Environmental Financing Strategies: User Charges in the Wastewater Sector in Thailand[*1]

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Background

There are 87 wastewater treatment plants (WWTP) in 76 provinces of Thailand. All of them are built and funded by government agencies: 22 plants by Ministry of Science and Technology, 50 plants by Civil Department, 7 plants by Bangkok Metropolitan Administration, and 8 plants by other agencies. User pay principle was introduced as an alternative for funding wastewater treatment operation and maintenance and in turn increasing WWTP numbers in which result in clean water availability for poor. The study of charging user fee using polluter pay principle by Pollution Control Department and Wastewater Management Authority based on cost recovery accomplished in 2000. The concept is new to Thai and not yet widely applied. Currently there are four municipalities utilizing this tool and a few more are working toward the idea. Central government supports local government by financing the facility construction. Enforcement is through local government according to the Decentralization Act and the Enhancement and Conservation of the National Environmental Quality Act of 1992. Integrated water management practice result in merging of irrigation department and wastewater management. The government is also encouraging private company involvement. Private company may either be an operator or a provider (Appendix I)

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User Charge Study

1. Pollution Control Department (PCD)

1.1 Strengthening National Financing and Cost Recovery Policies for the Wastewater Management Sector

User fee is evaluated according to the "Strengthening National Financing and Cost Recovery Policies for the Wastewater Management Sector" project with financial assistance of Asian Development Bank. The model (Appendix II) was constructed for the purpose of:

1. Different fees for different users. Must reflect cost of WWTP construction, operation, and personals.
2. Fee is substantial for continuing effective operation.
3. Fee is affordable for all users.
4. WWT operation is simple and manageable by local authority.

The user is divided into three groups; (1) household and others, (2) state agency, state enterprise, and small enterprise, and (3) industry and big enterprise. There are three options of cost recovering in collecting fee that can be applied starting in 2001; (1) no subsidy by municipality, (2) 50% subsidy by municipality in the first 4 years, and (3) 50% subsidy by municipality in the first 4 years and refund in the next 7 years.

The study concluded that without municipality subsidy the average of user fee in Sriracha, Pichit, and Sakonakorn Municipalitites are 6.83, 5.62, and 3.45 baht/m^3 water used, respectively (Appendix IV). The third user group has highest fee, the second group has middle fee, and the first group has lowest fee. Different fees for different user groups are likely to be more successful as the third group has higher potential to afford higher fee than the first group.

1.2 Pattaya Municipal Wastewater Treatment System

The model used the same principles as the 1.1 model that divided users into 3 groups. The fee was calculated to cover cost of operating wastewater collection system and treatment, sewer line expansion, and returning the Environmental Fund. Fist calculation was based on the assumption that there is no outside financial support. The fees for first, second, and third group are 3.00,4.25, and 5.50 baht/m^3 water used, respectively. However, Pattaya Municipality decided to recalculate the fee without considering sewer line expansion and the Environmental Fund. Using new calculation, the fees in the first year (2001) for first, second, and third group are 2.50, 3.00, and 3.50 baht/m^3 water used.

2. Wastewater Management Authority (WMA)

2.1 Sansuk Municipality, Chonburi Province

Sansuk Municipality has implemented a fee levying system with the assistance of WMA. After completion of construction facilities, there was no budget for equipment operation and maintenance. The WMA obtained the budget from the central government funds to manage and to operate the facilities. There are 3 categories of WWT fees.

- User fee : monthly fee based on wastewater produced
- Connection fee : annual fee 0.65 baht/volume of wastewater produced
- Additional connection fee : case by case cost

Monthly user fee was calculated based on dirtiness of wastewater produced (BOD), volume of wastewater, and size of residence. The flat fee was calculated by this equation:

$$\text{Cost of treatment per unit} = \frac{\text{(cost of operation in 20 years)}}{\text{(volume of wastewater enter the system in 20 years)}}$$

The results divided the user into 7 groups as shown in Table 1.

Table 1. Wastewater Fees in Sansuk Municipality

Group	BOD (mg/L)	User Fee (baht/m3 of wastewater)
1. Household	(Wastewater ≤20 m3/month)	2.00
2. Building	≤200	3.00-3.50
3. Building	>200 but ≤500	4.50
4. Industry	≤200	3.00-3.50
5. Industry	>200 but ≤500	4.50
6. Others (not in 1-5)	≤200	3.50
7. Others (not in 1-4)	>200 but ≤500	4.50

2.2 Wastewater Treatment Project on the North Side Phase I (Kukot-Prachatipat)

User Fee = Operation cost at break even point + management

The service fee calculated for Kukot-Prachatipat Municipality based on the actual cost of plant operation. Operation costs at break even point for the project included operation and maintenance, plant construction, and land acquisition. The fee for household and commercial and industrial business in 2004 are 3.50 and 19.00 baht/m^3 water used, respectively. The user fees are scheduled in Table 2.

Table 2 Wastewater treatment plant intake and user fee (5 years interval)

Year	2004	2005	2006	2016	2021	2026
Wastewater volume (m3/day)	21,405	44,312	62,682	76,929	88,834	100,727
Average User Fee For household (baht/m3/day)	3.50	4.20	5.04	6.05	7.26	7.26
Average User Fee For industry (baht/m3/day)	19.00	22.80	27.36	32.83	39.40	39.40

Note: User fee in this table does not include BOD. Dirtiness fee will be charged if BOD ≥ 200 mg/L.

3. Office of Natural Resources and Environmental Policy and Planning (OEPP)

3.1 Evaluation of user charges in local municipality for wastewater treatment and waste management system

There are 14 user groups divided in OEPP study. (1) household (2) apartment, flat, and dormitory (3) state agency, state enterprise, and private company (4) school, university, and college (5) hospital (6) hotel, (7) department store (8) restaurant (9) fresh market (10) nightclub, pub, and bar (11) gas station (12) industrial plant (13) religious and public health center (14) other businesses. The fee calculation based on average cost recovery rate in which depending on user type.

- Pretreated effluent treatment rate considered only cost per unit of sewer and collection system
- Raw WWT rate considered cost per unit of sewer, wastewater collection, and treatment system.

There are 8 scenarios for cost recovery analysis

1. 50% recovery of operation and maintenance cost only
2. 100% recovery of operation and maintenance cost only
3. Total recovery of operation, maintenance, and equipment replacement cost
4. Operation, maintenance, equipment replacement, and construction cost
5. Operation, maintenance, equipment replacement, construction, and land acquisition cost
6. Operation, maintenance, equipment replacement, construction, and land acquisition cost including municipal fund
7. 100% recovery of operation and maintenance cost and 5% recovery of municipal fund used in operation and maintenance
8. 100% recovery of operation and maintenance cost and 10% recovery of municipal fund used in operation and maintenance

The results of raw WWT rate calculation using 2nd scenario of Kumpangpetch, Warinchumrab, Tak, Nan, Chumsang, Maesod, and Prainrach Municipalities are 75.9, 98.4, 33.00, 101.9, 67.3, 86.3, and 236.8 baht/household/month, respectively. The results of 2nd scenario analysis for the year1998 to 2017 are in Appendix III. Prainracha municipality has the highest fee in WWT rate because there is the site limitation in WWTP construction/expansion where only activated sludge can be built. The system therefore has high electricity consumption, operation, and maintenance cost while other sites have sedimentation pond that has no need for mechanical operation.

Real Application/Pilot Projects

1. Sansuk Municipality, Chonburi Province

Sansuk wastewater system is a combined sewer overflow system and 139 km long. There are 2 WWTPs and both are upgraded to meet the new standard according to the Enhancement and Conservation of the National Environmental Quality Act of 1992. WWT system is the oxidation ditch with the capacity of 14,000 m3/day for the north side system and 9,000 m3/day for the south side system. Wastewater Management Authority (WMA) is in charge of managing and funding operation and maintenance, assisting the municipality in future plan for system improvement and water quality management, and collecting user fee. The charges for industry were first categorized into 7 groups based on dirtiness of wastewater (BOD) while household was charged 2 baht/m^3. Initially, the municipality charged 2 baht/m^3 for regular household and 3.50 baht/m^3 for the rest for public encouragement. The user fee was effective in April 2001. However, after less than 2 months, the municipality discover many problems: unfinished database, public familiarization, inconsistent of water usage and census data, and incomplete sewer network. The municipality disrupted fee collection, corrected the problems, and recalculated new user fee to best represent water usage of people. The new user fee is based on 80 percent of monthly water usage. The fees are 2 baht/m^3 for household and 3.50 baht/m^3 for others. Use fee was effective in July 2001.

2. Pattaya City, Chonburi Province

Pattaya City enforced WWT user fee since July 1990. WWT is the activated sludge with the capacity of 65,000 m^3/day. Private company is hired to run the system on annually contract. As Pattaya became a pollution control district, WWT system have to be upgraded to meet new regulation. The project of upgrading WWT facility is financed by the Environmental Fund and the Enhancement and Conservation of the National Environmental Quality Act of 1992. The new user fee is calculated based on water usage and BOD loading. The charges should be 3 baht/m^3 for household, 4.25 baht/m^3 for state agencies, state enterprise and small enterprise, and 5.50 baht/m^3 for industry and big enterprise. However the municipality adjusted the fee to the acceptable rate at 2.50 m^3 for household, 3.00 baht/m^3 for state agencies, state enterprise and small enterprise, and 3.50 baht/m^3 for industry and big enterprise effective 2001. In 2002, Patattaya City is planning a change, based on meter of water consumption as shown in Table 3.

Table 3. Wastewater Charges in Pattaya City

Class of User	Fee	Unit
Hotel	672	baht/room/year
Condominium	360	Baht/room/year
Restaurant	36	Baht/m^3/year
Commercial	6	Baht/m^3/year
Residential	3.6	Baht/m^3/year
Food Industry	40	Kg/product/dry

3. Patong Municipality, Phuket Province
The Decentralization Act is not yet utilized. The project has been using the old Municipality Law to enforce wastewater treatment fee collection since 1992. WWT is the aeration basin with the capacity of 9,000 m^3/day. As a well-known tourist attraction area, only hotels had to pay for user charge. The charge was based on water consumption on the basis of number of room per year. However, the charge was not previously included O&M which central government had to subsidize.

4. Hatyai Municipality, Songkla Province
The municipality used the Enhancement and Conservation of the National Environmental Quality Act of 1992 to enforce wastewater treatment fee collection since 2002. WWT is the stabilization pond with the capacity of 138,000 m3/day. Currently, the municipality is trying to find an appropriate means of the fees.

On-going Projects

1. Bangkok Metropolitan

Bangkok Metropolitan Administration announced on 3rd September this year that starting in March 2004 thirteen districts in will be charged for WWT. The charges are 2 baht/m^3 for household, state agencies and state enterprise, 4 baht/m^3 for hotels, department stores, and hospital, and 8 baht/m^3 for factories. For household, the city will subsidize 1 baht/m^3 for 3 years and raise the charge by 25 satang/m^3 every 6 months up to the full rate. The charge can be waived if the factory have treatment facility that is up to standard. The city had yet decided what to do if people refused to pay.

2. Samutprakarn Municipality

There are 2 wastewater systems serving Samutprakarn Province, combined sewer overflow (CSO) and industrial direct connection (IDC). WWT is the extended aeration activated sludge with the capacity of 525,000 m3/day. Local government will manage O&M and collecting fee. There are 3 user types: household, commercial building, and industrial plant. Cost recovery study calculated user fee based on water usage for household, 80% wastewater generated for commercial building, and dirtiness (BOD) for industrial plant.

User Fee (baht/m^3) = Flat fee (baht/m^3) +
[(dirtiness baht/BOD mg/L .m^3) x BOD mg/L]

The municipality uses cross subsidy by industrial group will pay above recovery cost to subsidize household and commercial group which will pay below recovery cost as shown in Table 4. Therefore, user fees starting in 2006 for household, commercial building, and industrial plant will be 2.00, 4.50, and 12.00 baht/m^3, respectively.

Table 4 Cross Subsidy Factor by user group and year

User Group	2006			2011			2016		
	Initial cost (baht/m^3)	CFS	User fee (baht/m^3)	Initial cost (baht/m^3)	CFS	User fee (baht/m^3)	Initial cost (baht/m^3)	CFS	User fee (baht/m^3)
Household	5.08	0.39	2.00	7.46	0.54	4.00	9.37	0.64	6.00
Commercial building	5.81	0.77	4.50	8.59	0.99	8.50	10.74	1.12	12.00
Industrial plant (average BOD 740 mg/L)	9.09	1.32	12.00	13.62	1.17	16.00	16.84	1.13	19.00
Average	7.21	1.03	7.41	11.11	1.03	11.43	13.74	1.03	14.16

Table5 User Charges by user group and year.

User Group	User Charges (baht/m3)		
	2006	2011	2016
Household	2.00	4.00	6.00
Commercial building	4.50	8.50	12.00
Industrial plant (average BOD 740 mg/L)	12.00	16.00	19.00
Average	7.41	11.43	14.16

User Charge Collection

The following regulations, authorize government agencies and local government organization to collect user charge for operation and maintenance of a central wastewater facilities.

1. The Decentralization Act, B.E 2542 (1999)
   The Decentralization Act (Section 23) allows all municipalities, cities, and TAO (Tambol Administration Organization) to earn income from tax and fee. This can cover the user charge from public service which includes wastewater treatment fees.
2. The Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (1992)
   This regulation has accepted the important principle that an government agency or local administration having operated a central wastewater treatment system by using the state budget or local administration revenue, and the funds under the Environmental Funds under this regulation, may collect a wastewater charge, the rate of which shall be prescribed by the national Environment Board. Exemptions from the payment of wastewater fees are:
   - pollution source owner that already have their own treatment system that is able to treat wastewater according to the standard prescribed by this regulation, and
   - domestic households that can be classified as small-scale users.
3. The Wastewater Management Authority Establishment Royal decree, B.E. 2538 (1995)
   The decree empowers a state enterprise to collect a wastewater fee as a mean of income. But the prescription of the fees must be according to the provision of the Enhancement and Conservation of National Environmental Quality Act, B.E. 2535.

Obstacles of User Charges Application

1. Public Opposition

Public opposes both WWTP construction and user charges. Lack of understanding is the major obstacle. Siting a treatment plant is difficult. Public work experiences NIMBY syndrome as siting a landfill.

2. Lack of Information

There are a few matters that set back/slow down the user fee reinforcement. One of them is lack of information/unfinished data aggregation to correctly calculate user fee such as water usage and census data. Th

3. Funding

There is only federal fund involved in WWTP improvement. Foreign fund given as a loan is available for the state on case by case basis. Foreign aids are in form of research and technology assistant. Numbers of WWTP are in the priority list of Civil Engineering Department but unable to start the construction due to lack of budget.

4. Politics

Enforcement is difficult especially in a lobby situation. Polluters such as industrial sector may refuse to pay and politicians are too afraid to loose votes going against the voters.

Future Consideration

Currently, four municipalities calculate user charges by Polluters Pay Principle (PPP). However, there is an alternative calculation, Beneficial Pay Principle (BPP), where the poor or people outside service area will not be charged. Additionally, water pollution taxes are considered.

Conclusion

Currently, all WWTPs in Thailand own by the government. There are some private company involvement in upgrading, O&M, and managing the facility under the government contract. According to the Enhancement and Conservation of the National Environmental Quality Act, more WWTPs are required to effectively manage wastewater and conserve water resource. User fee is an appropriate mean to achieve that goal. Most studies that have been done categorized users into 3 groups according to water usage and dirtiness (BOD): household, government enterprise and commercial building, and industrial plant. The charges are vary depend on nature of each municipality. In the first phase of practicing the user charge concept, the fees are low (lower than the rate in the cost recovery study due to government/municipality subsidy to encourage the payment. The first group, the household, is charged in the rage of 2-3 baht/m^3 water used. The second and third groups are charged in the range of 3-4 baht/m^3 water used. The third group's charge may be up to 12 baht/m3 water used as this group has a high dirtiness (BOD) factor. Since user charge is a new concept to Thai, many refuse to pay or accept the concept. Both Sansuk and Pattaya Municipality still able to collect the user charge less than 50%. The treatment plants are likely to rely on government/municipality subsidy. The government/municipality should prepare a concrete plan to solve this obstacle.

Appendix I

Private Involvement

Private joint operation of a wastewater treatment system is prescribed in Section 73 and 77 of the Enhancement & Conservation of National Environmental Quality Act. Also the Royal Decree on "Establishing Wastewater Management Authority" (1995) mentions in Section 7 that WMA has the power to establish a limited company or limited public company to operate a wastewater treatment business (Item 9), and to join in business with other work unit, whether private or public (Item 10). Private concern may apply for permission in the next two cases.

1) Wastewater Treatment System Operator Permit
The government constructs the system and lets a private concern receive the permit in order to be the operator of the system by receiving remuneration from the government. However, the act does not have a provision empowering the permit grantee private concern to collect a user charge.

2) Wastewater Treatment System Provider Permit
The government grants permission for a private concern to be employed to provide the whole system of service, which may include the case where a private concern is allowed to be the investor in the construction of a central wastewater treatment system and be himself the operator. In this case, Section 73 has empowered the employed service provider permit grantee to collect a user charge from the service users.

In addition to the above, Section 77 also empowers the local administration to employ wastewater service provider permit grantees.

Siting Criteria

Site selection for wastewater management facilities should exclude the following area:

1) Within the watershed areas Classes 1 and 2 as defined under the Cabinet Resolution (may 28, 1985) in setting up the watershed classification, and
2) Within 1-km of the property boundary of any ancient monuments as defined under the Ancient Monuments, Relics, Antiques & National Museum Act.

In addition, the National Executive Council Announcement No.286 (1972) was issued for land allocation control. The Land Allocation Control Board has power to issue the regulation involving land allocation. The drainage system and wastewater treatment system may be constructed in such land by the applicant for land allocation license under the Regulation Involving Land Allocation (1992).

Appendix II User Charge Formulation by PCD

$$T_n = \frac{[O_n + A_n + K_n]}{[Q_n]} \times \frac{[R_n]}{[C_n]}$$

when T_n = minimal user charge in the nth year (baht/m^3 water used)

O_n = operation and maintenance cost in the nth year (million baht) such as labor, electricity, chemical, sludge removal, nonrenewable maintenance equipment, sampling, water analysis, water usage, safety equipment, etc.

A_n = management cost in the nth year (million baht) including nonrenewable equipments, service such as billing, managing fee collection, telephone, office supply, accountant, permit, etc.

K_n = cost recovery in the nth year (million baht) such as wastewater collection system and treatment system construction, system expansion, system improvement,etc.

Q_n = total volume of wastewater in the nth year (million m3 wastewater in dry season)

R_n = wastewater to water usage ratio

C_n = fee collection efficiency in the nth year; ratio of fee billed to fee collected

Appendix II Total Treatment, Operation, and Maintenance Cost

Year	Total Treatment, Operation, and Maintenance Cost (million baht) by Municipality						
	Kumpangpetch	Varinchumrap	Tak	Nan	Chumsang	**Mesod**	Prainracha
1999	0.00	0.00	4.02	0.00	1.96	0.00	0.00
2000	8.98	0.00	1.26	0.00	2.06	0.00	12.39
2001	9.52	0.00	4.51	11.60	2.17	0.00	13.12
2002	10.09	0.00	4.79	12.23	2.28	13.50	13.88
2003	10.69	9.63	5.08	12.89	2.40	14.35	14.69
2004	14.49	10.14	5.39	13.58	2.52	15.26	15.55
2005	18.33	10.69	5.72	14.31	2.65	16.22	16.46
2006	19.38	11.27	6.07	15.08	2.79	17.24	17.43
2007	20.49	11.88	6.45	15.90	2.93	18.33	18.47
2008	21.66	12.52	6.84	16.76	3.08	19.50	19.54
2009	22.91	13.20	7.28	17.67	3.24	20.76	20.69
2010	24.24	13.92	7.73	18.62	3.41	22.09	21.91
2011	25.64	14.68	8.22	19.63	3.59	23.51	23.21
2012	27.10	15.50	8.72	20.74	3.78	25.02	24.58
2013	28.58	16.30	9.19	21.81	3.97	26.63	26.04
2014	30.13	17.14	9.69	22.93	4.18	28.37	27.60
2015	31.78	18.03	10.22	24.12	4.39	30.23	29.24
2016	33.51	18.96	10.80	25.36	4.61	32.21	31.00
2017	35.34	19.94	11.38	26.67	4.85	34.31	32.87

Note: Operation and maintenance cost at 5% inflation

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Appendix IV User Charges Study for the year 2001by PCD

Municipality	Treatment	Capacity	Status	Cost in 2001 (millIion baht)					Wastewater Volume (million m3) in		Average Fee	User Fee in 2001 (baht/m3) based on Population in	
	System	(m3/day)		O&M	Management	Equipment	Expansion	Total	Service Area	Municipality Area	Collection Efficiency	Service Area	Municipality Area
1. Sriracha	OD	18,000	Running	7.701	1.60	0.40	-	9.701	2.19	2.77	50%	7.09	5.60
2. Pichit	AL	12,000	Running	2.24	0.88	0.10	-	3.22	1.1	1.13	50%	4.71	4.56
3. Sakolnakorn	SP	16,000	running	2.81	1.32	0.30	-	4.43	2.19	2.51	50%	3.24	2.82
4. Pattaya	AS	65,000	running	30.2	0.50	-	10.00	40.7	8.65	9.72	70%	5.36	4.79
5. Sansuk	OD	23,000	running	12.32	3.216	-	-	15.84	5.32	-	50%	4.76	-
6. Kukot-Prachatipat	AS	100,000	Proposing construction in 2002	32.66	-	-	-	32.66	7.81	-	60%	5.56	-
7. Kumpangpetch	SP	16,800	running	9.52	-	-	-	9.52	2.80	3.27	50%	92.55 baht/month	79.19 baht/month
8. Varinchumrap	SP	22,300	constructing	9.63	-	-	-	9.63	3.09	3.34	50%	89.65 baht/month	82.81 baht/month
9. Tak	SP	5,400	running	4.51	-	-	-	4.51	2.44	2.61	50%	53.44 baht/month	49.88 baht/month
10. Nan	SP	8,259	constructing	11.60	-	-	-	11.60	2.62	2.62	50%	120.50 baht/month	120.50 baht/month
11. Chumsang	SP	1,659	running	2.17	-	-	-	2.17	0.46	0.63	50%	113.37 baht/month	82.78 baht/month
12. Maesod	SP	13,200	constructing	13.50	-	-	-	13.50	3.19	4.07	50%	142.19 baht/month	111.45 baht/month
13. Prainracha	AS	4,500	running	4.51	-	-	-	13.12	1.66	1.82	50%	366.70 baht/month	334.26 baht/month