示す課題に対し、将来の IOMS 導入への布石として HPC と本邦企業団による Joint Company を設立し対応することを提案した。

- ハノイ市全域での下水道料金支払い意思調査
- 商工業の下水道料金を設定するための汚水水質調査
- 日本を含む他国の類似都市での下水道料金設定に関する調査
- 下水道料金体系の設計と、詳細な料金徴収システムの設計及び予算措置
- 料金収入規模に応じた公的補助金額の算出
- 下水道料金導入の為の法制度変更のドラフト作成

調査団からのこの提案に対し、ハノイ側ワーキンググループは HPC に持ち帰り協議することで調査団と合意した。

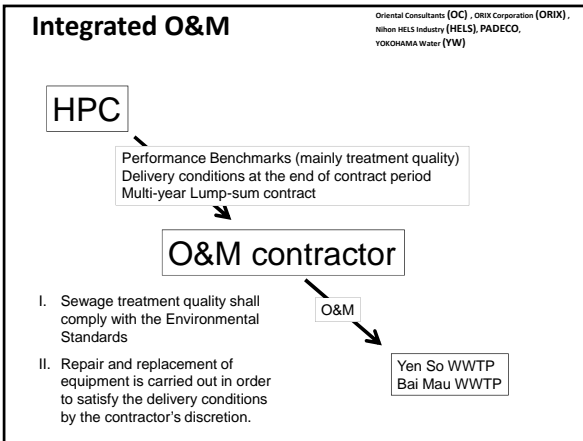
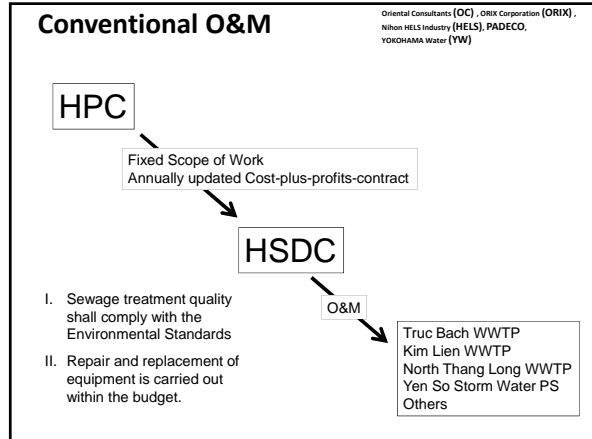
添付資料：プレゼンテーション資料

- 1) Kick-Off Meeting資料（2011年4月20-21日）
- 2) Working Group Meeting資料（2011年5月26日）
- 3) Working Group Meeting資料（2011年6月20日）
- 4) Interim Meeting資料（2011年6月23日）
- 5) Working Group Meeting資料（2011年8月12日）
- 6) Wrap-Up Meeting資料（2011年8月30日）

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI STUDY A KICK-OFF MEETING

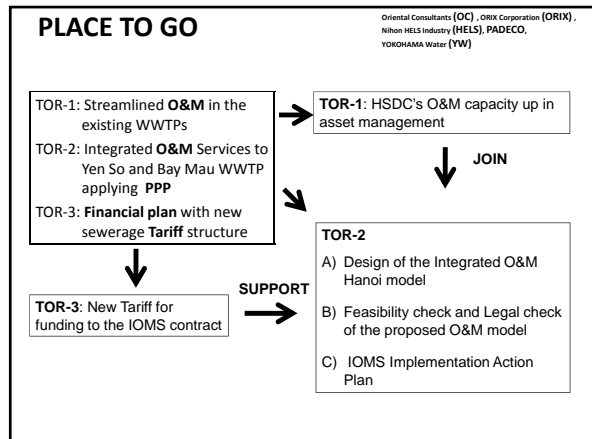
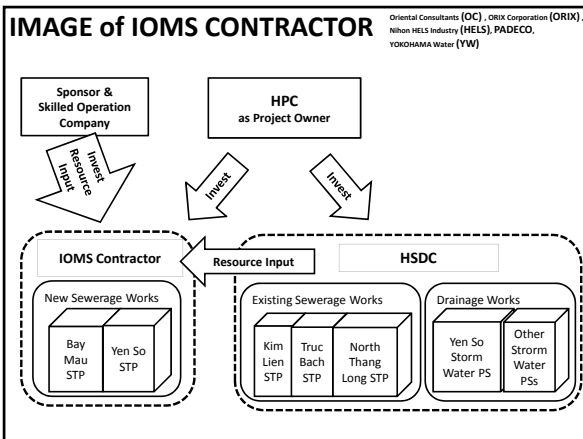
20 April 2011, Hanoi
Study Team A

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M

	Conventional O&M	Integrated O&M
Basis of Contract	<p>a. Fixed Scope of Work</p> <p>b. Annually updated Cost-plus-profits-contract</p>	<p>a. Performance Benchmarks (mainly treatment quality) & Delivery conditions at the end contract.</p> <p>b. Multi-year Lump-sum contract</p>
Employer's Requirement	<p>I. Sewage treatment quality shall comply with the environmental standards</p> <p>II. Repair and replacement of equipment is carried out as per the Scope of Work.</p>	<p>I. Sewage treatment quality shall comply with the environmental standards</p> <p>II. Repair & replacement of equipment is carried out by the contractor's discretion, in order to comply with the delivery conditions.</p>



Points to be concerned

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

- **improving environment** → improve health, wealth & lifestyle
- **financially viable** → not exposed to budgetary trauma
- **socially acceptable** → create benefits – not a grudge purchase
- **administratively understandable** by community
- **'pay for use'** → no subsidies?! Encourage economic efficiencies

7

REVENUE, MOST CONCERN

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Drivers – factors that most affect revenue from tariffs collection:

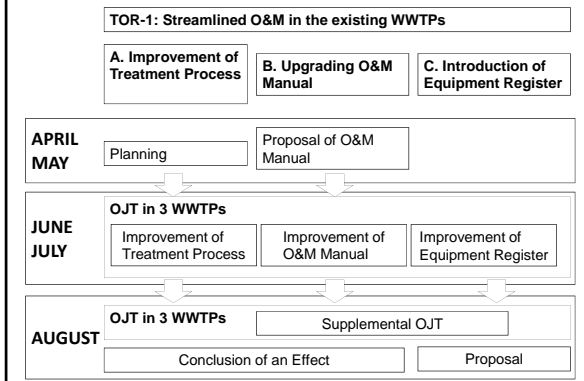
- Willingness to Pay;
- Affordability;
- Tariff level;
- Service Coverage;
- **Level of cost recovery**;
- Community Service Obligations

The income structure shall be made within local situation.

- History of low tariffs and fees
- Difficult to get decisions on a 'cost recovery' basis
 - Often perceived as easier
 - to subsidize and/or
 - Provide a low quality service

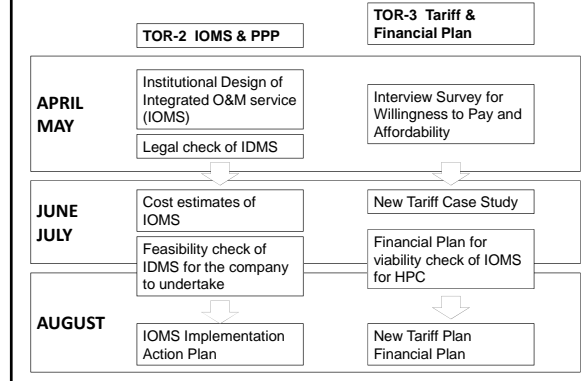
WORK PLAN (TOR-1)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)



Work Plan (TOR-2 & TOR-3)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)



FAQ (frequently-asked question)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Frequent Questions	Our Answers
B) This PPP is just for money to Japanese?	No it isn't. Japan invest to this PPP with you.
D) Suppose, PPP uses his money not my money, right?	We share costs, so you save money.
E) What is advantage of this PPP for us?	You can have more employment opportunities in this PPP. Most staff in new company is Vietnamese who can learn and earn in the job. New company gives opportunity to wider business into staff training services and even planning & engineering in sewerage field.

Study Team

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Phase 2	Introduction of PPP for Sewerage Facilities in Hanoi, 2011			
TOR-1: Streamlined O&M in the existing WWTPs				
TOR-2: Integrated O&M Services to Yen So & Bay Mau WWTPs applying PPP				
TOR-3: Financial plan with new sewerage Tariff structure				

ASSIGNMENT SCHEDULE

	APRIL				MAY				JUNE				JULY				AUGUST							
Sun	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	
Mon	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	
Tue	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	
Wed	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	
Thu	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	
Fri	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	
Sat	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	
Koichi Suzuki (Leader)	■	■	■	■					■				■	■	■						■	■	■	■
Takehiro Nakano (O&M)			■	■									■	■	■							■	■	■
Kota Kinoshita (O&M)													■	■	■								■	■
Etsuo Fujiwara (O&M)													■	■	■								■	■
Yoichiro Ono (PPP)			■	■										■									■	■
Kenji Suzuki (Financial)													■	■									■	■
Nami Tanaka (Financial)			■	■		■	■	■																
Takeo Tanaka (Tariff)			■	■									■	■										■
Susumu Shibuya (Tariff)													■	■										

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

	TOR2 Integrated O&M + PPP	TOR3 Tariff & Financial Plan
APR	1. PPP model and proposal of Joint Company Option 2. Design of Joint Company	A. Approach to New Tariff and Financial Plan B. Implementation Plan of Interview Survey
MAY		Interview Survey
JUN	1. Cost estimates of JC incl. O&M, office running costs 2. SPC business expansion plan 3. Preliminary FS of JC 4. Review of Regulations concerned	A. Analysis of Interview survey result B. Case study for New Tariff C. Conditions for Financial Planning D. Review of Regulations concerned E. Current status of Water works in Hanoi
JUL		
AUG	1. FS for establishing Joint Company 2. Road Map for establishing Joint Company	A. Proposed amendment of Tariff system B. Financial plan for HPC (incl. Subsidy plan)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

PREDICTION

Current Status of Sewage Works in Hanoi

Waste Water Treatment Plant	Capacity (m ³ /day)	Operation Year
Kim Lien	3,700	2005
Truc Bac	2,500	2005
North Thang Long	42,000	2009
Bay Mau Lake	14,000	2013(Planned)
Yen So	190,000	2011(Planned)
Yen Xa	270,000	2016(Planned)
Phu Do	84,000	2016(Planned)
Total	606,200	

Many WWTPs to be operated in the near future → The more WWTPs, the more cost of Construction and O&M...

2

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI, STUDY A

TOR-2 Integrated O&M service by PPP

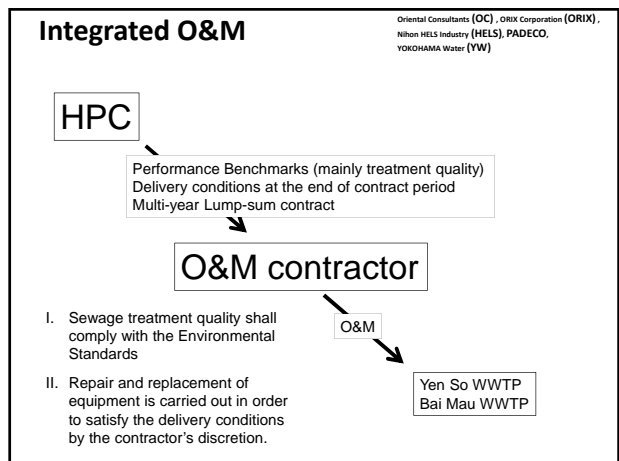
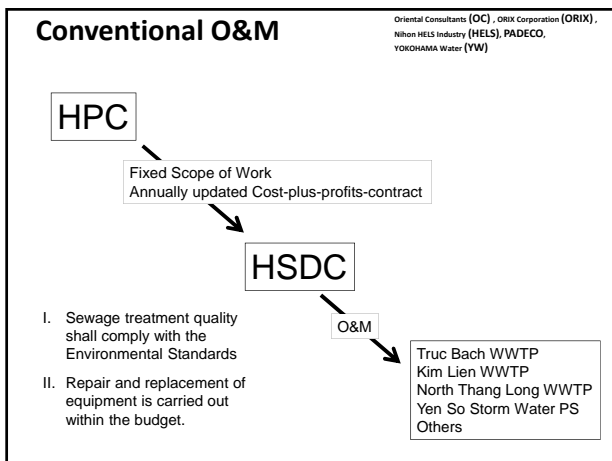
- A. Approach to TOR 2
- B. Required Data & Information
- C. Selection of PPP model

21 April 2011, Hanoi

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

SOLUTION

ISSUES	SOLUTION
With increasing WWTPs	
a. Operation costs increase.	→ Direct costs (power, chemical) are increasing as per treatment volume. Overheads (management, administration) shall be minimized.
b. More O&M staff are required.	→ Recruitment of additional O&M staff is needed but to be minimized by rationalizing work-procedure .
c. Stock management becomes cumbersome.	→ Stock (chemical, spare parts, consumables) shall be managed transparently by computerized database .
With aging equipment	
d. Replacement costs are required.	→ Proper maintenance with proactive care can prolong the life-time of equipment .



Integrated O&M

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

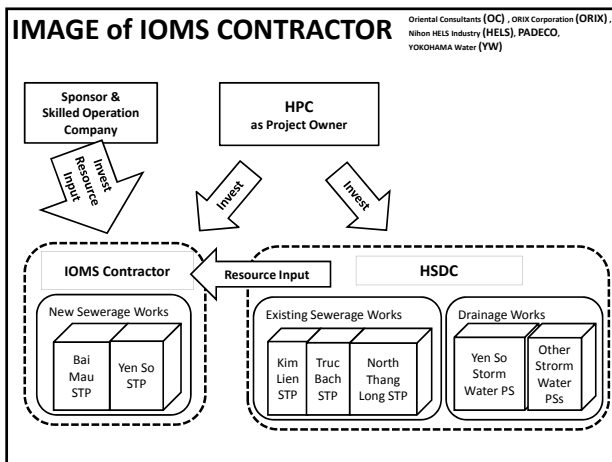
	Conventional O&M	Integrated O&M
Basis of Contract	<p>a. Fixed Scope of Work</p> <p>b. Annually updated Cost-plus-profits-contract</p>	<p>a. Performance Benchmarks (mainly treatment quality) & Delivery conditions at the end contract.</p> <p>b. Multi-year Lump-sum contract</p>
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Who will undertake IOMS?

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Option 1:	HSDC to undertake the IOMS
Option 2:	Joint Company established by HPC, HSDC and Private firm to undertake the IOMS
Option 3:	A Private firm to undertake the IOMS

	Option 1	Option 2	Option 3
Capacity to undertake IOMS	Lack of capacity to undertake	Enough capacity	Enough capacity
Cost saving opportunity	Less because lack of experience	Promising	High cost due to Foreign company
Comfort for HPC	Comfort	Comfort	Uncomfortable to ignore HSDC
Compliance of laws and regulations	Complied	Need to study	Complied
Evaluation	Need more capacity development of HSDC.	HSDC's locality and Private firm's skill make synergy. Recommendable	HSDC's 5 year experience cannot contribute in this option.



Scope of Work of Joint Company

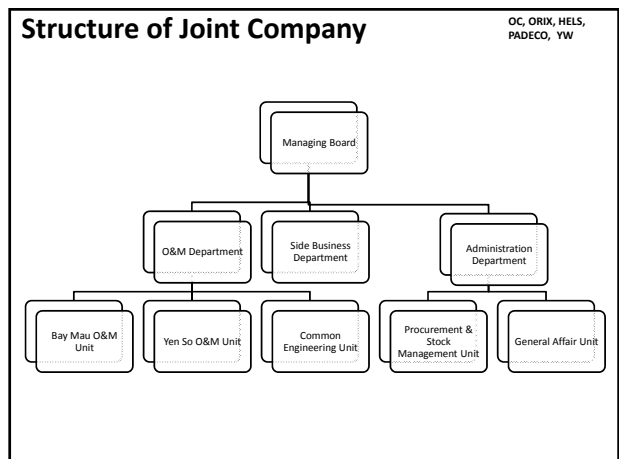
OC, ORIX, HELS, PADECO, YW

Integrated O&M service
A) Sewage treatment & disposal
B) Sludge treatment & disposal
C) Repair and Replacement of equipment
D) Water quality check and report to DONRE
E) Management of spare parts and consumables
Staff Training Service (OPTION)
A) Capacity building course for sewerage operators (Junior, Senior)
B) Capacity building course for administrators of sewerage
Technical Service (OPTION)
A) Sewerage development planning
B) Engineering of sewerage facilities
C) Construction management, Project management

Finance of Joint Company

OC, ORIX, HELS, PADECO, YW

Income	<p>WWTP O&M fee from HPC</p> <p>In addition (as option), Sewerage operator training fee from other cities Engineering service fee from other cities</p>
Expenses	<p>WWTP O&M costs</p> <p>WWTP repair/replacement costs</p> <p>(optional) Sewerage operator training costs</p> <p>(optional) Engineering service costs</p> <p>Overheads (administration & management)</p> <p>Taxes</p>



Location, Assets of Joint Company

OC, ORIX, HELS, PADECO, YW

Location	Either Bay Mau WWTP site or Yen So WWTP site
Assets	Administration office Side business office
Facilities provided at no cost	Bay Mau WWTP Yen So WWTP

NEXT STEP

OC, ORIX, HELS, PADECO, YW

- I. Cost Estimates of O&M costs, Running costs of JC, Overhead of JC
- II. Feasibility Study of JC

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI, STUDY A

TOR-3 Tariff Plan & Financial Plan

- A. Approach to TOR 3
- B. Required Data & Information
- C. Interview Survey

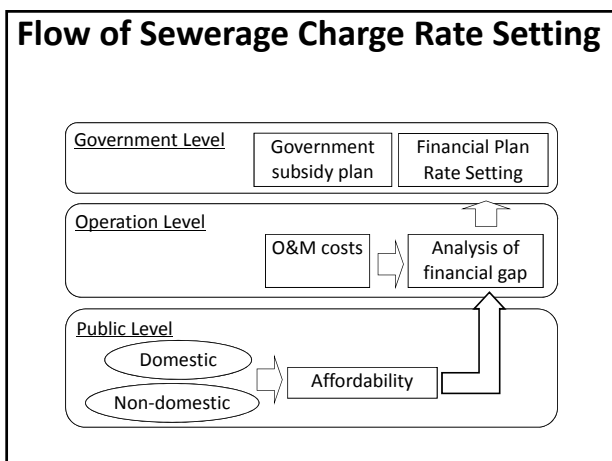
21 April 2011, Hanoi

Content of the Study

Goal:

Proposal of financially sustainable mechanism for Hanoi sewerage services

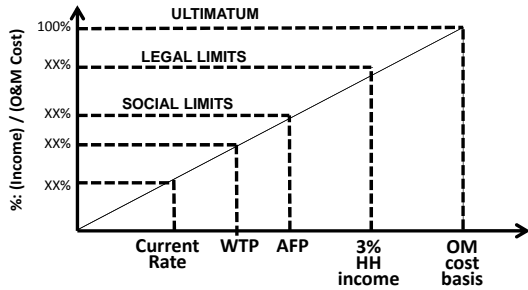
1. Review of Water and Sewerage Rates
2. Estimates of WWTP O&M Costs
3. Sewerage Rate Plan and Financial Plan



Cases of Tariff Setting

- Case 1: Current rate setting
- Case 2: Based on current Willingness-to-Pay
- Case 3: Based on current Affordability-to-Pay
- Case 4: 3% of average household income (referring No. 09/2009/TT-BXD)
- Case 5: Based on all O&M costs

Output image of Tariff Setting



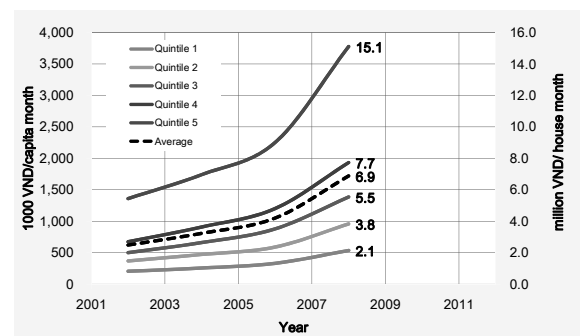
Charges in Vietnamese Cities

- Hanoi: 10% (\approx VND300)
- Haiphong: VND300
- Cantho: VND300
- Nhatrang: VND250
- Danang: VND300

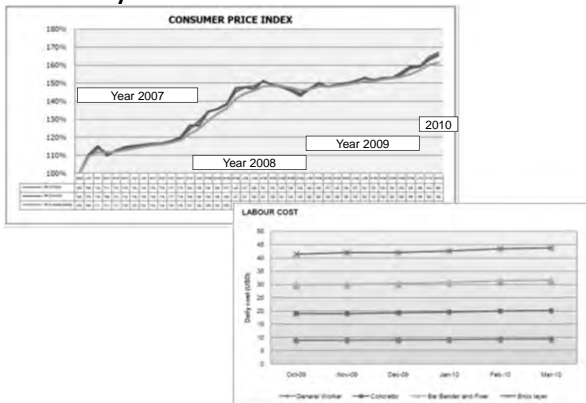
Charges in Other Cities (USD/m³)

- HCMC 0.32
- Manila East 3.19
- Manila West 5.36
- Tokyo 14.97
- Sydney 36.16
- London 19.84

Monthly Household Income in Hanoi



Monthly Household Income in Hanoi



Very Preliminary Calculation

(no confident)

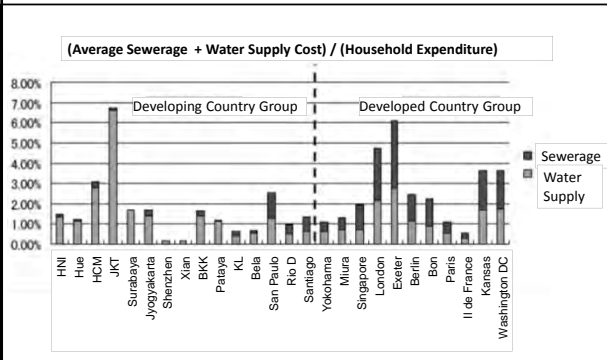
Monthly sewage discharge (Preliminary)
 $= 120\text{Lpcd} \times 4 \text{ person/HH} = 0.48\text{m}^3/\text{day HH} = 14.4 \text{ m}^3/\text{month HH}$

Current expenses for Water & Sanitary
 (World Bank 2009)

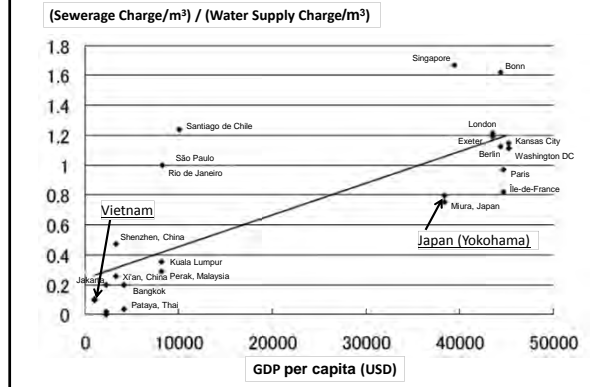
	VND / month HH	VND / m ³
Water max	100,000	
Water min	20,000	
Sanitary max	10,000	694
Sanitary min	2,000	139

Census 2009	Average	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
3% of household income VND	206,400	64,200	114,840	166,320	231,960	453,360
per Water+Sanitation Max	188%	58%	104%	151%	211%	412%
per Water+Sanitation Min	938%	292%	522%	756%	1054%	2061%

Ratio of Average (Sewerage + Water) Charge to Household Expenditure



Sewerage tariff/ Water tariff



Immediate Action after this Meeting

- a. Check Willingness-To-Pay Interview survey
- b. Check Social Limits Per% of Household Income
- c. Check Legal Limits 3% of Household Income
- d. Check Financial Gap Affordability - Willingness

Water Supply Data

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Water supply data as follows is necessary for analyzing sewage income.

Classification of water user	Number of the user	Unit price (VND/m ³)	Consumption (m ³)	Annual turn over
General household				
Commercial user				
Industrial user				
...				
Total				

Study at Public Level

Questionnaire Survey

Target:

- Households (100 samples)
- Commercial and Industrial Organization (30 samples)

Item:

Willingness to Pay (WTP): the maximum amount a person would be willing to pay, sacrifice or exchange in order to receive a good or to avoid something undesired

Schedule:

- Preparation: Mid. April – Early May
- Implementation: Mid. May
- Data Processing: Late May – Early June

Survey Schedule

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

- Survey Area: 7 Districts (Ba Dinh, Dong Da, Hai BaTrung, Hoang Mai, Thanh Tri, TuLie, Dong Anh)
- Household Survey: 105 samples (15 household/Districts)
- Commercial & Industry Survey: 35 Samples (5 CI/Districts)

Month	Activities
APRIL	<p>Preparation</p> <ul style="list-style-type: none"> -Questionnaire Forms -Local survey team arrangements -Endorsement letter by HAPI -Identification of CI by DOC (request letter dispatched)
MAY	<p>Interview Surveys Implementation(planned schedule)</p> <ul style="list-style-type: none"> -25 April- 5 May Household Survey -27 April - 12 May Commercial & Industry Survey <p>Results analysis and Reporting</p> <ul style="list-style-type: none"> -6 May-25 May: Analysis, preparation of materials for the 26th meeting -26 May: Survey Results Reporting at the Meeting

ASSIGNMENT SCHEDULE

	APRIL	MAY	JUNE	JULY	AUGUST
Sun	26 2 9 16 23	30 7 14 21	28 4 11 18	25 2 9 16 23	30 6 13 20 27
Mon	27 3 10 17 24	1 8 15 22	29 5 12 19	26 3 10 17 24	31 7 14 21 28
Tue	28 4 11 18 25	2 9 16 23	30 6 13 20	27 4 11 18 25	1 8 15 22 29
Wed	29 5 12 19 26	3 10 17 24	31 7 14 21	28 5 12 19 26	2 9 16 23 30
Thu	30 6 13 20 27	4 11 18 25	1 8 15 22	29 6 13 20 27	3 10 17 24 31
Fri	31 7 14 21 28	5 12 19 26	2 9 16 23	30 7 14 21 28	4 11 18 25 1
Sat	1 8 15 22 29	6 13 20 27	3 10 17 24	1 8 15 22 29	5 12 19 26 2
Koichi Suzuki (Leader)	■ ■ ■ ■		■ ■ ■ ■		■ ■ ■ ■ ■ ■
Takehiro Nakano (O&M)		■ ■ ■ ■		■ ■ ■ ■	
Kota Kinoshita (O&M)			■ ■ ■ ■		■ ■ ■ ■
Etsuo Fujiwara (O&M)				■ ■ ■ ■	
Yoichiro Ono (PPP)		■ ■ ■ ■		■ ■ ■ ■	■ ■ ■ ■
Kenji Suzuki (Financial)				■ ■ ■ ■	■ ■ ■ ■
Nami Tanaka (Financial)		■ ■ ■ ■			
Takeo Tanaka (Tariff)		■ ■ ■ ■			■ ■ ■ ■
Susumu Shibuya (Tariff)				■ ■ ■ ■	








Work Plan (Detail)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

	TOR2 Integrated O&M + PPP	TOR3 Tariff & Financial Plan
April	1. Approach to TOR2 2. Design of Joint Company (SPC) A) Scope of Work (O&M, Training Services, Planning & Engineering) B) Profit Structure C) Staffing (HSDC + Private firms) D) Location, Assets, Equipment	A. Approach to TOR3 B. Approach to New Tariff and Financial Plan C. Implementation plan and utilization of Interview survey (Willingness to Pay) D. Analysis of current sewerage income E. Linkage between Tariff and Financial Plan F. Necessary data for Financial Plan
May		
June	1. O&M costs of Bay Mau & Yen So STP 2. SPC Running Costs 3. SPC Training service business plan 4. SPC Engineering service business plan 5. Preliminary FS for establishing SPC 6. Regulations for establishing SPC	A. Analysis of Interview survey result B. Case study for Amendment of Tariff C. Conditions for Financial Planning D. Regulations for New Tariff & Financial Plan E. Current status of Water works in Hanoi
July		
August	1. FS for establishing SPC under New Tariff System proposed 2. Road Map for establishing SPC in compliance with current regulations	A. Proposed amendment of Tariff system B. Income forecast under New Tariff System C. Financial plan under New Tariff System for HPC (incl. Subsidy plan)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

 Koichi SUZUKI (OC) Team Leader Framework of Integrated O&M Services	 Kenji SUZUKI (PADECO) Financial Planner Financial Plan for PPP	 Susumu SHIBUYA (Yokohama Water) Water Works Expert Liaison of Water Supply and Sewerage
 Takehiro NAKANO (HELS) Sewerage & Drainage Expert (Treatment Process)	 Nami TANAKA (PADECO) Financial Planner Questionnaire Survey	 Takeo TANAKA (Yokohama Water) Water Works Expert Water and Sewerage Rate
 Kota KINOSHITA (HELS) Sewerage & Drainage Expert (Mechanical & Electric)	 Etsuo FUJIWARA (HELS) Sewerage & Drainage Expert (O&M System)	 Yoichiro ONO (ORIX) PPP Expert PPP Framework

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI


Working Group Meeting – Study A

26 May 2011, Hanoi

TOR-3 Tariff Plan & Financial Plan

AGENDA

- A. Household Interview Survey
- B. Commercial & Industry Survey
- C. Next action





TOR-3:HH Survey Result

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

PURPOSE OF THE HOUSEHOLD SURVEY

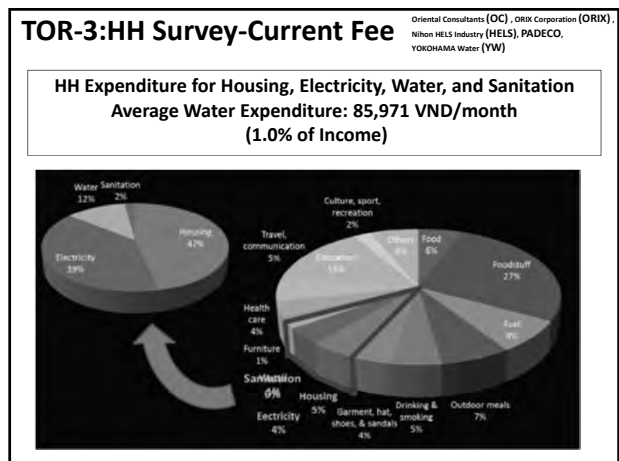
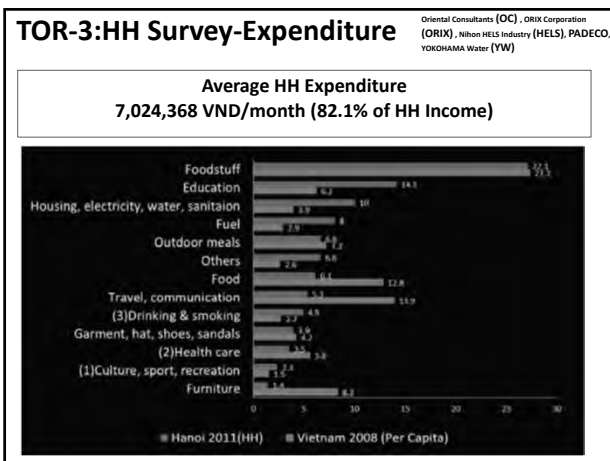
- To grasp the citizen's awareness of sewerage services
- To get the citizen's willingness to pay for the sewerage services

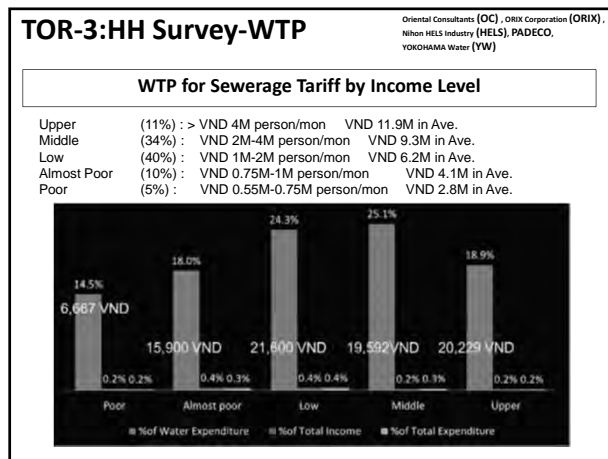
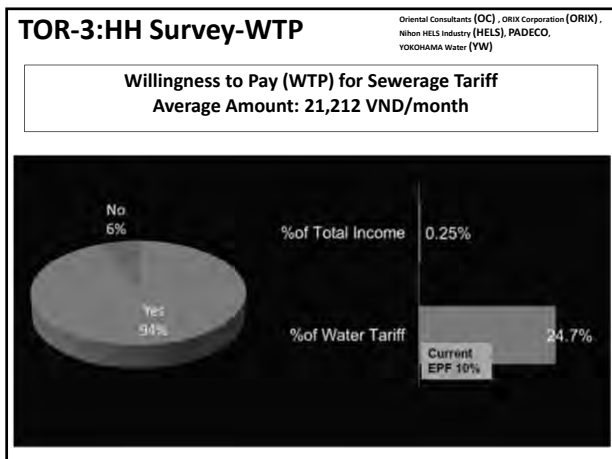
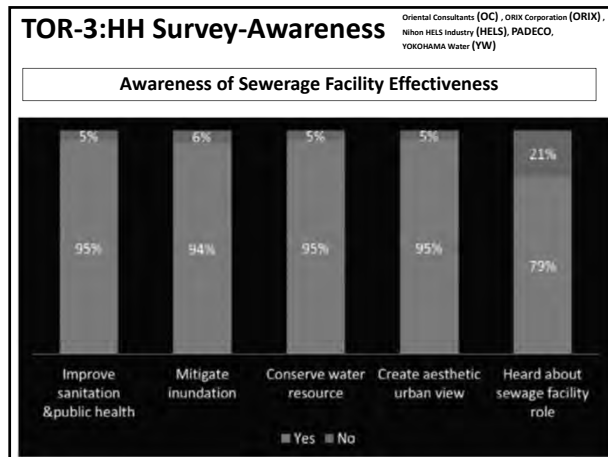
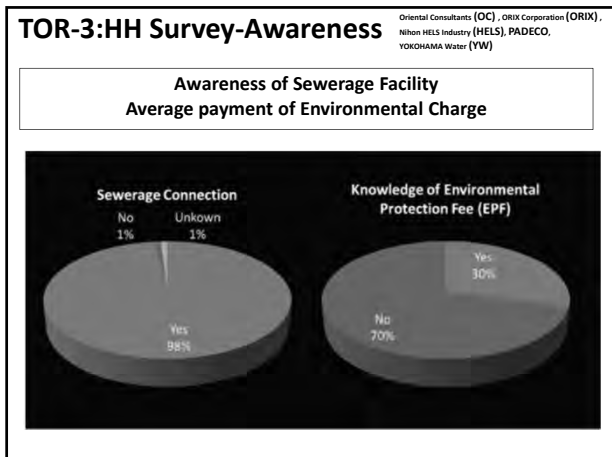
Contents	
1.	Outline of the Survey
2.	Household Income & Expenditure
3.	Awareness of Sewerage Services
4.	Willingness to Pay
5.	Recommendation

TOR-3:HH Survey-Outline

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Outlines of Survey	
Surveyed Area	Ba Dinh, Dong Da, Hai Ba Trung, Hoang Mai, Thanh Tri, Tu Liem, Dong Anh
Sampled Number	105 House Hold (15HH from each district)
Method	Interview by trained surveyors
Duration of Survey	6 th to 9 th May 2011
Profiles of HH	
SEX	Male:21%, Female:79%
Age	45 year old (average)
Occupation	Commercial:47%, Public:7%, Manufacturing:7%, Others (incl. agriculture, temporary workers, unemployed) 39%
Income	8,560,962 VND /month per HH in average
Expenditure	7,024,368VND/month per HH in average (82.1% of Income)





TOR-3:HH Survey Result

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Our HH Survey Results & Other Factors

- 1) Citizen are recognizing to be served by the sewerage service conducted by HPC.
- 2) Willingness to Pay was VND 21,212 per month in average that is equivalent to 0.25% of average HH income.

↓

Recommendations

- 1) Remarks to determine the sewerage charge are (1) Willingness-to-Pay (WTP), (2) Legal Max 3% and (3) Revenue for full coverage of O&M costs.
- 2) Reasonable Affordability-to-Pay (ATP) is subject to the required budget for O&M of sewerage services.

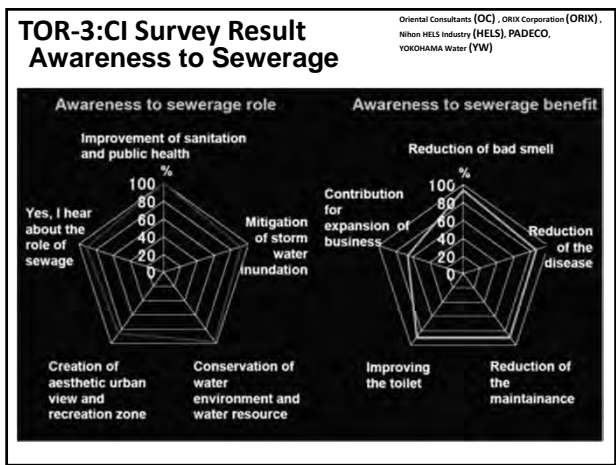
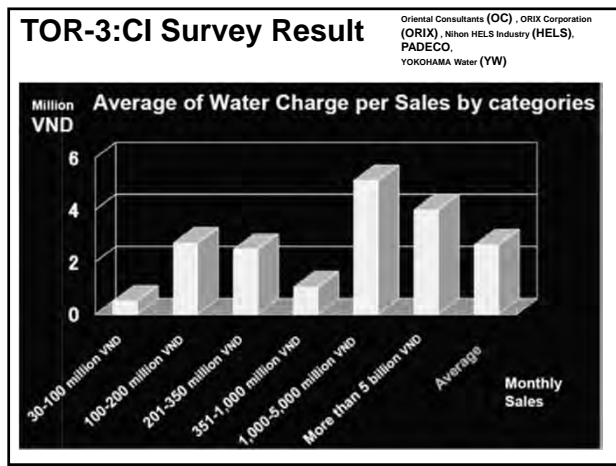
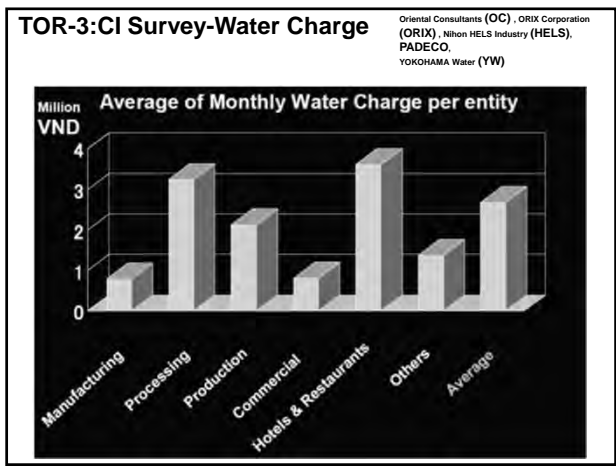
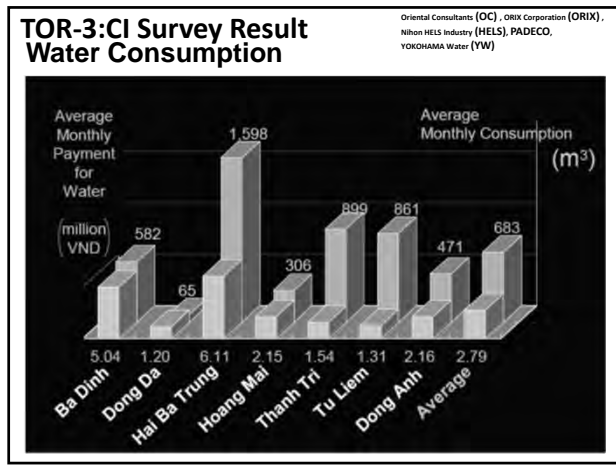
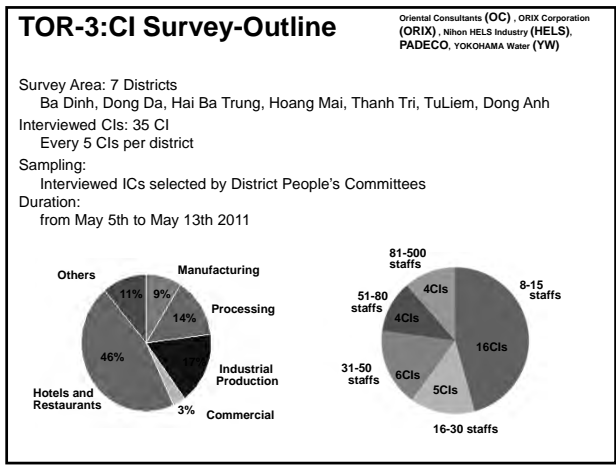
TOR-3:CI Survey Result

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

PURPOSE OF THE Commercial & Industry (CI) SURVEY

- To grasp the CI's awareness of sewerage services
- To get the CI's willingness to pay for the sewerage services

Contents
1. Outline of the Survey
2. Sales
3. Awareness of Sewerage Services
4. Willingness to Pay
5. Recommendation



TOR-3:CI Survey Result

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Willingness to pay

CI's Willingness-to-Pay (WTP) is 0.13% per month sales that is equivalent to monthly VND 2.8 million per entity.

↓

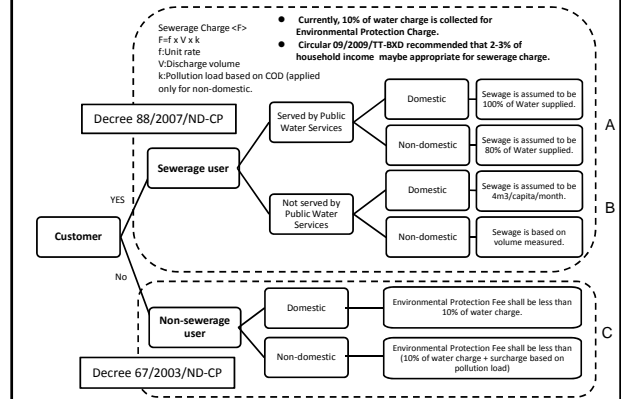
Recommendations

- Awareness of the sewerage benefit is low in interviewed CI, hence further promotion is required.
- It shall be noted that WTP of CI per entity (VND 2.8M) is 132 times of WTP per HH (VND 21K). CI customer shall be reserved for Cross-Subsidy Financial Source.
- Reasonable Affordability-to-Pay (ATP) is subject to the required budget for O&M of sewerage services and cross-subsidy plan.

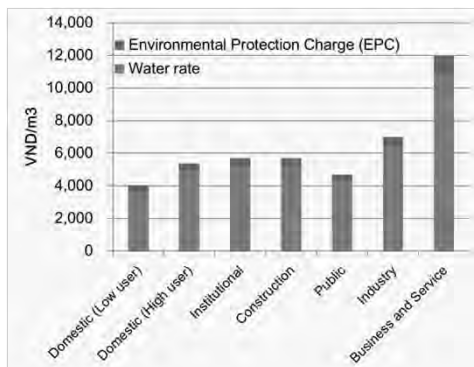
C. Sewerage Charge Financial Analysis

Purpose: Provide framework and action plan of the financial aspects for sustainable sewerage operation in Hanoi

C. Sewerage Charge-Legal Basis



C. Sewerage Charge-EPF Hanoi 2010



C. Sewerage Charge-EPF Hanoi 2010

EPF Hanoi, Domestic

Water usage level of household (m ³ /month/HH)	EPF (VND/m ³)
1 First 16m ³	347.83
2 Above 16m ³ to 20m ³	408.70
3 Above 20m ³ to 35m ³	495.65
4 Above 35m ³	817.39

(From 119/2009/QD-UBND)

EPF: Environmental Protection Fee

C. Sewerage Charge Financial Analysis

Scenario for Analysis to be done

- Scenario Set 1: 4WWTPs (Truc Bach, Kim Lien, Bay Mau and Yen So) in service
- Scenario Set 2: 6 WWTPs (Truc Bach, Kim Lien, Bay Mau, Yen So, Yen Xa and PhuDo) in service

C. Sewerage Charge Financial Analysis

Analysis of Set A: 4 WWTPs in service

Case	(EPF at HH) per (Average HH Income)	(EPF at HH) per (O&M Cost)
1: Current rate setting	0.09%	Under analysis
2: Based on current WTP	0.30% based on Census 0.25% based on the Survey	Under analysis
3: To cover all O&M Costs	O&M costs is under-calculation	Under analysis
4: Based on ATP	will be determined subject to required budget for O&M.	Under analysis
5: 3% of average HH Income	3.00%	Under analysis

EPF: Environmental Protection Fee

C. Sewerage Charge Financial Analysis

Result of the Analysis (Set B: 6 WWTPs operate)

Case	(EPF at HH) per (Average HH Income)	(EPF at HH) per (O&M Cost)
1: Current rate setting	0.09%	Under analysis
2: Based on current WTP	0.30% based on Census 0.25% based on the Survey	Under analysis
3: To cover all O&M Costs	O&M costs is under-calculation	Under analysis
4: Based on current ATP	will be determined subject to required budget for O&M.	Under analysis
5: 3% of average HH Income	3.00%	Under analysis
6: To Cover Initial Investment Costs	Total investment is under-calculation.	Under analysis

EPF: Environmental Protection Fee

Following Works

1. Estimates of O&M costs
2. Check Legal Limits (3% of Household Income)
3. Determination of ATP per household Income
4. Estimates of Operator's running costs & overheads
5. Project cash flow
6. Check Financial Gap in Full cost recovery, Affordability, and Willingness
7. Proposal for Cross Subsidy Plan

Thank You


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI
Study-A Working Group Meeting no.5
20 June 2011, Hanoi

TOR-2 Integrated OM services
TOR-3 Tariff Plan & Financial Plan

AGENDA

1. PPP law & IOMS
2. Tariff plan
3. Sewerage promotion



Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Previous Meeting

	Date	Agenda	Participants
Kick-off M	April 20	Purpose and Scope of Work Study schedule	DOC, HAPI, DOF, HSDC
WGM no.1	April 21	Required Data & Information for Study Selection of PPP model for Integrated O&M Implementation plan of Interview survey	DOC, HAPI, DOF, HSDC
WGM no.3	May 26	Analysis of Interview survey result Willingness to pay for Sewerage service Average Household Income	DOC, HAPI, DOF, HSDC
Interim M	June 23	Status report of TOR 1,2 & 3	DOC, HAPI, DOF, HSDC
WGM no.4	June 28	Project Cost Estimates JC Business Plan New Tariff Plan Pre FS	DOC, HAPI, DOF, HSDC

TOR-2

TOR-2

Integrated O&M service (IOMS)
applying Public Private Partnership

IOMS, Regulator, Pilot PPP Law

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

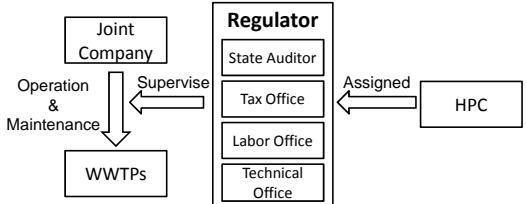
TOR-2: What IOMS brings

- **Cost Reduction**
 - ✓ Generally in Japan, 10-15% cost reduction is achieving.
 - ✓ Cost merit is significant when the duration is longer and the level is higher.
- **Prolongation of Equipment and Facility Lifetime**
 - ✓ Appropriate equipment inspection can act as a proactive measure against failure.
 - ✓ Regulate equipment running time.
- **After the contract period, what will happen? (Japan's case)**
 - ✓ Most contractors are re-contracting same job.
 - ✓ Tends to keep or raise the level.
 - ✓ Never return to Single-year, measurement base payment.

TOR-2: Regulator For IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

• **Framework of Regulator**



```

graph TD
    JC[Joint Company] -- Supervise --> Regulator
    Regulator -- Assigned --> HPC[HPC]
    Regulator --> OM[Operation & Maintenance]
    OM --> WWTPs[WWTPs]
    subgraph Regulator
        SA[State Auditor]
        TO[Tax Office]
        LO[Labor Office]
        TEO[Technical Office]
    end
  
```

- ✓ **Object:** Supervision of O&M quality in accordance with Performance Indicators.
- ✓ **Position:** Inside or Outside of HPC?
- ✓ **Members:** State auditor, tax office, DOC, HSDC, and Independent Party, etc?

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: Issues of PPP Pilot Law

<Applied or not>

- **Article 2: Interpretation**
 - ✓ Clause 2: Project means pilot project for infrastructure development or public provision implemented in the form of public-private partnership investment
- **Article 4: Areas**
 - ✓ 8: Environment (waste treatment plants)
 - ✓ 9: Other infrastructure development & public services
- **Article 5: Criteria**
 - ✓ Clause 3: A project which is capable of exploiting advantages in regards of technological and management and operation experiences, ...

TOR-2: Issues of PPP Pilot Law Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

● **Article 9 clause 2**
 ✓ State Contribution shall not exceed 30% of the total project investment
 → In this case, 30% of project cost (IOMS Cost) will be subsidies, but...

Legend: O&M Cost, Tariff, State Contribution

TOR-2: Subsequent Work Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

1. "Scope of Work" and "Contract terms" of IOMS
2. Estimates of operator's running costs & overheads
3. Project cash flow & Sensitivity Analysis
4. Feasibility Check
5. Road map to materialize IOMS
6. Draft MOU between HPC and Partners for establishment of Joint Company

TOR-3 Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-3

**New Tariff Plan
Financial Plan**

Estimates of O&M costs
New Tariff Plan

TOR-3:OM & Replacement Costs Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

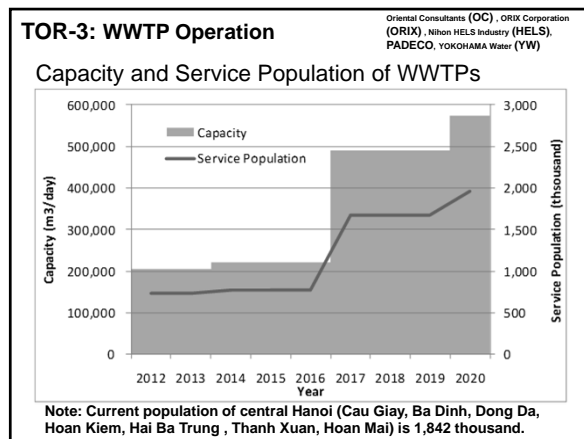
WWTP	Inflow m ³ /day	O&M Cost		O&M + Replacement Cost	
		mil VND/year	VND/m ³	mil VND/year	VND/m ³
1 Truc Bach WWTP	2,300	3,672 (HSDC) 4,294 (JICA)	4,374 (HSDC) 5,057 (JICA)	6,435 (JICA)	7,052 (JICA)
2 Kim Lien WWTP	3,700	4,798 (HSDC) 5,465 (JICA)	3,552 (HSDC) 4,047 (JICA)	8,047 (JICA)	5,959 (JICA)
3 Bay Mau WWTP	14,000	18,485 (JICA)	3,617 (JICA)	28,372 (JICA)	5,552 (JICA)
4 Yen So WWTP	200,000	140,674 (JICA)	1,927 (JICA)	219,771 (JICA)	3,011 (JICA)
5 Yen Xa WWTP	270,000	167,634 (JICA)	1,701 (JICA)	246,731 (JICA)	2,504 (JICA)
6 Phu Do WWTP	84,000	70,789 (JICA)	2,309 (JICA)	90,563 (JICA)	2,954 (JICA)
7 North Thang Long	6,000 ¹⁾	7,231 (HSDC) 9,800 (JICA)	3,301 (HSDC) 5,962 (JICA)	35,676 (JICA)	2,327 (JICA)

Note: North Thang Long Data is only reference because Inflow rate is not confirmed.

TOR-3: Assumptions of Analysis Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Assumptions for Financial Analysis

- This analysis focuses on central area of Hanoi, without North Thang Long WWTP.
- Commercial Operation Schedule
 - 2011: Truc Bach, Kim Lien
 - 2012-2013: Truc Bach, Kim Lien, Yen So
 - 2014-2016: Truc Bach, Kim Lien, Yen So, Bay Mau
 - 2017-2019: Truc Bach, Kim Lien, Yen So, Bay Mau, Yen Xa
 - 2020- : Truc Bach, Kim Lien, Yen So, Bay Mau, Yen Xa, Phu Do



TOR-3: Assumptions of Analysis

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

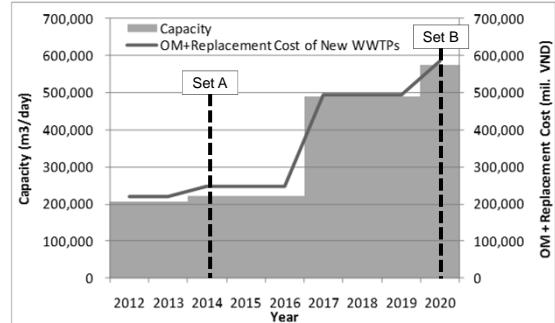
Concept of Income for WWTP Operation

- Existing 2 WWTPs are operated by local budget.
- New WWTPs are operated by sewerage tariff. Sewerage tariff is collected in service areas.
- Both sewerage tariff is collected from domestic and non-domestic.
- It is assumed that 58% of total tariff income is collected from domestic. Remaining 42% is collected from non-domestic.

TOR-3:WWTP Operation

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Capacity and OM + Replacement Cost



TOR-3:Cost Analysis

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

OM + Replacement Cost of New WWTPs

Operating New WWTPs	Year	OM + Replacement Cost per Capacity (VND/m ³ /day)	OM + Replacement Cost per Service Population (VND/person)
Yen So	2012-2013	1,065,812	299,458
Yen So, Bay Mau	2014-2016	1,126,896	320,145
Yen So, Bay Mau, Yen Xa	2017-2019	1,009,534	295,430
Yen So, Bay Mau, Yen Xa, Phu Do	2020-	1,019,569	299,442

TOR-3:Results of Analysis

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Set-A: 5 WWTPs in service

(Kim Lien, Truc Bach, North Thang Long, Bay Mau, Yen So)

	Sewerage tariff and EPF per Household Income	Revenue per O&M + Replacement Costs
Case 1 (Current, EPF)	0.085% (6,461 VND/HH/m)	0%
Case2 (Willingness to Pay)	0.278% (21,212 VND/HH/m)	24%
Case3 (Full recovery of O&M costs)	0.880% (67,246 VND/HH/m)	100%
Case4 (Legal Max)	3.000% (229,233 VND/HH/m)	366%

Note: All collected EPF from households is taken into consideration in this analysis.

TOR-3:Results of Analysis

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Set-B: 7 WWTPs in service

(Kim Lien, Truc Bach, , North Thang Long Bay Mau, Yen So, Yen Xa, Phu Do)

	Sewerage tariff and EPF per Household Income	Revenue per O&M + Replacement Costs
Case 1 (Current, EPF)	0.085% (6,461 VND/HH/m)	0%
Case2 (Willingness to Pay)	0.278% (21,212 VND/HH/m)	28%
Case3 (Full recovery of O&M costs)	0.829% (63,315 VND/HH/m)	100%
Case4 (Legal Max)	3.000% (229,233 VND/HH/m)	392%
Case5 (Full recovery of WWTP Investment)	1.261% (96,369 VND/HH/m)	158%

TOR-3: Tariff Scenario

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

- Example: Set A, Case 3 (Full recovery of O&M costs)

Sum of Sewerage tariff and EPF per Household Income:

0.880%

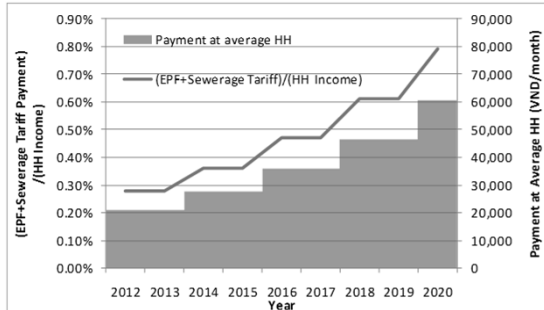
[For Domestic]

Supplied Water Use	Water Tariff	Sewerage Tariff
-16m ³	4,000 VND/m ³	3,273 VND/m ³
16-20m ³	4,700 VND/m ³	3,845 VND/m ³
20-35m ³	5,700 VND/m ³	4,663 VND/m ³
35m ³ -	9,400 VND/m ³	7,690 VND/m ³

TOR-3: Example of Tariff Plan

Oriental Consultants (OC) , ORIX Corporation (ORIX) , Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

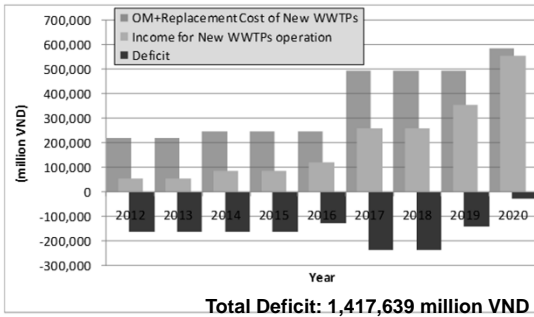
(Sample) Sewerage tariff increases to WTP level in 2012. Then, increases 30% every 2 years.



TOR-3: Example of Tariff Plan

Oriental Consultants (OC) , ORIX Corporation (ORIX) , Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Income and Cost of New WWTP Operation



Subsequent Works

Oriental Consultants (OC) , ORIX Corporation (ORIX) , Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

1. Determination of Affordable Tariff per Household Income
2. Operation Cash Flow
3. Check Financial Gap in Full Cost Recovery, Affordability, and Willingness
4. Proposal for Cross Subsidy Plan

Strategy of Public Awareness Development for Sewerage

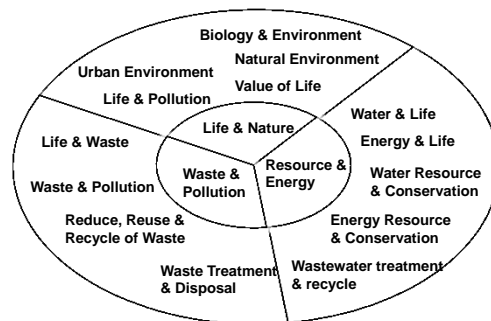
OC
ORIX
HELS/PADECO
Yokohama Water

Strategy

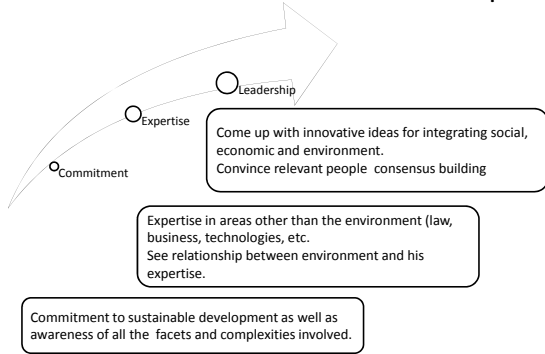
Sewerage service is a silent force behind the scene of living. Hence the people are not aware of value of sewerage. Lack of awareness makes introduction of sewerage tariff and PPP promotion been slow down. To avoid it, Strategies of public awareness development are;

- A) Environmental education to School children for teaching importance of sewerage as a part of discipline.
- B) Sewerage service promotion through the media such as TV, radio and internet.
- C) HPC's Public consensus meeting to make residents' understanding of sewerage tariff.
- D) Sewerage customer service counter is established in HPC website for inquiry and complain.

Environmental Education Program



Environmental Protection Leadership

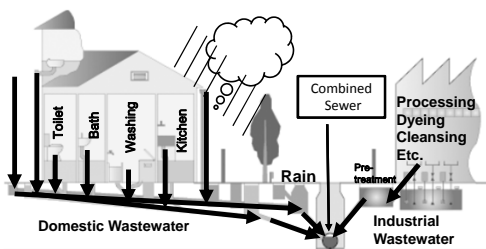


Awareness of Sewerage

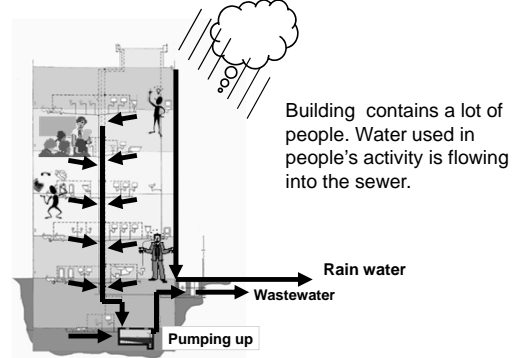


WASTEWATER COLLECTION

Rain is flowing into sewers. Water discharged from kitchen, toilet, washing and bath is combined with rain water in the sewer. Industrial water also come into sewer after pretreatment. This system is called the Combined Sewer System.

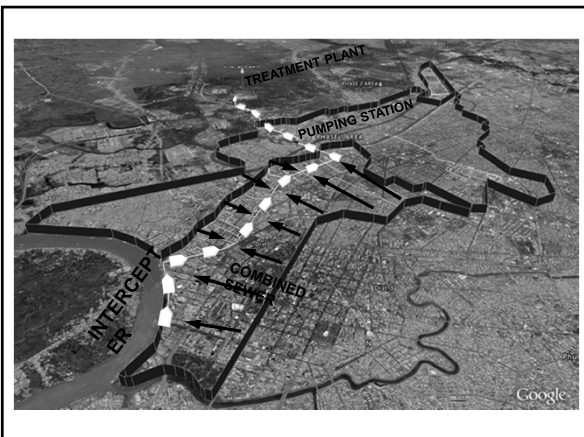
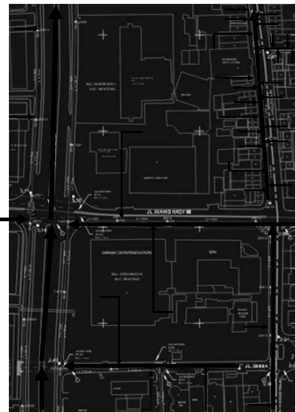


WASTEWATER COLLECTION



WASTEWATER TRANSFER SEQUENCE

- House connection sewers
- Service sewers (COMBINED SEWER)
- Main sewers (INTERCEPTER)



Environmental education - Promotion
Video for Kids



Aduh gimana ya..?
Lingkungan Kotaku

Ada apa Om?

Proyek Perbaikan Lingkungan Kota Jakarta
(Air Limbah)

JWDP



**MASALAH KESEHATAN
dan LINGKUNGAN**

Karena terbatasnya kebutuhan Sanitasi dasar seperti sarana pembuangan kotoran manusia, air bersih dan lain lain.



Jamban merupakan salah satu pemutus mata rantai penularan penyakit dari tinja

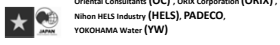


Begitu Om



Oh Yeh!

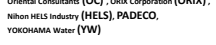
Pengelolaan lingkungan adalah tanggung jawab masyarakat dan pemerintah. Salah satu bentuk bantuan pemerintah berupa rehabilitasi MCK yang telah rusak.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) 

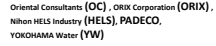
**INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI
Study-A Interim Meeting, 23 June 2011**

AGENDA

- Status report-TOR1** OJT with improvement of O&M manual
- Status report-TOR2** IOMS cases in Japan & Thai
Implementation framework for Integrated OM Service
- Status report-TOR3** Sewerage Tariff plan and sewerage O&M costs

Previous Meeting 

	Date	Agenda	Participants
Kick-off M	April 20	Purpose and Scope of Work Study schedule	DOC, HAPI, DOF, HSDC
WGM no.1	April 21	Required Data & Information for Study Selection of PPP model for Integrated O&M Implementation plan of Interview survey	DOC, HAPI, DOF, HSDC
WGM no.2	May 26	Analysis of Interview survey result Willingness to pay for Sewerage service Average Household Income	DOC, HAPI, DOF, HSDC
Interim M	June 23	Status report of TOR 1,2 & 3	DOC, HAPI, DOF, HSDC
WGM no.3	June 28	Project Cost Estimates JC Business Plan New Tariff Plan Pre FS	DOC, HAPI, DOF, HSDC

Proposal in the Study 

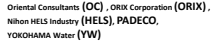
**Single Year Cost+ base O&M contract
to be converted to
Multi-year Performance base O&M contract**

Why?

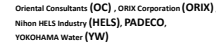
Because expecting the **Saving Project Life-cycle costs**

A) Conventional O&M ordering system is the Cost plus contract in which the contractor is paid his cost plus a stated percentage of profit for achieving fixed scope of work.

B) IOMS is the Performance-based ordering system in which the contractor is paid his cost and create his profit in achieving performance benchmarks.

Key Factor & TOR 

- TOR-1: Selection of capable contractor with**
 - experiential problem solving capacity
 - holistic view of the asset management process with prolongation of equipment lifespan.
- TOR-2: Terms of reference clarifying**
 - performance indicator & project delivery method
 - liabilities of government & contractor
- TOR-3 : Political support for**
 - financially viable revenue stream
 - fair allocation of profits and losses

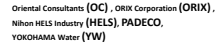
TOR-1 

TOR-1

Betterment of O&M in 3 WWTPs

OJT with upgrading O&M manual

5

TOR-1: Purpose & Goal 

Purpose

- Upgrading O&M manual with HSDC
- Upgrading O&M data management system with HSDC

Goal

- Upgrading HSDC's O&M skills

6

TOR-1: Work done

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

- JICA team provided supplemental O&M manual that HSDC have checked.
- Exchange of opinions between HSDC and JICA team about up-gradation of O&M manual and O&M data management system
- Exchange of opinions between HSDC and JICA team about treatment process testing

7

TOR-1: Findings

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Current status

- HSDC is using the O&M manuals authorized by HPC at taking-over the WWTP.
- HSDC is recording O&M data by simple data management system.

Alternative treatment process was scheduled in 3 WWTPs however cancelled due to technical issues.

8

TOR-1: Common understanding

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

O&M manual

O&M manual will be supplement for existing one.

O&M data management system

HSDC is using equipment register.

O&M data management system is proposed to make up...

- Historical failure record
- Repair / restore record
- Water quality analysis record

9

TOR-1: Common understanding

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

HSDC's expectation

HSDC asks JICA team to add more information in O&M manual.

- Further control parameters
- Contingency plan for unexpected case
- Definitions of technical term

10

TOR-1: Actions in July

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

- JICA team reviews existing O&M manual and data recording sheet.
- JICA team feeds back into the upgraded O&M manual and O&M data management system
- JICA team provides more information for O&M in the upgraded O&M manual
- HSDC checks particular water quality items for stabilization of effluent quality

11

TOR-1: Actions in August

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

To upgrade the O&M manual and O&M data management system

Existing O&M manual

Existing O&M data management system

+

Supplemental O&M manual and O&M data management system

JICA team asks HSDC will upgrade supplemental O&M manual and O&M data management system continuously

12

TOR-2

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2

Integrated O&M service (IOMS) applying Public Private Partnership

IOMS cases in Japan & Thai
Proposed IOMS framework

TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Contract Level	Period	Cost components
Conventional	Single year	Process cost (measurement base)
IOMS level-1	Short term multi year	Process + utility cost (Lump sum)
IOMS level-2		Process + utility cost (Lump sum) + Small replacement
IOMS level-3		Process + utility cost (Lump sum) + Medium replacement
IOMS full scale	Long term multi year	Process + utility cost (Lump sum) + Large replacement

Number of IOMS project in 2011	
Level-1	29 projects
Level-2	201 projects
Level-3	21 projects
Total	251 projects

Statistic, Contract Period (as of 2011)	
1 year	32 projects
3 years	182 projects
4 years	14 projects
5 years	14 projects
Over 5 years	1 project
Total	243 projects

TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Integrated O&M service
Hanamigawa WWTP
no.2, Chiba, Japan,
3-year contract



Project started in 2007

Plant feature	Capacity 576,000m3/day Conventional activated sludge treatment Sludge incinerator 150 ton/day Treated Sewage Effluent (TSE) Tertiary Treatment Photovoltaic power generation (1828 KWh)
Scope of work	1) O&M of sewage treatment, sludge treatment, TSE transmission 2) Environmental monitoring & protection 3) Ancillary facility maintenance 4) Replacement of equipment (less than JPY 2,500,000 per item) 5) Procurement of consumables

TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Integrated O&M service, **Hanamigawa WWTP no.2**, Chiba, Japan

Employer's Requirements, Performance Indicator (PI)				
	Item	Unit	Legal limits	Contract target
Effluent Standard	pH		5.8~8.6	5.8~8.6
	Transparency	cm	-	>80
	BOD	mg/L	15	3
	COD	mg/L	-	12
	SS	mg/L	40	3
	T-N	mg/L	30	13
	T-P	mg/L	4.0	1.5
incinerator Emission	F.Coli	MPU/mL	<3000	<500
	N0x	ppm	250	20
Odor	SOx	ppm	-	20
	H2S	ppm	-	1.0
Energy saving	Year-on-year decrease 1%			

TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Integrated O&M service, **Hanamigawa WWTP no.2**, Chiba, Japan

3-year operation outcome (2007-2009)

- i.Total O&M costs decreased 14%.
- ii.Electricity consumption had been saved 7%.
- iii.Equipment malfunction and system failure decreased 12% (52 to 46 per year)

Costs Comparison before & after project in 3 years, unit million JPY

Item	3-year costs before project	3-year costs during project	Improvements
Remuneration	231	138	▼93 or -14%
Direct costs incl. Utilities	3,548	2,886	▼662 or -19%
Small replacement (<JPY250K)	72	52	▼20 or -28%
Large replacement (>JPY250K)	954	1,049	△95 or +10%
Others	114	118	△4 or +4%
total	4,919	4,243	▼676 or -14%

TOR-2: Japanese IOMS cases

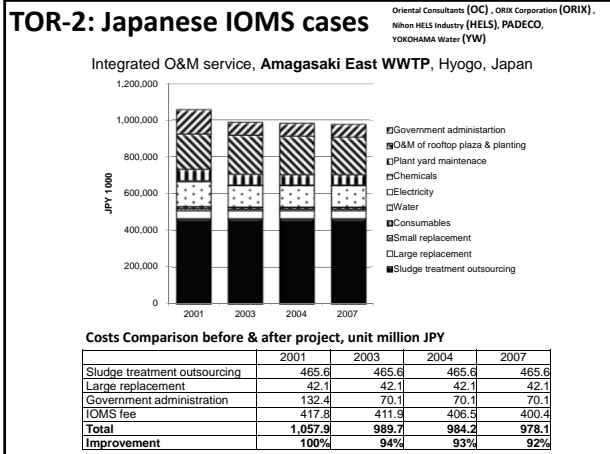
Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

Integrated O&M service
Amagasaki East
WWTP, Hyogo, Japan
5-year contract



Project started in 2003

Plant feature	Capacity 134,000m3/day for sewage Conventional activated sludge treatment Relay Pumping S-1 139m3/min(S) + 1971m3/min(R) Relay Pumping S-2 1745m3/min(R) Sludge transmission pumping station
Scope of work	(1) O&M of Sewage treatment (2) Environmental monitoring (3) O&M of relay pumping stations (4) Inspection and maintenance of plant utilities (5) Procurement of consumables and utilities (6) Equipment replacement (> JPY 1M) (7) O&M of rooftop plaza, planting zone



TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Item	Shiwa (Iwate)	Hamakurosaki (Toyama)	Arakawa (Saitama)	Nagata (Shizuoka)	Takehara (Hiroshima)	Matsuyama (Ehime)
Period	3 year	3 year	3 year	3 year	3 year	3 year
Type	Combined	Separated	Separated	Separated	Separated	Combined
Contract level	2	2	2	2	1	2
Replacement Max	USD 10,000	Not available	USD 5,000	USD 5,000	0	USD 5,000
Process	C.A.S	C.A.S	O.D	C.A.S	S.A.S	C.A.S
Design capacity (m3/d)	9,200	178,500	38,700	17,000	Not available	151,000
PI - BOD	13 mg/L	5.6 mg/L	Not available	Not available	5 mg/L	4.3 mg/L
COD		8.9 mg/L	Not available	Not available	10 mg/L	7.2 mg/L
SS	20 mg/L	5.3 mg/L	Not available	Not available	5 mg/L	2 mg/L
T-N	None	None	Not available	Not available	10 mg/L	13 mg/L
T-P	None	None	Not available	Not available	1 mg/L	0.48 mg/L
Coliform G	80 MPU/mL	7 MPU/mL	Not available	Not available	Nil	Nil

TOR-2: Thailand IOMS case

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service
Nong Khaem WWTP,
Bangkok, Thailand
5-year contract

Plant feature: Capacity 157,000m3/day in Nong Khaem WWTP, Vertical loop reactor activated sludge, Sludge transmission pumping station

Scope of work: (1) O&M of Sewage treatment, (2) O&M of Sludge treatment (dehydrate), (3) Environmental monitoring, (4) Inspection and maintenance of plant utilities, (5) Procurement of consumables and utilities

PI: SS, BOD, COD, T-N, T-P, Coliform group, F.Coli & E.Coli

Payment: Payment = Kfix + Kq(Q) + KB + Ksludge, where, fix = fixed rate, Q = inflow rate, B = storm water bypass flow and Sludge = sludge volume

Project started in 2003

TOR-2: Integrated OM Service

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

	Circular 09/2009/TT-BXD ANNEX1	Hanoi Model (This Study)	Compliance
Duration	5 to 10 years	3-5 Years?	To be Discussed
Scope	Drainage, Sewerage, Disposal of Sludge, Asset Management, etc	Yen So STP, Bay Mau STP (Other STPs) (Other PSs)	Complied
Contract Type	Lump-Sum, or Unit price	Lump-Sum	Complied
Repair & Replacement cost	Partly included	Japanese Level 2 is recommended	Under Consideration
Regulating Body	Drainage/Sewerage system owner	Not Appointed	To be Discussed

TOR-2: Regulation to be Applied

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

- Decision 71/2010/QD-TTg: Pilot PPP Law is not applied in this case
- Article 1. This regulation provisionally provides the conditions, procedures, and principles applied for investment projects for infrastructure development ... under the PPP model.
 - Article 1 is not applied for the IOMS because the work dose not include a infrastructure development.
- Article 4: Areas of pilot investment under PPP Road, Bridges, Railway, Airport, Seaports, Power Plant, Fresh Water Supply System, Waste Treatment Plant, etc.
 - Wastewater is not included.

TOR-2: Regulation to be Applied

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

- Regulations to be applied are as below
 - 59/2005/QH11: Law on Investment
 - 60/2005/QH11: Law on Enterprises and other related decrees and circulars
- Joint Company's Proportion of Capital Contribution
 - Vietnam: Japan = 50:50 (To be considered)
 - Vietnam: HPC
 - Japan: ORIX, and other skilled companies

TOR-2: JC's Legal Framework Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

- According to Law on Enterprise, possible legal framework

	Shareholding Company	Single member Limited Liability Company	Limited Liability Company with 2 or more Members
Investor's Responsibility	Limited	Limited	Limited
Power of Operation	Board Meeting	Company Owner	Members (Capital Contributor)
Decision Making	Shareholder Meeting	Board meeting	Board Meeting
Number of Membership	At least 1	At least 1	2 or more

- Generally in Vietnam, limited liability company with 2 or more members is preferred.

TOR-2: Business Menu of JC Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Business Menu

A) **O&M:** Utilization of HSDC's Engineers and Staff at a maximum

B) **Training:** Capacity building course for operators in Hanoi and other neighboring cities

Establishment of Training facilities by ODA fund (Possibility)

C) **Planning & Engineering:** Sending Japanese skilled engineers by ODA Technical Assistance

TOR-2: Subsequent Work Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

- "Scope of Work" and "Contract terms" of IOMS
- Estimates of operator's running costs & overheads
- Project cash flow & Sensitivity Analysis
- Feasibility Check
- Road map to materialize IOMS
- Draft MOU between HPC and Partners for establishment of Joint Company

TOR-3 Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-3

New Tariff Plan

Financial Plan

Estimates of O&M costs

New Tariff Plan

TOR-3: Survey Area Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

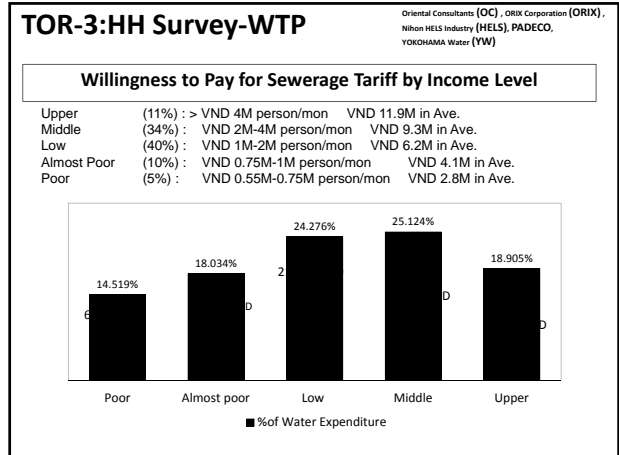
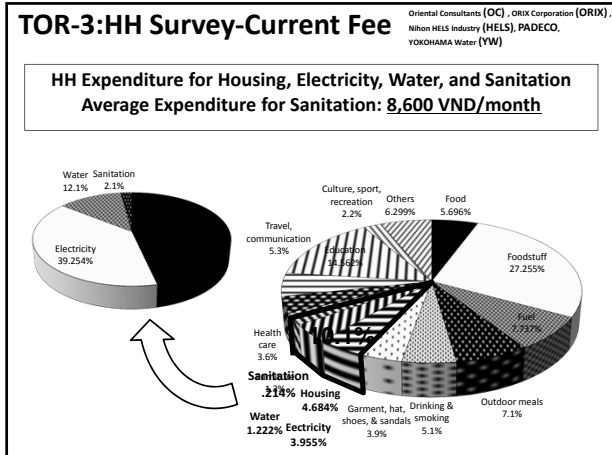
TOR-3: HH Survey-Outline Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

PURPOSE OF THE HOUSEHOLD SURVEY

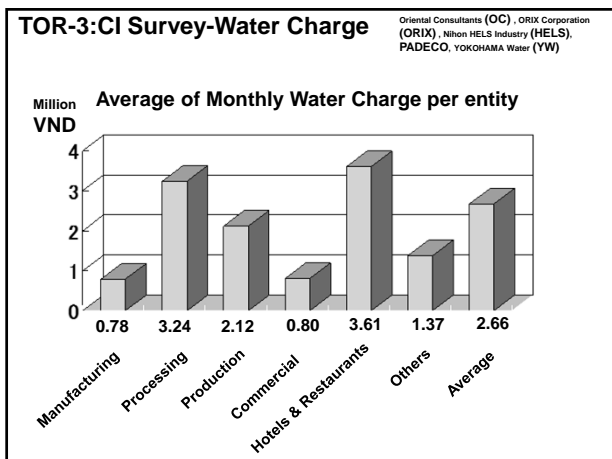
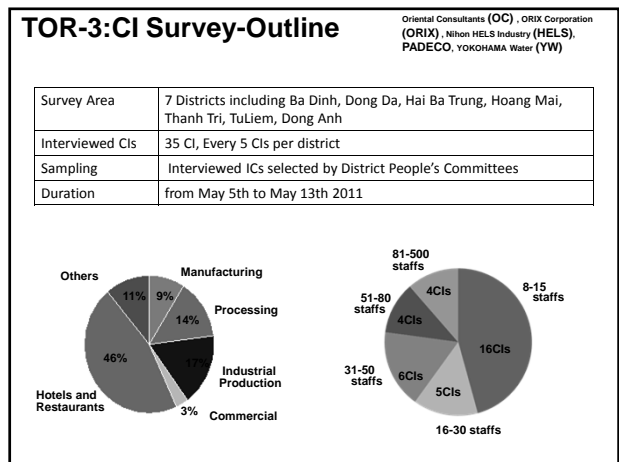
- To grasp the citizen's awareness of sewerage services
- To get the citizen's willingness to pay for the sewerage services

Outlines of Survey	
Surveyed Area	Ba Dinh, Dong Da, Hai Ba Trung, Hoang Mai, Thanh Tri, Tu Liem, 7 Districts in Hanoi, Dong Anh
Sampled Number	105 Household (15HH from each district)
Method	Interview by trained surveyors
Duration of Survey	6 th to 9 th May 2011

Income	8,560,962 VND /month per HH in average
Expenditure	7,024,368 VND/month per HH in average (82.1% of Income)



- ### TOR-3:HH Survey-WTP
- Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)
- Average monthly household income in survey area is VND 8,561,000 / month.
 - Average monthly household income of whole Hanoi (estimated based on GSO) is VND 7,641,100 / month (89.3 % of the survey.)
 - Willingness to Pay (WTP) in survey area is VND 21,210/month.
 - WTP / Income is 0.25%.
 - Average Water Charge is VND 85,000/month.
 - (WTP : Ave. Water Charge) is (1 : 4).



TOR-3:CI Survey Result

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Willingness to pay

CI's Willingness-to-Pay (WTP) is 0.13% per month sales that is equivalent to monthly VND 2.8 million per entity.

↓

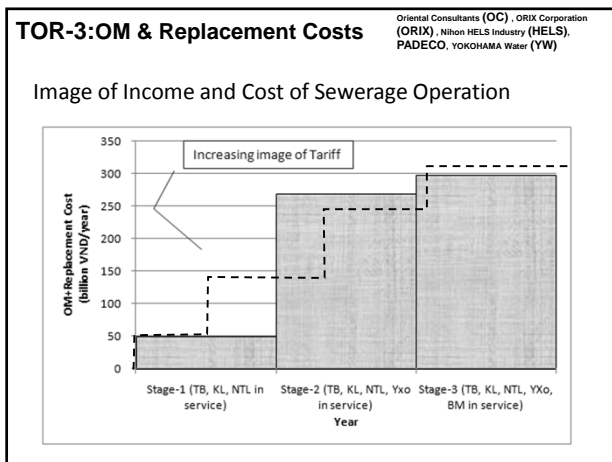
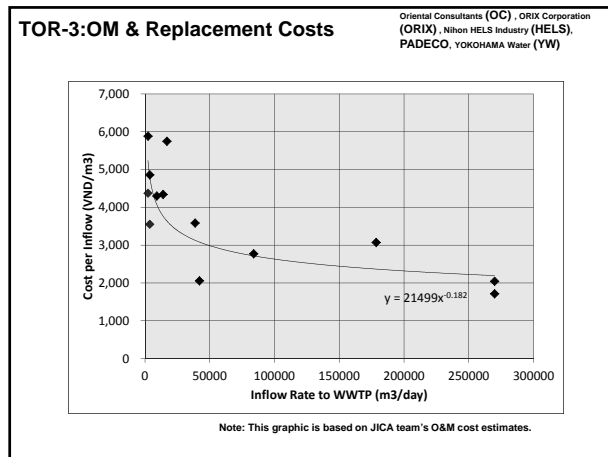
Recommendations

- Awareness of the sewerage benefit is low in interviewed CI, hence further promotion is required.
- It shall be noted that WTP of CI per entity (VND 2.8M) is 132 times of WTP per HH (VND 21K). CI customer shall be reserved for Cross-Subsidy Financial Source.

TOR-3:OM & Replacement Costs Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELIS), PADECO, YOKOHAMA Water (YW)

WWTP	Inflow m ³ /day	O&M Cost		O&M + Replacement Cost	
		mil VND/year	VND/m ³	mil VND/year	VND/m ³
1 Truc Bach WWTP	2,300	3,672 (HSDC) 4,294 (JICA)	4,374 (HSDC) 5,057 (JICA)	6,435 (JICA)	7,052 (JICA)
2 Kim Lien WWTP	3,700	4,798 (HSDC) 5,465 (JICA)	3,552 (HSDC) 4,047 (JICA)	8,047 (JICA)	5,959 (JICA)
3 Bay Mau WWTP	14,000	18,485 (JICA)	3,617 (JICA)	28,372 (JICA)	5,552 (JICA)
4 Yen So WWTP	200,000	140,674 (JICA)	1,927 (JICA)	219,771 (JICA)	3,011 (JICA)
5 Yen Xa WWTP	270,000	167,634 (JICA)	1,701 (JICA)	246,731 (JICA)	2,504 (JICA)
6 Phu Do WWTP	84,000	70,789 (JICA)	2,309 (JICA)	90,563 (JICA)	2,954 (JICA)
7 North Thang Long	6,000 ??	7,231 (HSDC) 9,800 (JICA)	3,301 (HSDC) 5,962 (JICA)	35,676 (JICA)	2,327 (JICA)

Note: North Thang Long Data is only reference because Inflow rate is not confirmed.



TOR-3:OM and Replacement Costs Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELIS), PADECO, YOKOHAMA Water (YW)

Set-A: 5 WWTPs in service
(Kim Lien, Truc Bach, North Thang Long, Bay Mau, Yen So)

	Sewerage tariff and EPF per Household Income	Revenue per O&M + Replacement Costs
Case 1 (Current, EPF)	0.080% (6,143 VND/HH/m)	0%
Case2 (Willingness to Pay)	0.278% (21,347 VND/HH/m)	26%
Case3 (Full recovery of O&M costs)	0.857% (65,807 VND/HH/m)	100%
Case4 (Legal Max)	3.000% (230,363 VND/HH/m)	381%

Note: All collected EPF from households is taken into consideration in this analysis.

TOR-3:OM and Replacement Costs Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELIS), PADECO, YOKOHAMA Water (YW)

Set-B: 7 WWTPs in service
(Kim Lien, Truc Bach, , North Thang Long Bay Mau, Yen So, Yen Xa, Phu Do)

	Sewerage tariff and EPF per Household Income	Revenue per O&M + Replacement Costs
Case 1 (Current, per EPF)	0.080% (6,143 VND/HH/m)	0%
Case2 (Willingness to Pay)	0.278% (21,347 VND/HH/m)	26%
Case3 (Full recovery of O&M costs)	0.847% (65,039 VND/HH/m)	100%
Case4 (Legal Max)	3.000% (230,363 VND/HH/m)	385%
Case5 (Full recovery of WWTP Investment)	1.284% (98,595 VND/HH/m)	158%

- Subsequent Works** Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELIS), PADECO, YOKOHAMA Water (YW)
1. Determination of Affordable Tariff per Household Income
 2. Operation Cash Flow
 3. Check Financial Gap in Full Cost Recovery, Affordability, and Willingness
 4. Proposal for Cross Subsidy Plan



Thank You For Attention

JICA Study Team - A

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI Study-A Working Group Meeting #4 12 August 2011

AGENDA	
TOR-3 Tariff & Financial Plan	1. Determination of Affordable Tariff per Household Income 2. Operation Cash Flow 3. Check Financial Gap in Full Cost Recovery 4. Proposal for Cross Subsidy Plan
TOR-2 IOMS	1. IOMS "Contract terms" and "Scope of work" 2. Running costs & overheads 3. Sensitivity factors for project cash flow 4. Pay item for feasibility check 5. Road map to materialize IOMS 6. Draft MOU for establishment of Joint Company

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Previous Meeting

	Date	Agenda	Participants
Kick-off M	April 20	Purpose and Scope of Work Study schedule	DOC, HAPI, DOF, HSDC
WGM no.1	April 21	Required Data & Information for Study Selection of PPP model for Integrated O&M Implementation plan of Interview survey	DOC, HAPI, DOF, HSDC
WGM no.2	May 26	Analysis of Interview survey result Willingness to pay for Sewerage service Average Household Income	DOC, HAPI, DOF, HSDC
Interim M	June 23	Status report of TOR 1,2 & 3	DOC, HAPI, DOF, HSDC
WGM no.3	June 28	Project Cost Estimates New Tariff Plan	DOC, HAPI, DOF, HSDC
WGM no.4	August 12	IOMS Road Map Tariff Case Study & Cash Flow Simulation	DOC, HAPI, DOF, HSDC
Wrap-up Meeting	August 30	Study Results Conclusion	DOC, HAPI, DOF, HSDC

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-3

New Tariff Plan Financial Plan

Determination of Affordable Tariff per Household Income
Operation Cash Flow
Check Financial Gap in Full Cost Recovery
Proposal for Cross Subsidy Plan

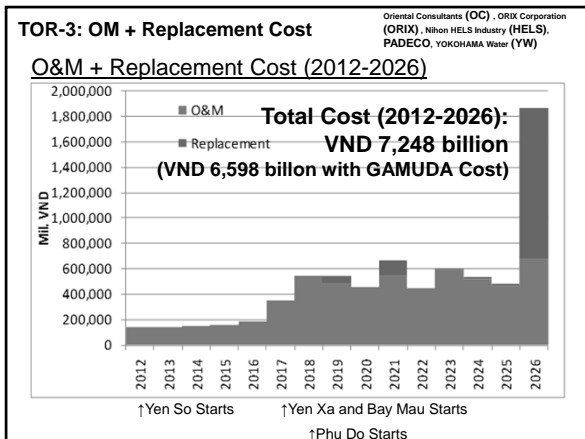
Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-3: OM + Replacement Cost

O&M Cost

	Total Capacity (m ³ /day)	Annual O&M Cost (mil. VND/year)	O&M Cost per Capacity (VND/m ³)
Existing 3WWTPs	48,200	17,544	997
Existing 3WWTPs +Yen So	248,200	190,891 (147,544 based on existing 3 WWTPs and GAMUDA)	2,107 (1,629)
Existing 3WWTPs +Yen So, Yen Xa, Bay Mau	532,200	445,739 (402,392 based on existing 3 WWTPs and GAMUDA)	2,295 (2,071)

Note: without replacement costs



Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-3: Tariff Level Analysis

4 WWTPs in service

(Kim Lien, Truc Bach, North Thang Long, Yen So)

	Sewerage Tariff plus EPF per Household Income	Financial Gap (mil. VND/year)
A: Current, EPF	0.08% (VND 6,461/HH/m)	A-C= -173, 347 A-D= -252, 444
B: Acceptable Tariff based on Willingness to Pay	0.28% (VND 21,212/HH/m)	B-C= -117,842 B-D= -196,983
C: Tariff for Full O&M Cost Recovery	0.69% (VND 52,532/HH/m)	C-D= -79,091
D: Tariff for Full O&M and Replacement Cost Recovery	0.96% (VND 73,551/HH/m)	

Note: Include collection fee

TOR-3:Tariff Level Analysis

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

7 WWTPs in service

(Kim Lien, Truc Bach, North Thang Long, Bay Mau, Yen So, Yen Xa, Phu Do)

	Sewerage tariff plus EPF per Household Income	Financial Gap (mil. VND/year)
A : Current, EPF	0.08% (VND 6,461/HH/m)	A-C= -512,273 A-D= -702,222
B: Acceptable Tariff based on Willingness to Pay	0.28% (VND 21,212/HH/m)	B-C= -369,454 B-D= -559,403
C: Tariff for Full O&M Cost Recovery	0.78% (VND 59,372/HH/m)	C-D= -189,951
D: Tariff for Full O&M and Replacement Cost Recovery	1.03% (VND 78,991/HH/m)	

Note: Include collection fee

TOR-3: Tariff Issue

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Yen So WWTP Operation Case

- O&M + Replacement Cost: VND 252 bil.
- Income from tariff at Willingness to Pay Level: VND 56 bil.
- It is political issue whether sewerage tariff starts at full cost recovery level or at willingness to pay level.

7 WWTPs Operation Case

- O&M + Replacement Cost: VND 702 bil.
- Income from tariff at Willingness to Pay Level: VND 143 bil.

TOR-3: Cash Flow Analysis

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Case Study for Sewage Tariff Introduction in Hanoi

Premise

- Tariff collection will be started in 2014
- Tariff will be started at Willingness to Pay level.
- Tariff will catch up the full cost recovery level within 10 years

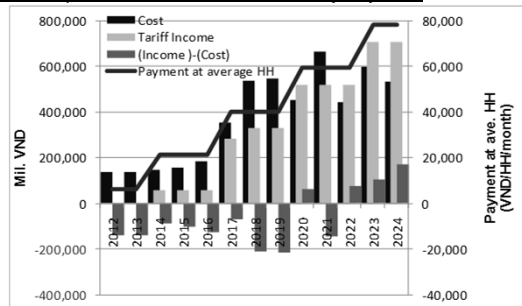
Parameter

- ✓ Duration of Tariff Raising-up
 - Tariff Option 1: every 3 years
 - Tariff Option 2: every 5 years

TOR-3: Cash Flow Analysis

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Tariff Option 1:Tariff is raised every 3 years

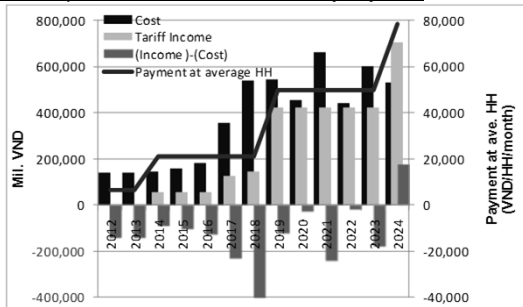


Total Amount (13 years, 2012-2024): -822 billion VND

TOR-3: Cash Flow Analysis

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Tariff Option 2:Tariff is raised every 5 years



Total Amount (13 years, 2012-2024): -1,637 billion VND

TOR-3: Weighting of Tariff Category

Oriental Consultants (OC) , ORIX Corporation
(ORIX) , Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Unit Rate of Water Supply in Hanoi as of 2010

Category	Weighting
Domestic	1.00
Manufactures	1.71
Administrative offices, and Implementation organization	1.40
Service business purposes	2.94
Public purposes	1.15

Water Supply Tariff Income Share in Hanoi as of 2010

Category	Share
Domestic	60%
Manufactures	6%
Administrative offices, and Implementation organization	10%
Service business purposes	24%

TOR-3: Conclusion

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

1. Hanoi needs the sewerage tariff to cover increasing O&M cost of sewerage facilities due to construction of new WWTPs.
2. As the result of willingness to pay survey does not meet O&M cost, it is required to make up the budgetary shortage somehow. (i.e. governmental subsidy)
3. In order to accommodate the operation of Yen So WWTP, preparation of tariff introduction should be conducted in 2012 and 2013.

TOR-3: Conclusion

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

4. Considering current social opinion, it is recommended that the tariff starts from willingness to pay level, and then catches up full O&M cost recovery level within 10 years.
5. Government shall support the O&M cost for Yen So WWTP with amount of VND 120 bil. per year in the early stage.
6. Large scale equipment replacement (relating to equipment life time) shall be discussed.
7. Weak point of this scenario is that the tariff level is not enough for Yen Xa operation when it will start.

TOR-2

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

**TOR-2
Integrated Operation &
Maintenance Service
(IOMS)**

1. IOMS "Contract terms" and "Scope of work"
2. Running costs & overheads
3. Sensitivity factors for project cash flow
4. Pay item for feasibility check
5. Road map to materialize IOMS
6. Draft MOU for establishment of Joint Company

TOR-2: Objective of IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Please remember the reasons why we suggest IOMS (multi-year performance-base contract) those are;

1. To reduce the life cycle O&M costs, and
2. To level up the O&M skills taking certain level of the risks.

TOR-2: IOMS Contract Terms

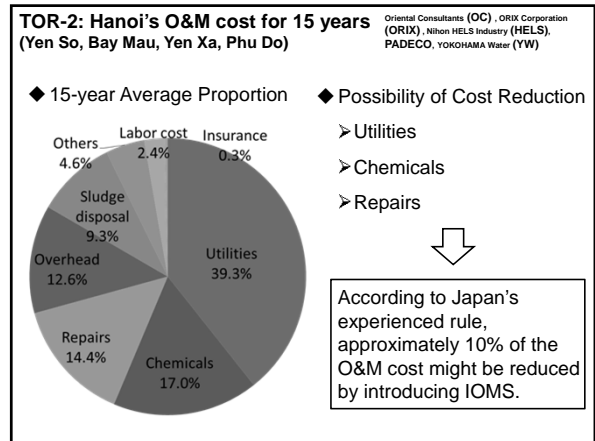
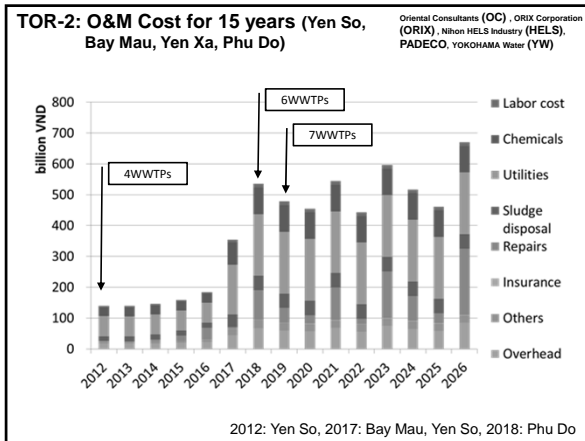
Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Key Clause	Description
Project Owner & Contractor	Owner: HPC Contractor: Joint Company
Contractor's Obligation	The Contractor shall provide the IOMS stipulated by the IOMS contract. (refer to the next slide)
Payment	<ul style="list-style-type: none"> • The owner shall confirm a conformity of the contractor's performance in collation with the performance indicators. • Unconformable work of the contractor will cause the reduction of the payment to the contractor.
Contractor's possession of site and duty to reserve function	<ul style="list-style-type: none"> • The owner shall grant the right to use the sewerage facility to the contractor for the purpose of contractor's obligation. • The contractor shall reserve the function of facility and compensate the damage or losses caused by the contractor.

TOR-2: IOMS Scope of Work

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

General	<ol style="list-style-type: none"> a. Staff management and Material Control for O&M b. Reporting of results of O&M work to the regulator c. Customer technical service
Technical	<ol style="list-style-type: none"> a. O&M in wastewater treatment and sludge treatment/disposal in compliance with Performance Indicator (PI) b. Repair work of facilities c. Small scale replacement of equipment (refer to Japanese case) d. Technical transfer through O&M PDCA cycle
Option	<ol style="list-style-type: none"> a. Promotion of sewerage service b. Engineering service to other cities c. Staff Training to other cities



TOR-2: Sensitivity factors for project cash flow 1

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

➢ Price Escalation Risk

Issues	Rescues
Price escalation impacts on Utilities, Chemicals, Repairs, Overhead, Labor Cost.	Price adjustment clause against unprojected price escalation is needed to stipulate in the IOMS contract.
10% price escalation causes 8-9% of O&M cost increase.	The IOMS contract period shall be set at the period within a predictable range of price escalation.
O&M cost in the contract is used to be a lump-sum.	

TOR-2: Sensitivity factors for project cash flow 2

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

➢ Tariff Collecting Risk

Issues	Rescues
Non-revenue sewage would be occurred	Contractor will not be incurred financial loss due to non-revenue sewage risk. One water bill for water supply and sewerage is recommendable
1) due to the lack of user's appreciation for sewerage . 2) due to the additional burden of households' economy.	
It is difficult for contractor to directly request households to pay for non-revenue sewage.	

TOR-2: Pay Item for feasibility check

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Services fees payable by the Owner to the Contractor shall be calculated according to the following formula:

$$\text{Services fees} = \text{Variable Expenses(A)} + \text{Fixed Expenses(B)}$$

(A) Variable Expenses	= Basic unit x Volume of treated water (Electricity and chemical consumptions relating to treatment process are the majority of variable expenses.)
(B) Fixed Expenses	= Costs other than A

Detail of the simulation will be presented in the Wrap-Up meeting.

TOR-2: Road map to materialize IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Events	HPC's Actions	IOMS
2012 Yen So in service		
2012-2014	Setup of tariff system	Establishing JC
2014	Collection of sewerage tariff	Implementing IOMS at Yen So
2015-2016	Preparatory period of rising tariff (tariff option 1)	
2017 Bay Mau & Yen Xa in service	Rising Up tariff (tariff option 1)	Implementing IOMS at Bay Mau & Yen Xa
2018 Phu Do in service		Implementing IOMS at Phu Do
2017-2018	Preparatory period of rising tariff (tariff option 2)	
2019	Rising Up tariff (tariff option 2)	

TOR-2: Draft MOU between HPC and Partners for Joint Company

Oriental Consultants (OC) , ORIX Corporation (ORIX) , Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Whereas:

HPC and JSC has been interest in establishing a joint venture company (JC) with HPC for the IOMS of sewerage facilities in Hanoi, based on their investment experiences to the infrastructure business. Both parties hereby confirm mutual understandings to commence further preparation for the actions listed below.

1. JSC desires to establish the JC with HPC for IOMS in the Yen So WWTP, Bai Mau WWTP and new sewerage facilities to be constructed in future.
2. The JC will operate the planning, engineering, construction management, operation and maintenance, operator's skill-up coaching and any other type of business related to sewerage.
3. JSC's share ratio in the JC with HPC will be determined later during the course of the establishment of the JC.

4. Both parties agree that the JC will be a licensed user of Bay Mau WWTP and Yen So WWTP.
5. HPC and JSC will assign members of the Coordination Committee to establish the JC.

It is further understood by the parties hereto that

- a. JSC shall have the right to access and review all documents for the purpose of establishment of the JC.
- b. Both party shall treat this M.O.U strictly confidential. Either party shall not disclose any information contained in this M.O.U to any third party without prior written consent of the other party.

The term of this M.O.U shall remain valid for an initial period of two (2) years starting from the date first set above, unless earlier terminated pursuant hereto or modified.

**Thank you very much
for your attention!**

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
 Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

INTRODUCTION OF PPP FOR SEWERAGE FACILITIES IN HANOI

Study-A WRAP-UP MEETING

30 August 2011

AGENDA	
TOR-1 Improvement of O&M	Betterment of O&M in 3 WWTPs OJT by interactive approach with HSDC and JICA team
TOR-3 Tariff & Financial Plan	New Tariff Plan & Financial Plan a. Comparison of Cost & Revenue b. Tariff System c. Financial Gap
TOR-2 IOMS	1. Introduction of IOMS 2. Implementation of IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Previous Meeting

	Date	Agenda	Participants
Kick-off M	April 20	Purpose and Scope of Work Study schedule	DOC, HAPI, DOF, HSDC
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WGM no.4	August 12	IOMS Road Map Tariff Case Study & Cash Flow Simulation	DOC, HAPI, DOF, HSDC
Wrap-up Meeting	August 30	Study Results Conclusion	DOC, HAPI, DOF, HSDC

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-1

Betterment of O&M in 3 WWTPs

OJT by interactive approach with HSDC and JICA team

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-1 Goal & Approach

Goal

- Upgrading HSDC's O&M skills

Approach

- Interactive approach in Upgrading O&M manual and Upgrading O&M database system at the sites
- On-The-Job Training

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-1 Upgrading O&M Manual

Original O&M manual

- HSDC is using the O&M manuals authorized by HPC at taking-over the 3WWTPs.
- HSDC's O&M work shall be comply with the original O&M manual because it was authorized by HPC.
- HSDC asked JICA team to add the information of (a) more control parameters for the operation, (b) Contingency plan for unexpected case and (c) Definitions of technical term in O&M manual.

Work done

- JICA team submitted the supplemental O&M manual covering of (a) more control parameters for the operation, (b) Contingency plan for unexpected case and (c) Definitions of technical term.

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-1 Upgrading O&M Manual

Original	1. Explanation of Wastewater Treatment Plant
Original	2. Equipment List
Original	3. Operation and Maintenance
	3.1 Operation Method
	<ul style="list-style-type: none"> Grit chamber facility Lift pump facility Wastewater treatment facility Disinfection facility Water supply facility Sludge treatment facility Deodorization facility General room facility
Supplemental	3.1.S Operation Method - Supplemental
	<ul style="list-style-type: none"> Introduction Control parameters Frequency of water analysis
Supplemental	3.1.S Safety, Health, Contingency Plan - Supplemental
	<ul style="list-style-type: none"> Measures for safety and health Contingency plan

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Original	3.2 Maintenance <ul style="list-style-type: none"> Grit chamber facility Lift pump facility Wastewater treatment facility Disinfection facility Water supply facility Sludge treatment facility Deodorization facility General room facility
Original	3.3 Maintenance for non-operation period <ol style="list-style-type: none"> Grit chamber facility Lift pump facility Wastewater treatment facility Disinfection facility Water supply facility Sludge treatment facility Deodorization facility General room facility
Supplemental	3.4 Supplemental Manual - Electric & Instrumentation Equipment Inspection / Maintenance <ol style="list-style-type: none"> Introduction Cautions Monthly Inspection Items Annual Inspection Items Device List

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Original	4. Trouble Shooting and Fault Finding <ul style="list-style-type: none"> Process Control panel
Original	5. Reference Documents <ul style="list-style-type: none"> Design calculation Calculation of capacities Motor and control list
Supplemental	5.5 Definitions of Technical terms <ul style="list-style-type: none"> Introduction Operation Electric equipment Instrumentation equipment

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Evaluation of Monitoring Data currently recorded by HSDC

Place	Control parameter	unit	Allowable Range			Countermeasures
			Kim Lien	Truc Bach	North Thang Long	
Reactor	DO	mg/L	2.5-3.5	2.5-3.5	2.0-3.0	Control aeration rate Maintenance of blower and diffuser
	MLSS	mg/L	2000-3000	1500-2000	2000-3000	Control excess sludge volume
	Anaerobic tank ORP	mV	< -50	< -150	< -50	Control return sludge ratio Control aeration rate
	Anoxic tank ORP	mV	< -50	< -150		Control recirculation ratio Control aeration rate
	Aerobic tank ORP	mV	> 100	> 50	> 50	Control aeration rate

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Evaluation of Monitoring Data to be recorded additionally by HSDC

Equipment	Control parameter	unit	Target minimum	Target maximum	Countermeasures
Influent	pH	—	6.5	8.0	(abnormal influent flow) Check waste water quality
Reactor	pH	—	6.0	7.4	Control aeration rate
Final settling tank	Sludge-liquid interface	m	---	0.5	Control excess sludge volume
Dehydrator	Water content	%	---	85 (TB) 83 (KL) 82 (NTL)	Control sludge volume of supply Control sludge conc. of supply Control polymer injection rate Control FeCl ₃ injection rate Maintenance of dehydrator

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Problem-solving: Total phosphorus value of effluent increase

Condition		
More than -50mv ORP	• DO interfusion by rainfall	• Increase coagulant (FeCl ₃) injection rate (Be careful of excess injection)
	• DO interfusion by return sludge	• Reduce return sludge ratio • Reduce aeration rate
Under -50mv ORP	• BOD/P ratio of influent to the reactor is under 20.	• Bypass Primary settling tank • Supply methanol etc. to increase BOD
	• Shortage of coagulant dosage	• Increase coagulant (FeCl ₃) injection rate (Be careful of excess injection)

TOR-1 Upgrading O&M Manual

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELIX Industry (HELIX), PADECO,
YOKOHAMA Water (YW)

Problem-solving: Floating sludge from bottom of final settling tank

Condition	Occasions	Countermeasures
Bubbling surface of brown colored sludge	• NO ₂ -N is denitrified in bottom of FST	• Reduce the aeration rate • Reduce the sludge retention time with high return sludge volume.
Surfacing of gray-black colored sludge	• Sludge retention occurs for long time.	• Increase the return sludge ratio • Increase the excess sludge volume • Cleaning of FST

Problem-solving: Abnormal activated sludge

Condition	Occasions	Countermeasures
Black colored sludge (Accumulation of sulfide)	• Factory wastewater (Industrial wastewater) • Over-retention of Sludge	• Governmental instruction
Many filamentous microorganism occur	• Deposition of sludge in a pipe (It is easy to increase the filamentous microorganism.)	• Removal of deposition of sludge in a pipe

TOR-1: O&M database system

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

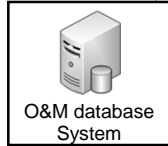
Present recording items (on daily bases)

- Operation data,
- Maintenance log, and
- Water quality data.

Proposed additional recording items

- Building and structural information,
- Material and parts information, and
- Technical document list (including design, drawings, manuals, instructions, warranties and correspondences)

JICA team proposes to consolidate the above data records and utilize for proactive trouble shooting and betterment of O&M work.

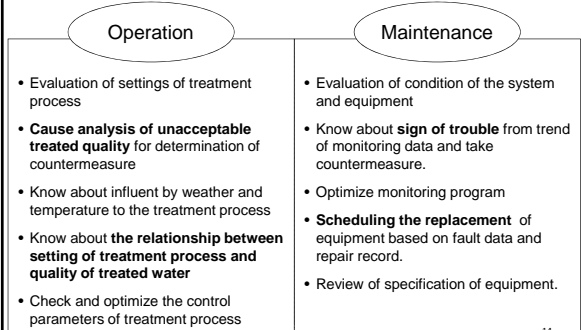


13

TOR-1: O&M database system

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

Advantage of O&M database system



14

TOR-1: O&M database system

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

Installation Procedure

Step	Procedure	Status
1	Paper-based recording	<ul style="list-style-type: none"> Method presently used. JICA study is proposing improvement of the present method with new formats (refer to next sheets)
2	Upgrading the paper-based recording with computerized recording as data-base.	<ul style="list-style-type: none"> Mid-term Goal JICA study will provide the concept for step-2 in the report.
3	Applying internet-base data recording system aiming at the centralized control for plural facilities.	<ul style="list-style-type: none"> Final Goal JICA study will provide the concept for step-2 in the report.

15

TOR-1: O&M database system

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

Get Started by collecting O&M data

Sheet Name	Item List
Equipment	installation location, year, manufacturer, builder, expected lifetime, specification
Construction	Construction year, name, description, equipment, location, contract date, completion date, contractor
Book	Year, title, contractor, description, equipment, storage location, electronic file name
Stock List	Item name, category, equipment, manufacturer, specification, location
Operation	Weather, temperature, flow rate, sludge volume, operating hours of machine, water quality
Maintenance	voltage, current value, insulation resistance, repair year, overview of repair, contractor

16

TOR-1: O&M database system

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

Example of Data Entry Sheet

Equipment List

Equipment name	Facility name	Classification	Style	Installed year	Contractor

Stock List

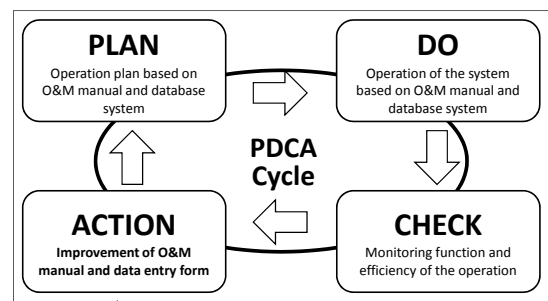
Item Name	Specification	Storage	Unit	Present stock quantity	Minimum stock quantity

Operation data

Day	Weather	Rain mm	Inflow rate		Raw Sewage								
			IPS m ³ /d	PSD m ³ /d	Temp deg-C	Appearance	pH	SS mg/L	COD mg/L	BOD mg/L	T-N mg/L	T-P mg/L	
1	Su												
2	Mo												

TOR-1: PDCA Cycle

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELIX Industry (HELIX), PADECO, YOKOHAMA Water (YW)

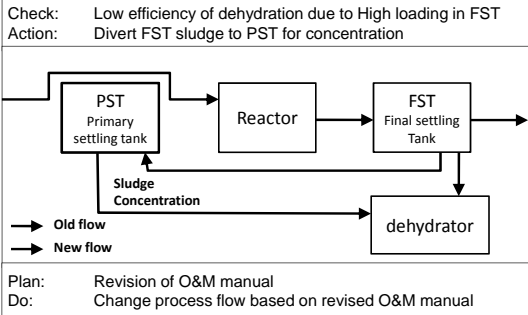


IMPORTANT

18

TOR-1: Example of PDCA Cycle in Van Tri WWTP

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)



19

TOR-3

**New Tariff Plan
Financial Plan**

Comparison of Cost & Revenue
Tariff System
Financial Gap

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

O&M Cost Projection –Direct Cost (M VND/year)

	Yen So	Bay Mau	Yen Xa	Phu Do
Labor Cost	7,776	4,080	7,776	6,240
Utilities	59,674	6,967	80,020	30,026
Chemicals	29,927	2,106	40,422	12,596
Legal Inspection Cost	240	240	105	240
Sludge Disposal Cost	18,135	1,269	24,482	7,616
Repairs	20,075	932	31,991	12,180
Small-scale Replacement	4,189	4,189	4,189	4,189
Cleaning and yard maintenance	178	178	178	178
Site Establishment	2,094	2,094	2,094	2,094
Insurance	569	88	765	301
Total	142,858	22,143	192,022	75,660

- ◆ Major Items of Direct Cost (% in Yen So)
- Utilities 41.8%
 - Chemicals 20.9%
 - Repairs 14.1%
 - Sludge Disposal Cost 12.7%
 - Labor Cost 5.4%

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

O&M Cost Projection - Total

- O&M Cost consists of "Direct Cost", "Provisional Sum for Contingency" and "Overhead".

WWTP	Direct Cost (DC) (M VND/year)	Provisional Sum for Contingency (M VND/year, 5% of DC)	Overhead (M VND/year, 6.5% of DC)	Total (M VND/year)
Yen So	142,858	7,143	9,286	159,286
Bay Mau	22,143	1,107	1,439	24,690
Yen Xa	192,022	9,601	12,481	214,105
Phu Do	75,660	3,783	4,918	84,361

Note : All amounts are average in 15 years.

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

O&M Cost of WWTPs (2012-2026)



TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

Estimation of Average Household Income in Hanoi

$$\frac{\text{(Monthly Income per Capita in 2008)} \times \text{(Average Number of Household)} \times \text{(Price Index Labor 2010 / Price Index Labor 2008)}}{1.443} = \text{Average Household Income 2010} = \text{VND 7.64 M/HH/month}$$

where

- Monthly Income per Capita (Source: Household Living Standards 2008)
Hanoi (Old Hanoi, 2008): VND 1,719.6 thousand
Ha Tay (New Hanoi, 2008): VND 876.4 thousand
- Average Number of Household (Source: Hanoi Statistical Year Book 2009)
3.92 person/HH
- Price Escalation
1.443 (=Price Index Labor 2010 / Price Index Labor 2008)

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Interview Survey

- In order to find the willingness to pay, JICA Team carried out the interview survey in 7 districts concerned to sewerage service in May, 2011.
- Sample number is 105 for domestic and 35 for commercial and industry organization.

[Questions in the interview survey]
✓ Profile of respondents
✓ Awareness of Sewerage
✓ Household monthly expenditure
✓ Willingness to pay for the sewerage
✓ Comfortable payment for sewerage

Please see Handout for reference of TOR and questionnaire sheet of interview survey

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Comparison of Statistical Household Income and Surveyed Household Income

Household Income

● **Statistical Household Income for whole Hanoi = VND7.64 M/HH/month**

● **Surveyed Household Income in 7 Districts**

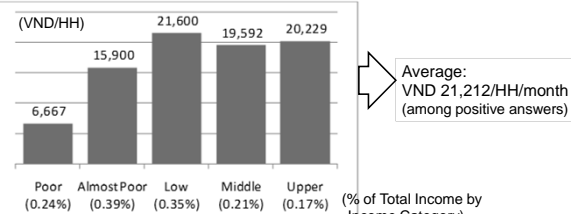
District	Average HH Income (M VND/month)
Ba Dinh	14.10
Dong Da	7.67
Hai Ba Trung	10.33
Hoang Mai	9.40
Thanh Tri	7.63
Tu Liem	5.97
Dong Anh	4.83
Total	8.56

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Willingness to Pay for Sewerage

Total answer: 105, (Positive to Pay: 99, Negative to Pay: 6)



[Income Category]	(Average Monthly HH Income)
Upper (11%) : > VND 4M person/month	VND 11.9M in Ave.
Middle (34%) : VND 2M-4M person/month	VND 9.3M in Ave.
Low (40%) : VND 1M-2M person/month	VND 6.2M in Ave.
Almost Poor (10%) : VND 0.75M-1M person/month	VND 4.1M in Ave.
Poor (5%) : VND 0.55M-0.75M person/month	VND 2.8M in Ave.

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

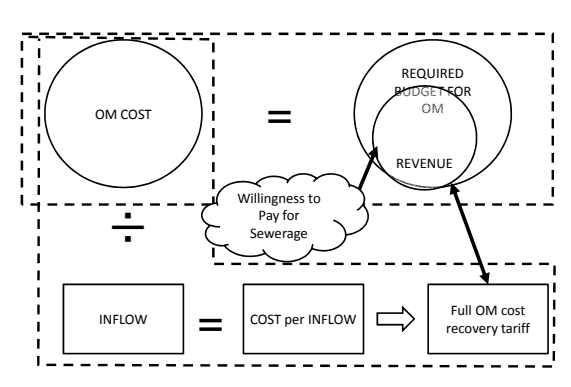
Water Consumption and Rate in 2010

(Source: HAWACO and VIWACO)

Category	Number of Connection	Unit Price (VND/m ³)	Consumption (m ³)		Annual Turnover (M VND)		Water Rate :F/D (VND/m ³)
			D	E	F	G	
Households	488,106	4,000-9,400	106,548,468	75%	472,694	60%	4,436
Commercial organizations	6,947	12,000	15,658,277	25%	187,899	40%	8,769
Industrial and manufacturing organizations		7,000	6,775,231		49,729		
Administrative organizations		5,700	13,329,814		75,980		

TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)



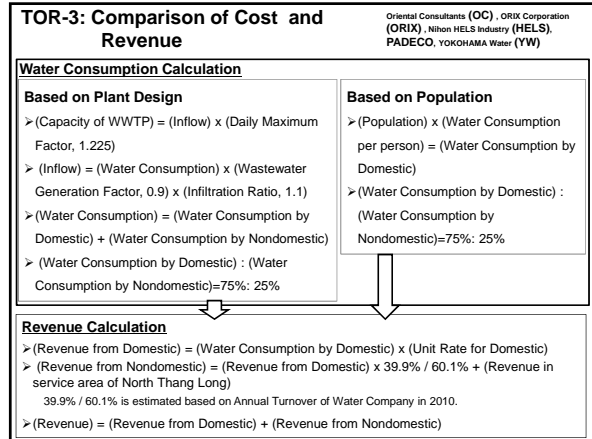
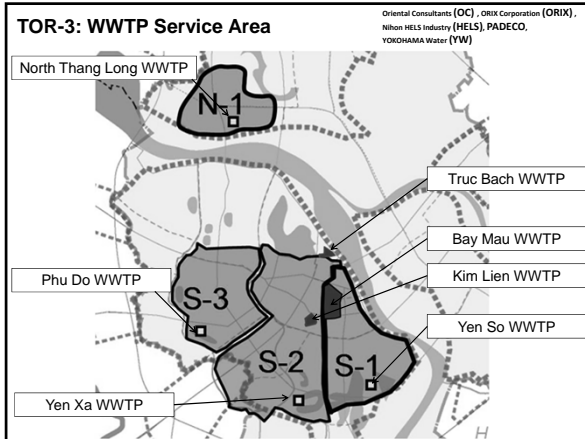
TOR-3: Comparison of Cost and Revenue

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Treatment Plants & Service Area

WWTP	Capacity (m ³ /day)	Basin	Service Area (ha)	Service Pop. 2010	Service Pop. 2020	Sewage 2010 (m ³ /d)	Sewage 2020 (m ³ /d)	Operation Start
1 Truc Bach	2,300	-	39	9,697	9,541	1,953	2,333	
2 Yen So	200,000	S-1	3,006	697,870	711,635	140,779	174,016	2012
3 Bay Mau	14,000							2017
4 Kim Lien	3,700	S-2	4,874	967,418	900,000	195,153	220,077	
5 Yen Xa	270,000							2017
6 Phu Do	84,000							S-3
Total	574,000		10,465	1,965,261	1,955,093	396,445	464,895	

Note:
 > Inflow of North Thang Long WWTP is set 6,500 m³/day from manufacturing organizations, based on current operation.
 > Service population in 2010 is estimated based on statistical data. Sewage is estimated based on water company data. (water consumption: 152L/day/person)
 > Service area and service population in 2020 are estimated based on "Partial Adjustment of Hanoi Drainage Master Plan" (October, 2010). Water consumption is assume to be 190L/day/person.



TOR-3: Comparison of Cost and Revenue

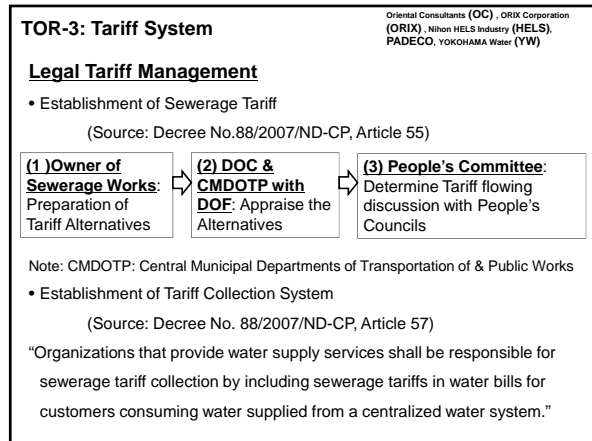
Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Tariff Level Analysis (7 WWTPs in Service)

(Kim Lien, Truc Bach, North Thang Long, Yen So, Bay Mau, Yen Xa, Phu Do)

	Sewerage Tariff Payment, Fee, VAT and EPF at Average Household (% of Average Income)	Financial Gap (Average Cost)-(Revenue) (M VND/year)
A : Current, EPF	VND 6,460/HH/m (0.08%)	A-C= -499,986 A-D= -669,197
B: Acceptable Tariff based on Willingness to Pay	VND 21,212/HH/m (0.28%)	B-C= -344,026 B-D= -513,237
C: Tariff for Full O&M Cost Recovery	VND 53,753/HH/m (0.70%)	C-D= -169,205
D: Tariff for Full O&M and Replacement Cost Recovery	VND 69,758/HH/m (0.91%)	

Note: Revenue is estimated based on plant designs. Water consumption is set 18.19 m³/month at average household.



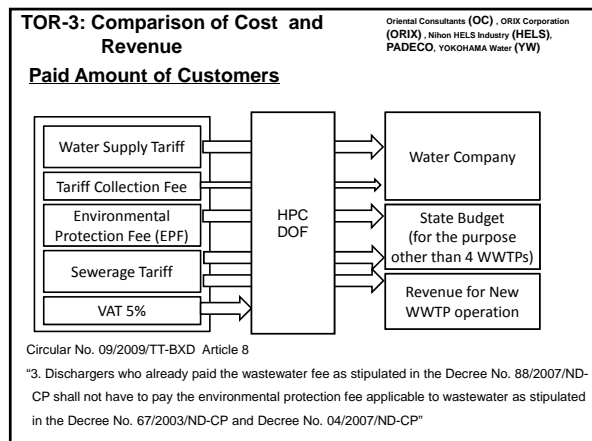
TOR-3: Tariff System

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Tariff Collection System

Option	Collection Rate	Fee for Collection	HSDC Contribution
Option 1 (HSDC)	Low (due to lack of public appreciation to sewerage)	High (collect only sewerage tariff)	High (issue bills and collect tariff)
Option 2 (Water Company)	Middle	Middle (collect sewerage and water tariff)	Low
Option 3 (Public Charge Collection Office)	High	Low (collect several public tariffs)	Low

- Joint Circular No. 125/2003/TTLT-BTC-BTNMT V. Management, Use of the Revenue from EPF "Leave a portion of the total amount of the collected EPF for water supply units to cover the costs of fee collection. The retained percentage is not exceeded 10% of the total obtained EPF for the domestic water."
- Recommendation: Option 2 (Easy to introduce and consideration for legal manner)
- Assumption for Analysis: Water company gains 8% of total sewerage tariff as collection fee.



Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

TOR-3: Tariff System

Tariff Table (2014, Acceptable Tariff based on Willingness to Pay)
[Domestic]

Water Use Level of Household(m ³ /month/HH)	Sewerage Tariff before Tax (VND/m ³)	Water Supply Tariff before Tax and Fee (VND/m ³)
First 16m ³	756	3,478
Above 16m ³ to 20m ³	889	4,087
Above 20m ³ to 35m ³	1,078	4,957
Above 35m ³	1,778	8,174

[Nondomestic]

Usage purpose	Sewerage Tariff before Tax (VND/m ³)	Water Supply Tariff before Tax and Fee (VND/m ³)
Water use for administrative organizations	1,078	4,957
Water use for implementation organizations	1,078	4,957
Water use for public purpose	889	4,087
Water use for manufacture units	1,324	6,087
Water use for business and service units	2,269	10,435

Note: Include collection fee.

Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

TOR-3: Tariff System

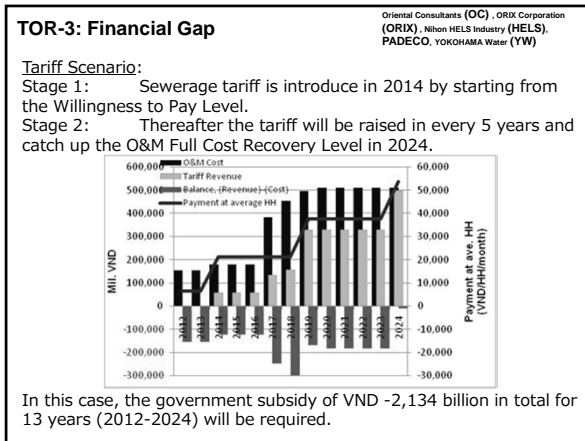
Tariff Table (2024, Tariff for Full O&M Cost Recovery)
[Domestic]

Water Use Level of Household(m ³ /month/HH)	Sewerage Tariff before Tax (VND/m ³)	Water Supply Tariff before Tax and Fee (VND/m ³)
First 16m ³	2,425	3,478
Above 16m ³ to 20m ³	2,849	4,087
Above 20m ³ to 35m ³	3,456	4,957
Above 35m ³	5,699	8,174

[Nondomestic]

Usage purpose	Sewerage Tariff before Tax (VND/m ³)	Water Supply Tariff before Tax and Fee (VND/m ³)
Water use for administrative organizations	3,456	4,957
Water use for implementation organizations	3,456	4,957
Water use for public purpose	2,849	4,087
Water use for manufacture units	4,244	6,087
Water use for business and service units	7,275	10,435

Note: Include collection fee.

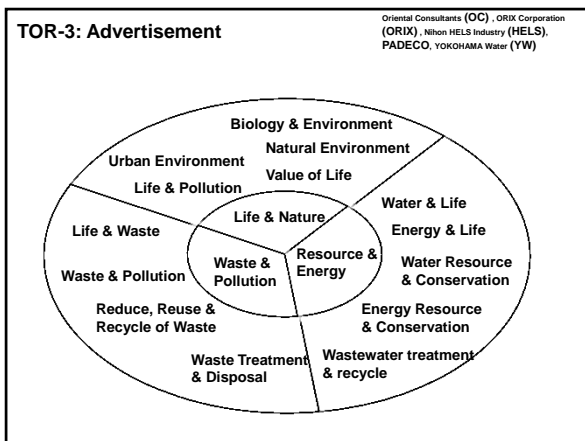


Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)

TOR-3: Advertisement

Sewerage service is a silent force behind the scene of living. Hence the people are not aware of value of sewerage. Lack of awareness makes introduction of sewerage tariff and PPP promotion been slow down. To avoid it, strategies of public awareness development are;

- Environmental education to school children for teaching importance of sewerage as a part of discipline.
- Sewerage service promotion through the media such as TV, radio and internet.
- HPC's public consensus meeting to make residents' understanding of sewerage tariff.
- Sewerage customer service counter is established in HPC website for inquiry and complain.



- Oriental Consultants (OC), ORIX Corporation
(ORIX), Nihon HELS Industry (HELS),
PADECO, YOKOHAMA Water (YW)
- ### TOR-3: Summary
- Hanoi needs the sewerage tariff to cover increasing O&M cost of sewerage facilities due to construction of new WWTPs.
 - As the result of willingness to pay survey does not meet O&M cost, it is required to make up the budgetary shortage somehow. (i.e. governmental subsidy)
 - In order to accommodate the operation of Yen So WWTP, preparations of tariff introduction should be conducted in 2012 and 2013.
 - Public understanding for sewerage shall be improved by continuous advertisement activities.

TOR-3: Summary

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

5. Considering current social opinion, it is recommended that the tariff starts from willingness to pay level, and then catches up full O&M cost recovery level within 10 years.
6. Government shall support the O&M cost for Yen So WWTP with amount of VND 120 bil. per year in the early stage.
7. Financial source of large scale equipment replacement (relating to equipment life time) shall be discussed.
8. Weak point of this scenario is that the tariff level is not enough for Yen Xa operation when it will start.

TOR-2

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

TOR-2: IOMS

1. Introduction of IOMS
 - a. Comparison of Conventional O&M vs. IOMS
 - b. On-going IOMS in Japan & Thailand
 - c. Cost merit analysis
 - d. Terms of IOMS contract
 - e. Scope of work in IOMS contract
 - f. Performance Indicators
2. Implementation of IOMS
 - a. Organizational plan
 - b. Financial plan
 - c. Analysis for modification of legal system for the proposed IOMS by JC

TOR-2: Comparison of Conventional O&M vs IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

	Conventional O&M	Integrated O&M
Basis of Contract	<ul style="list-style-type: none"> • Fixed Scope of Work • Annually updated Cost-plus-profits-contract (Unit price base) 	<ul style="list-style-type: none"> • Performance Benchmarks (mainly treatment quality) & Delivery conditions at the end contract. • Multi-year Lump-sum contract
Criteria of contractor's performance	<ul style="list-style-type: none"> • The contractor shall comply with Performance Indicator bound in the contract. 	<ul style="list-style-type: none"> • The contractor shall comply with Performance Indicator bound in the contract.
Repair & Replacement	<ul style="list-style-type: none"> • Budget of repair and replacement of equipment is accounted as a Provisional-Sum. 	<ul style="list-style-type: none"> • Repair budget is either included in Lump-Sum amount or accounted as a Provisional-Sum. • Replacement budget is accounted as a Provisional-Sum.

TOR-2: On-going IOMS in Japan

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Contract Level	Period	Cost components
Conventional	Single year	Process cost (measurement base)
IOMS level-1	Short term multi year	Process + utility cost (Lump sum)
IOMS level-2		Process + utility cost (Lump sum) + Small replacement
IOMS level-3		Process + utility cost (Lump sum) + Medium replacement
IOMS full scale	Long term multi year	Process + utility cost (Lump sum) + Large replacement

Number of IOMS project in 2011		Statistic, Contract Period (as of 2011)	
Level-1	29 projects	1 year	32 projects
Level-2	MAJORITY → 201 projects	3 years	MAJORITY → 182 projects
Level-3	21 projects	4 years	14 projects
Total	251 projects	5 years	14 projects
		Over 5 years	1 project
		Total	243 projects

TOR-2: On-going IOMS in Japan

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service
Hanamigawa WWTP no.2, Chiba, Japan,
 3-year contract



Project started in 2007

Plant feature	Capacity 576,000m3/day Conventional activated sludge treatment Sludge incinerator 150 ton/day Treated Sewage Effluent (TSE) Tertiary Treatment Photovoltaic power generation (1828 KWh)
Scope of work	<ol style="list-style-type: none"> 1) O&M of sewage treatment, sludge treatment, TSE transmission 2) Environmental monitoring & protection 3) Ancillary facility maintenance 4) Replacement of equipment (less than JPY 2,500,000 per item) 5) Procurement of consumables

TOR-2: Japanese IOMS cases

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service, **Hanamigawa WWTP no.2**, Chiba, Japan

3-year operation outcome (2007-2009)


- i. Total O&M costs decreased 14%.
- ii. Electricity consumption had been saved 7%.
- iii. Equipment malfunction and system failure decreased 12% (52 to 46 per year)

Costs Comparison before & after project in 3 years, unit million JPY

Item	3-year costs before project	3-year costs during project	Improvements
Remuneration	231	138	▼ 93 or -14%
Direct costs incl. Utilities	3,548	2,886	▼ 662 or -19%
Small replacement (<JPY250K)	72	52	▼ 20 or -28%
Large replacement (>JPY250K)	954	1,049	△ 95 or +10%
Others	114	118	△ 4 or +4%
total	4,919	4,243	▼ 676 or -14%

TOR-2: Japanese IOMS cases Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service Amagasaki East WWTP, Hyogo, Japan 5-year contract

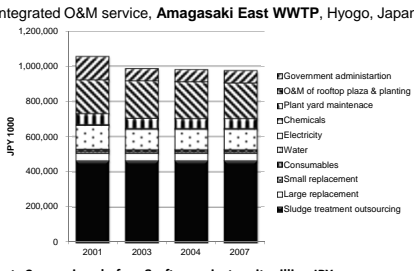


Project started in 2003

Plant feature	Capacity 134,000m ³ /day for sewage Conventional activated sludge treatment Relay Pumping S-1 139m ³ /min(S) + 1971m ³ /min(R) Relay Pumping S-2 1745m ³ /min(R) Sludge transmission pumping station
Scope of work	(1) O&M of Sewage treatment (2) Environmental monitoring (3) O&M of relay pumping stations (4) Inspection and maintenance of plant utilities (5) Procurement of consumables and utilities (6) Equipment replacement (> JPY 1M) (7) O&M of rooftop plaza, planting zone

TOR-2: Japanese IOMS cases Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service, Amagasaki East WWTP, Hyogo, Japan



Costs Comparison before & after project, unit million JPY


	2001	2003	2004	2007
Sludge treatment outsourcing	465.6	465.6	465.6	465.6
Large replacement	42.1	42.1	42.1	42.1
Government administration	132.4	70.1	70.1	70.1
IOMS fee	417.8	411.9	406.5	400.4
Total	1,057.9	989.7	984.2	978.1
Improvement	100%	94%	93%	92%

TOR-2: On-going IOMS in Japan Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Item	Shiwa (Iwate)	Hamakurosaki (Toyama)	Arakawa (Saitama)	Nagata (Shizuoka)	Takehara (Hiroshima)	Matsuyama (Ehime)
Period	3 year	3 year	3 year	3 year	3 year	3 year
Type	Combined	Separated	Separated	Separated	Separated	Combined
Contract level	2	2	2	2	1	2
Replacement Max at one time	USD 10,000	Not available	USD 5,000	USD 5,000	0	USD 5,000
Process	C.A.S	C.A.S	O.D	C.A.S	S.A.S	C.A.S
Design capacity (m ³ /d)	9,200	178,500	38,700	17,000	Not available	151,000
PI - BOD	13 mg/L	5.6 mg/L	Not available	Not available	5 mg/L	4.3 mg/L
COD	Not available	8.9 mg/L	Not available	Not available	10 mg/L	7.2 mg/L
SS	20 mg/L	5.3 mg/L	Not available	Not available	5 mg/L	2 mg/L
T-N	None	None	Not available	Not available	10 mg/L	13 mg/L
T-P	None	None	Not available	Not available	1 mg/L	0.48 mg/L
Coliform G	80 MPU/mL	7 MPU/mL	Not available	Not available	Nil	Nil

TOR-2: On going IOMS in Thailand Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Integrated O&M service Nong Khaem WWTP, Bangkok, Thailand 5-year contract



Project started in 2003

Plant feature	Capacity 157,000m ³ /day in Nong Khaem WWTP Vertical loop reactor activated sludge Sludge transmission pumping station
Scope of work	(1) O&M of Sewage treatment (2) O&M of Sludge treatment (dehydrate) (3) Environmental monitoring (4) Inspection and maintenance of plant utilities (5) Procurement of consumables and utilities
P.I	SS, BOD, COD, T-N, T-P, Coliform group, F.Coli & E.Coli
Payment	Payment = Kfix + Kq(Q) + KB + Ksludge where, fix = fixed rate, Q = inflow rate, B = storm water bypass flow and Sludge = sludge volume

TOR-2: Features & Merits of IOMS Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Introduction of IOMS Summary

- Features of IOMS
 1. Multi-year contract
 2. Performance based payment (Lump-sum)
- Merits of IOMS
 1. Reduction of the life cycle O&M costs
→ 8-12% cost reduction is expected based the Japanese experience.
 2. Level up of the O&M skills taking certain level the risks

TOR-2: New PFI Law & IOMS Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

- ◆ Acknowledgment for IOMS so far
IOMS has been enough verified to be worth for cost reduction in trial stage as shown in previous sheets.
- ◆ New PFI Law effectuated in 2011
New PFI Law is almost same as EU standard and encourages to have long term contract for operation.

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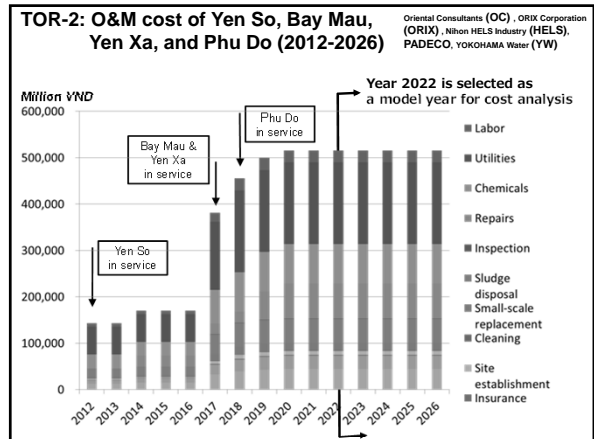
Japan just started full scale IOMS under new PFI law.

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: IOMS for Hanoi

- ◆ Our Result will be carried over to Yen Xa JC is supposed to be established to implement full scale IOMS under the PPP contract b/w SPC and HPC.
- ◆ To maximize Benefit of IMOS for Hanoi Meantime, IOMS can be usually applied to operation itself after the construction.

The following calculation is the impact of IOMS for new 4 STPs.



Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: Cost merit analysis

◆ Breakdown of Direct Costs in 2022

◆ Potential Reduction of Direct costs, such as

- Utilities
- Chemicals
- Repairs

According to Japan's experience, 8-12% of such direct costs might be reduced by introducing IOMS.

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: Cost merit analysis

Comparison of Direct Costs between Conventional O&M contract vs. IOMS in Year 2022 under 4 new WWTPs in service.

Items	Conventional Contract	IOMS Contract	Reduction (%)
	million VND	million VND	
Utilities	176,687	159,018	10.0%
Chemicals	85,051	76,546	10.0%
Repairs	75,205	67,684	10.0%
Sludge disposal	51,504	51,504	0.0%
Small-scale replacement	16,755	16,755	0.0%
Labor	25,872	12,240	0.0%
Others	11,657	11,529	1.1%
Total Direct Cost	442,730	408,908	7.6%

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: Cost merit analysis

◆ Result of the analysis

Based on the costs analysis referring to the Japanese experience, the IOMS can reduce 7.6% of the direct cost comparing with the conventional O&M contract.

It is, therefore, that IOMS is worth introducing.

Oriental Consultants (OC), ORIX Corporation (ORIX),
Nihon HELS Industry (HELS), PADECO,
YOKOHAMA Water (YW)

TOR-2: IOMS Contract Terms

Key Clause	Description
Project Owner & Contractor	Owner: HPC Contractor: Joint Company
Contractor's Obligation	The Contractor shall provide the IOMS stipulated by the IOMS contract. (refer to the next slide)
Payment	<ul style="list-style-type: none"> • The owner shall confirm a conformity of the contractor's performance in collation with the performance indicators. • Unconformable work of the contractor will cause the reduction of the payment to the contractor.
Contractor's possession of site and duty to reserve function	<ul style="list-style-type: none"> • The owner shall grant the right to use the sewerage facility to the contractor for the purpose of contractor's obligation. • The contractor shall reserve the function of facility and compensate the damage or losses caused by the contractor.

TOR-2: IOMS Scope of Work

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

General	<ul style="list-style-type: none"> a. Staff management and Material Control for O&M b. Reporting of results of O&M work to the regulator c. Customer technical service
Technical	<ul style="list-style-type: none"> a. O&M in wastewater treatment and sludge treatment/disposal in compliance with Performance Indicator (PI) b. Repair work of facilities c. Small scale replacement of equipment d. Technical transfer through O&M PDCA cycle
Option	<ul style="list-style-type: none"> a. Promotion of sewerage service b. Engineering service to other cities c. Staff Training to other cities

TOR-2: Performance Indicators

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

QCVN24:2009, column B

Item	Legal Effluent Quality	Proposed Effluent Quality
BOD5 (mg/L)	50	40
COD (mg/L)	100	80
SS (mg/L)	100	80
Nitrogen (mg/L)	30	24
Phosphorus (mg/L)	6	5

- 5 out of 36 items in QCVN24:2009 shall be used as Performance Indicators after the construction in 2009.
- These items shall be checked and reported to the regulator weekly.

TOR-2: Performance Indicators

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ How to use the Performance Indicators

The contractor reports the results of the wastewater treatment in accordance with PI.



The regulator verifies and reports the conformity of the contractor's performance to HPC



If the performance is not conformed with PI, HPC reduces the payment to the contractor.

TOR-2: Contractor's Risk

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ Contractor's Major Risk

- Third-party Liability
 - Complaints from Residents
 - Changes of Regulations
 - Fluctuation of Influent Volume
 - Increase of repair expense due to sudden failure
 - Price Escalation
 - Tariff Collection
- Critical matters for the IOMS Contractor
-

TOR-2: Contractor's Risk

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ Price Escalation Risk

Issues	Rescues
Price escalation impacts on Utilities, Chemicals, Repairs, Overhead, Labor Cost.	Price adjustment clause against unprojected price escalation is needed to stipulate in the IOMS contract. The IOMS contract period shall be set at the period within a predictable range of price escalation.
10% price escalation causes 8-9% of O&M cost increase.	
O&M cost in the contract is used to be a lump-sum.	

TOR-2: Contractor's Risk

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ Tariff Collecting Risk

Issues	Rescues
Non-revenue sewage would be occurred 1) due to the lack of user's appreciation for sewerage . 2) due to the additional burden of households' economy.	Contractor will not be incurred financial loss due to non-revenue sewage risk. One water bill for water supply and sewerage is recommendable.
It is difficult for contractor to directly request households to pay for non-revenue sewage.	

TOR-2: Service fees

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ **Formula of Services fees (Payment form the Owner to the Contractor)**

Services fees= Variable Expenses(A) + Fixed Expenses(B)

(A) Variable Expenses	= Basic unit x Volume of treated water (Electricity and chemical consumptions relating to treatment process are the majority of variable expenses.)
(B) Fixed Expenses	= Costs other than A

TOR-2: Service fees

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ **Services Fee Calculation**

Items	Type
Labor	Fixed
Chemicals	Variable
Fuel	Variable
Electricity	Variable
Consumables	Fixed
Repair	Fixed
Other expenses	Fixed
Overhead	Fixed

Calculation 1
 $\alpha = \text{Variable expenses basic unit} = \frac{\text{Total variable expenses}}{\text{Design flow}}$

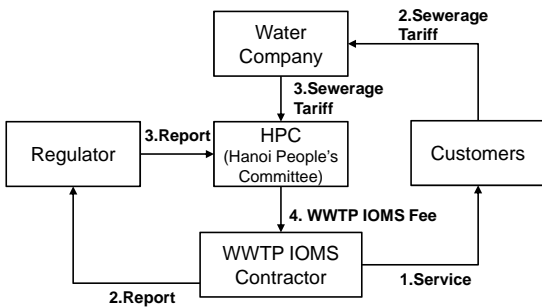
Calculation 2
 $\beta = \text{Monthly fixed expenses}$

Calculation 3
 $\text{Monthly Service Fee} = \alpha \times (\text{Actual inflow volume}) + \beta$

TOR-2: Organizational plan of IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

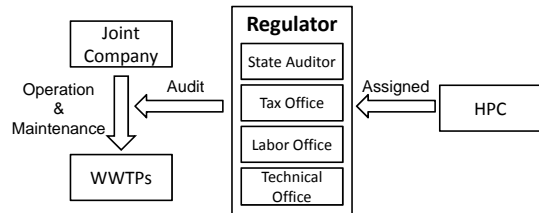
◆ **Implementation framework of WWTP IOMS**



TOR-2: Organizational plan of IOMS

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ **Framework of Regulator**



- ✓ **Objective:** Supervision of O&M quality in accordance with Performance Indicators.
- ✓ **Members:** State auditor, tax office, DOC, and Independent Party, etc.

TOR-2: Organizational Plan of JC

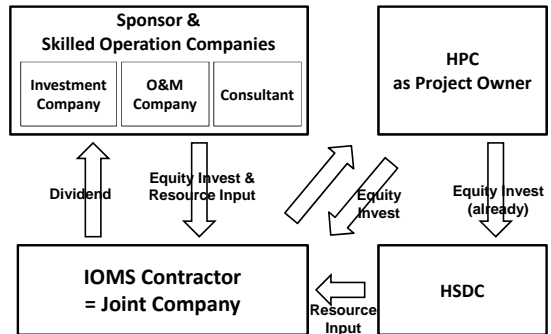
Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

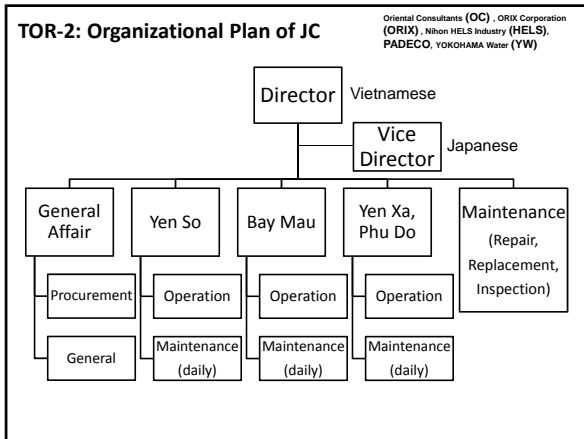
- Option 1: HSDC to undertake the IOMS
- Option 2: Joint Company established by HPC and Private firm to undertake the IOMS
- Option 3: A Private firm to undertake the IOMS

	Option 1	Option 2	Option 3
Capacity to undertake IOMS	Need time for new experience	Enough capacity	Enough capacity
Cost saving opportunity	Less because lack of experience	Promising	High cost due to Foreign company
Comfort for HPC	Comfort	Comfort	Uncomfortable to ignore HSDC
Compliance of laws and regulations	Complied	Need to study	Complied
Evaluation	Need enough time for experience and support from outside	HSDC's locality and Private firm's skill make synergy. Recommendable	HSDC's 5 year experience cannot contribute in this option.

TOR-2: Organizational Plan of JC

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)





TOR-2: Financial Plan of Joint Company

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

◆ Conventional vs. IOMS by JC (as at 2022)

Items	Conventional(A)		Joint Company(B)		Difference (B-A)	
	million VND	%	million VND	%	million VND	%
Direct Cost	442,730	89.7%	408,901	82.8%	-33,829	-7.6%
Utilities	176,687	35.8%	159,018	32.2%	-17,669	-10.0%
Chemicals	85,051	17.2%	76,546	15.5%	-8,505	-10.0%
Repairs	75,205	15.2%	67,684	13.7%	-7,520	-10.0%
Sludge disposal	51,504	10.4%	51,504	10.4%	0	0.0%
Small-scale replacement	16,755	3.4%	16,755	3.4%	0	0.0%
Labor	25,872	5.2%	25,872	5.2%	0	0.0%
Site establishment	8,378	1.7%	8,378	1.7%	0	0.0%
Other Expenses	3,279	0.7%	3,144	0.6%	-135	-4.1%
Overhead	28,777	5.8%	26,579	5.4%	-2,199	-7.6%
Provisional sum	22,137	4.5%	20,445	4.1%	-1,691	-7.6%
Profit	0	0.0%	20,445	4.1%	20,445	4.1%
Total	493,644	100.0%	476,370	96.5%	-17,274	-3.5%

Even the JC ensures a certain profit (5% of Direct Cost), HPC can reduce 3.5% of O&M cost.

TOR-2: Analysis for modification of legal system for IOMS by JC

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

	Circular 09/2009/TT-BXD ANNEX1	Hanoi Model (This Study)	Compliance
Duration	5 to 10 years	3-25 Years	To be Discussed
Scope	Drainage Sewerage Disposal of Sludge Asset Management, etc	Yen So STP Bay Mau STP Yen Xa STP Other STPs	Complied
Contract Type	Lump-Sum, or Unit price	Lump-Sum	Complied
Repair & Replacement cost	Partly included	Japanese Level 2,3 or full scale IMOS are recommended	Under Consideration
Regulating Body	Drainage/Sewerage system owner	Not Appointed	To be Discussed

TOR-2: Analysis for modification of legal system for IOMS by JC

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

<Decision 71: Issues>

- Article 2: Interpretation
Clause 4: The state participation portion is neither the contributed equity capital in the project enterprise nor ...
- Article 9: State participation portion
Clause 2: The total state participation portion must not exceed 30% of the total investment level of a project, except other cases decided by the Prime Minister.

JICA team's understanding and proposal

⇒ Decision 71 stipulates that the ceiling of the state participation portion at 30% of the total investment. It may cause a shortage of OM budget when the sewerage tariff level does not meets total OM costs.

⇒ Decision 71 does not stipulate the private sector's equity capital for the O&M contract case. We propose Joint Company's equity proportion is Vietnam: Japan = 50:50.

TOR-2: Conclusion

Oriental Consultants (OC), ORIX Corporation (ORIX), Nihon HELS Industry (HELS), PADECO, YOKOHAMA Water (YW)

Establishment of Joint Company - Summary

- ◆ Applying IOMS can be expected 7.6% reduction of WWTP O&M direct cost comparing with the conventional contract.
- ◆ HPC and Joint Company can share the profit of O&M cost reduction according to the capital share.

↓

It is, therefore, recommendable to establish Joint Company to introduce IOMS.

**Thank you very much
for your attention!**