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Understanding Household Demand and Supply of Water: The Metro Manila Case*

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*This issue of the **Policy Notes** highlights the results of a study undertaken to understand the nature of and estimate household demand for water in Metro Manila.*

Widespread water shortages in Metro Manila have made this urban problem a central policy issue. In recent times, various actions from various fronts have been noted. 1A year ago, for instance, President Ramos called a "Water Summit" and directed all concerned agencies to develop short- and medium-term strategies to address the impending water crisis. In Congress, the Water Crisis Act was passed which empowered the President to contract new water supply projects expeditiously, bypassing the usual government bidding procedures. About $7 million is being spent to develop

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an action program to privatize the Metro Manila Waterworks and Sewerage System (MWSS). At the same time, efforts to address the widespread perception of gross inefficiency and graft and corruption at the MWSS led to the replacement of its top officials.

Performance Assessment

The weak performance of the MWSS becomes evident when compared with the public waterworks systems in other ASEAN countries (Table 1). Of the total MWSS service area, only 69 percent is covered by piped water connection, compared to 79 percent covered by the public waterworks in Bangkok, and 100 percent by those in Kuala Lumpur and Singapore. In terms of the number of house connections per capita, the gap between Manila, on the one hand, and Bangkok, Kuala Lumpur and Singapore, on the other hand, is even much wider.

Jakarta has the lowest coverage in terms of percentage of service area and house connections per capita. However, *in terms of efficiency* (i.e., ratio of nonrevenue water, hours of water availability, and number of personnel per 1,000 connection), *Manila has the worst record*. On the average, for example, water is available in Metro Manila for only about 16 hours per day whereas piped water service in Jakarta is available 19 hours a day and 24 hours in other ASEAN cities. MWSS's efficiency and financial performance also greatly suffer from *overmanning* as indicated by the high ratio of staff to the number of connections, six times more than Singapore and Kuala Lumpur and double that of Bangkok.

Nonrevenue Water

The greatest evidence of MWSS's inefficiency is the high ratio of nonrevenue water (NRW) or water that is not accounted for due to illegal connections, leakages, and others. Nearly 60 percent of water produced by MWSS is not billed or is unaccounted for. In contrast, NRW is only 8 percent in Singapore, one of the lowest worldwide, and about 30 percent in Bangkok which is about the average among developing countries.

Efforts to reduce the high rate of NRW have largely failed as annual volume of NRW is seen to have risen by 276 percent since the mid-1960s (World Bank, 1992). In fact, increases in water supply due to the series of major investments of the MWSS over the past 25 years have been almost entirely lost as NRW. A recent project to reduce the high rate of NRW funded by an Asian Development Bank loan was in fact suspended because of MWSS's failure to achieve planned reductions.

Because of MWSS's inability to provide water to nearly 40 percent of its service area, widespread rationing in many parts of Metro Manila, higher charges for industrial and commercial establishments, and private extraction of groundwater resources had grown rapidly. About 80 percent of industrial establishments rely largely on their own tubewells. As early as 1980, groundwater was reported to

Table 1
Coverage and Measures of Efficiency of Service of Public Waterworks Systems in the Main Cities of ASEAN Countries, 1990

	Area (km^2)	*Coverage Area (%)*	*House connections (000)*	*Non-revenue water (%)*	*Water availability (hrs/day)*	*Staff per 1000 connections*
Manila*	1488	69	618	58	16	12.8
Bangkok	710	79	768	31	24	5.5
Jakarta*	286	25	243	57	19	10.2
Kuala Lumpur	180	100	105	37	24	1.8
Singapore	633	100	728	8	24	2.4

* With significant private water vending; other cities do not have any significant water vending.

Source: Asian Development Bank. *Water Utilities Data Book*. Manila, 1993.

have accounted for about 40 percent of water supply. That rate is expected to be currently higher. With the unregulated and essentially free use of groundwater, extraction rate greatly exceeds the natural recharge, lowering the groundwater table and causing the progressive salinization of the aquifer, particularly in coastal areas (Monasinghe 1990; JICA 1992; Liongson et al. 1993; and Roca 1993).

Need for Empirical Analyses

While the government has taken concrete steps to address the urban water issues, designing the appropriate policy, institutional framework, and action programs is hampered by limited empirical analyses. These analyses are necessary in resolving issues on the appropriate water pricing policies of public waterworks, pricing and regulation of groundwater extraction, water demand management or water conservation, provision of water in squatter areas, private water vending, and so forth.

Most studies on urban water issues have been feasibility studies undertaken in preparation for water supply construction loans from multilateral/bilateral agencies. And while there have been some household-level demand studies, these were usually conducted in relation to health, nutrition, poverty, and urban studies. All were descriptive and most of them simply documented the sources of water supply. A number of studies focusing on willingness to pay for water and sewerage have also been conducted but these were mostly outside of Metro Manila. Efforts to quantify the rate of over-extraction of groundwater resources in Metro Manila have not yet led to definitive estimates of their economic cost.

A key policy question in designing urban water policy and institutional reforms is: ***What should be the appropriate structure of water use charges to ensure long-term sustainability of water supply? And since water pricing is politically sensitive, the equity issue and consumers' willingness to pay are also equally important concerns.*** Moreover, even with a privately managed MWSS, the government will have to regulate water tariffs because of the natural monopoly nature of water production and distribution.

To determine optimal pricing policies, estimates of demand and supply functions for water are required. This paper is therefore part of a project to understand the nature of household demand for water, including the estimation of household demand functions for water. It aims to characterize the household sources of water supply, quality of water service, cost of water, and levels of water demand in relation to household income. From there, the study draws some policy implications.

The Study

The study is based on a survey of 506 households conducted in Metro Manila in mid-1995. The survey covered 95 barangays in 11 major cities and municipalities. Table 2 lists the number of households interviewed for each sample by barangay.

The selected barangays are representative of the different types of water sources (e.g., MWSS, private waterworks, individual tubewells, and private water vending), the quality of service (e.g., water pressure and time availability), and the various household income levels (i.e., low, middle and high incomes) within each municipality.

Table 2
Location and Number of Households, Household Demand Survey for Water in Metro Manila, 1995

Cities/Municipalities	*Number of Barangays*	*Number of Households*
Manila City	20	87
Quezon City	23	142
Makati City	13	59
Pasig City	10	72
Caloocan City	11	88
Parañaque	4	30
Mandaluyong	5	10
Pasay City	4	7
Las Piñas	2	6
Cainta	2	2
Taguig	1	3
Total	**95**	**506**

Characteristics of Water Supply and Demand

Sources of water

To cope with the limited supply of MWSS water, the general public resorted to a number of coping mechanisms. These include capital in-

Table 3
Distribution of Households in the National Capital Region (NCR) by Source of Water, 1990[a]

	No. of Sample (000)	MWSS/CWS[c] Own (%)	MWSS/CWS[c] Shared (%)	Piped deep well[d] Own (%)	Piped deep well[d] Shared (%)	Vendors[e] (%)	Others[f] (%)
NCR[b]	1570	55	28	4	7	5	1
Kalookan	151	48	28	6	14	1	3
Manila	309	64	31	1	1	3	0
Pasay	74	52	36	2	2	7	3
Quezon City	332	59	25	4	9	2	1
Las Piñas	58	40	20	15	15	7	3
Makati	89	62	28	2	2	5	1
Malabon	58	54	35	1	3	5	2
Mandaluyong	50	63	33	2	1	1	0
Marikina	60	65	23	4	5	2	1
Muntinlupa	54	39	21	16	20	1	3
Navotas	39	45	36	1	2	15	1
Parañaque	61	49	23	7	8	11	2
Pasig	78	59	30	2	2	7	0
Pateros	10	50	29	2	1	18	0
San Juan	24	78	21	1	0	0	0
Taguig	53	21	22	12	24	12	9
Valenzuela	70	35	26	8	20	9	2

[a]Based on a 10% sample of total households in the National Capital Region
[b]National Capital Region
[c]Metropolitan Waterworks & Sewerage System, and Community Water System typically using deep tubewells.
[d]Individual or shared (few HH) piped deep tubewells.
[e]Refers to households solely dependent on water vendors.
[f]Shallow well, dug well, spring, lake, river, rain, etc.

Source: National Statistics Office.

vestments in private waterworks systems, putting up of individual tubewells, use of booster pumps, use of storage tanks, and water delivery through private water vendors. However, no systematic information on the extent and nature of these mechanisms are available. Table 3 shows the usual type of information available, i.e., distribution of households in the National Capital Region by source of water based on the 1990 Population Census. This is the closest information available in this regard. This table only provides a crude characterization of the nature of water supply. The importance of private tubewells and private water vending seems very much understated while the fact that households use two or three sources is not reflected in these data.

Based on this study's survey, meanwhile, more defined information on the distribution of households by water source can be outlined. For one, Table 4 shows that at least 40 percent of households obtain water outside MWSS's piped water connection system, implying that only an approximate 60 percent of households actually have MWSS water connection. This figure, it should be noted, is lower than the officially reported MWSS service area coverage of about 70 percent. Almost 10 percent of these households with MWSS connections supplement their water supply through tubewell pumps and private water vendors. These households rely on two or even three sources of water.[1] Some have installed booster pumps, particularly among high-income families situated in areas with low or moderate water pressure. In some areas in Manila, Makati, and Quezon cities, 6 percent of households have both water and sewerage connection with the MWSS. Another 10 percent of households have piped water connections using private waterworks systems and deep or shallow tubewells. These households are mostly found outside the service area of MWSS.

The study also notes that nearly 30 percent of households rely mostly if not fully on vended water for their daily supply. A small proportion of vended water is delivered in containers using either carts, bicycles, or jeepneys or in tanks using trucks. Most of vended water is picked up by consumers from other households, and a few from cooperative-managed public faucets using 5-gallon plastic con-

[1]They are part of the households relying on 2 or 3 combinations of water sources observed during the survey as noted in Table 4.

tainers or 3-gallon plastic pails. A significant proportion of vended water is distributed through plastic pipe connections from other households or MWSS's water main pipes, with consumers being billed a fixed charge. Vended water may also be delivered through plastic pipes from other households but paid for on a per container basis.

An important finding of this study is that over 80 percent of households relying on vended water are actually buying MWSS water indirectly. In most squatter colonies, for instance, particularly in Quezon City where vast tracks of public lands exist, there is an "open system"[2] of obtaining a plastic hose connection by attaching to a water main line or to a government building for a connection fee and a monthly fixed charge usually determined by the number of outlets and household size. Often, households with such plastic hose connection also distribute water to other households by charging on a container basis.

Most vended water picked up by consumers is purchased from households with MWSS (legal or illegal) connections. Because of the progressive nature of the household water tariff structure and the ease of tampering meters and of bribing bill collectors, households selling MWSS water from legal connections most likely have tampered water meters.[3] Again, because water vending activities across households are quite visible, those households with tampered meters can be easily identified. Given the relatively high proportion of households buying privately vended MWSS water (nearly 25 percent compared to 60 percent with MWSS connection), *a significant proportion of nonrevenue water is therefore not actually lost, but paid for by the final consumers*. Vended water is sold through a well-organized, informal, and relatively open system of illegally distributing MWSS water. Although not well documented in the survey, several cases of illegal connections were encountered, including indirect use of MWSS by households. For example, a commercial 2-storey building along a major highway removed its water meter and has not paid for its water for nearly a decade. In a high-income subdivision, the homeowners' association administers truck delivery of water from a fire hydrant (without any meter) located in a low-lying area because of low water pressure in the elevated areas. *Thus, poor water service itself is exacerbating the problem of high nonrevenue water.*

Table 4
Distribution of Sample Households
by Source of Water, Metro Manila, 1995

Source	*Number of Households*	*% of Households*
MWSS		
(w/o sewer)	260	51.4
(w/ sewer)	31	6.1
Private waterworks (PWW)	25	4.9
Individual tubewell (TBW)	11	2.2
Public faucets (PF)	5	1.0
Private water vendors	116	22.9
MWSS water	96	19.0
Pick-up	52	10.3
Hose (container)	16	3.2
Hose (fixed charge)	22	4.3
Delivered	6	1.2
TBW water	20	3.9
Pick-up	14	2.8
Hose (container)	1	0.2
Hose (fixed charge)	4	0.8
Delivered	1	0.2
Combinations*	58	11.5
Total	**506**	**100.0**

*See Table 3 for further details.

Water source and tenure

Table 5 shows the distribution (in percent) of households by water source according to residential tenure. Most of the households with piped water connection from MWSS, private waterworks systems, and tubewells own or rent their house and lot. It is surprising to find, however, that about 30 percent of households with MWSS connections are squatters. Although some squatters on private land may be using old water connections, a significant proportion (about 20 percent to 25 percent of MWSS connections) appears to have not followed official rules. In Makati, it is

[2]It is an open system in the sense that everyone in the community, including the barangay captain, knows how, for how much, and from whom to obtain an illegal water connection. There is also a well-organized monthly collection system. MWSS officially requires proof of ownership of land or permit from the landowner to apply for a water connection.

[3]This is clearly evident from our failure to successfully interview any of those households.

Table 5
Distribution of Sample Households by Water Source and Tenure of Residence, Metro Manila, 1995 (%)

Tenure	MWSS	PWW	TBW	PF	Water Vendors			
					Delivered*	HF*	HC*	PU*
Own H & L*	46	72	73	20	57	12	12	23
Rent H & L	23	24	18	-	-	8	-	5
Squatting on private land								
Own H	15	-	-	60	14	19	23	30
Rent H	5	-	-	-	-	3	12	9
Squatting on public land								
Own H	9	4	9	20	29	46	47	21
Rent H	2	-	-	-	-	12	6	12
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*H = house; L = lot; Del = delivered by carts/bicycles/jeeps/trucks; HF = hose with fixed charges; HC = hose by containers; PU = pick-up by containers.

common knowledge that such connections can be obtained for a cost of about ₱25,000, in contrast to about ₱2,300 for a legal connection.

Water vending is prevalent in squatter areas. The use of plastic hose to deliver water is more widespread among squatter colonies located in public lands where large, contiguous squatter areas make hose connections from water mains or government buildings feasible and economical. Water sold by other households in containers are more popular among squatters in private lots because they are residential areas with MWSS water connections. Close to 60 percent of households buying delivered water own their house and lot, but usually these are in areas not served by MWSS, in areas where water from MWSS or private waterworks is severely rationed, or where the cost of drawing groundwater is extremely high.

Water source and income

Table 6 presents the distribution of households categorized by income class using the different water sources. Twenty-five percent of households using MWSS water have an annual household income within the ₱60,000 - ₱99,999 range. Households relying on private waterworks and individual tubewells generally belong to higher income brackets. In contrast, households dependent on vended water belong to the low income groups. Of the households with MWSS connections, 43 percent have annual household income below ₱100,000. It could be surmised that about three-fourths of low income households with MWSS connections may have illegally obtained those connections.

Water source and average consumption

Poor households rely mostly on vended water and consume less as shown by the distribution of households with different water sources and their levels of water use. Households with MWSS connection consume an average of 32 cubic meters per household or 6 cubic meters per capita

Table 6
Distribution of Sample Households by Water Source and by Annual Household by Income Bracket, Metro Manila, 1995 (%)

Income Class (In ₱)	MWSS	PWW	TBW	PF	Water Vendors			
					Delivered	HF	HC	PU
Under 30,000	1	-	-	40	14	4	12	9
30,000-39,999	6	4	-	20	14	12	6	12
40,000-59,999	11	8	9	20	-	19	18	26
60,000-99,999	25	4	9	-	29	42	29	41
100,000-149,999	16	8	-	-	14	15	35	8
150,000-199,999	14	12	18	20	29	4	-	3
200,000-249,999	5	4	28	-	-	-	-	1
250,000-499,999	13	36	9	-	-	4	-	-
500,000-749,999	2	8	18	-	-	-	-	-
750,000-999,999	4	-	-	-	-	-	-	-
1,000,000 and above	3	16	9	-	-	-	-	-

which is about 5 times than that of poorer households dependent on vended water. Only about 10 percent of households connected to MWSS use less than 10 cubic meters, considered the lifeline level, while nearly all of the households using vended water belong to this category. However, households relying on private waterworks consume higher than households relying on MWSS mainly because of their higher average incomes. Households with individual tubewells, meanwhile, consume lower than both due to the high cost of small-scale extraction of groundwater. In sum and as will be shown later, *households dependent on vended water have low incomes yet pay for a higher cost of vended water.*

Water source and quality

By Asian standards, MWSS water is relatively of good quality (ADB 1993). While MWSS water is considered potable, tap water in Bangkok, Jakarta, and other parts of Asia cannot be directly used for drinking. Except for problems in turbidity, the sample households found their water to be generally of good taste, odorless, and clear. Since vended water is sourced from MWSS, there are no major differences in the perceptions on quality. In terms of turbidity, however, nearly all households using vended water complained about the presence of particles in the water. The same is true for those with water sourced from groundwater extracted by private waterworks and individual tubewells. The main difference in terms of quality of water is the taste. MWSS water generally tastes better and because individual tubewells are shallower than deep tubewells used by private waterworks, the taste of water from shallow wells is generally poorer.

Water source, availability and pressure

Quality of water service is judged by its availability and degree of water pressure. Less than 60 percent of households with MWSS connections have continuous water supply throughout the day. In fact, in 30 percent of these households, water flows for less than 12 hours a day. On the average, MWSS provides water for about 18 hours a day among the sample households, somewhat higher than the reported average of 16 hours for the whole MWSS operation. Private waterworks have a lower record, with an average of 15 hours a day and with only 40 percent of the sample households receiving water supply 24 hours a day. On water pressure, 32 percent of households covered by private waterworks report high water pressure compared to only 12 percent among MWSS-connected households. Thus, 40 percent of MWSS-connected households suffer from low water pressure compared to 16 percent among households under private waterworks. Water pressure is moderate for about half of the households using both sources of water.

Cost of Water and Household Income

Because of the essential nature of water for human survival, the pricing of water is a politically sensitive issue. Officially, the price of MWSS water is set to recover the direct cost of water production, without any attempt to include the scarcity value of water nor the appropriate charge for the use of groundwater. The water tariff structure is set in increasing blocks with a low lifeline rate to favor low-income households. In addition, water charges for industrial and commercial users are about double those for household consumers. Such tariff schedule is meant to benefit the poor but the question is: Are the poor really benefiting from such a pricing policy?

Price, income, and water source

Table 7 reports the average price, monthly income, and the percentage ratio of monthly water bill to income by source of water. The cost of water varied widely by source. Households with official MWSS connections pay the lowest price for water averaging ₱5.50 per cubic meter.[4] In areas where a centralized sewer system exists, the cost of water and sewerage service is about ₱8.50. Private waterworks charge a price that is slightly over 40 percent higher than MWSS average price without sewer. In contrast, vended water costs much

[4]Water charges of MWSS consists of 4 items: a) basic charge based on a progressive water rate structure; b) currency adjustment computed on a per cubic meter of water consumed; c) environmental fee computed as 10% of the sum of the basic charge and currency adjustment cost (in areas where MWSS operates a central sewerage system, a sewerage charge of 50% is added to the environmental fee); and d) a small meter service charge fixed depending on the size of the water meter, i.e., ₱1.50 for meter size of 1/2 inch, ₱2.00 for 3/4 inch, and ₱3.00 for one inch.

Table 7
Average Price of Water, Income per Capita, and Ratio of Water Bill to Household Income by Source of Water, Metro Manila, 1995

Source	Average Price (₱/cu m)	Monthly Income (₱/capita)	% of Water Bill to Income
MWSS			
(w/o sewer)	5.53	2887	2.0
(w/ sewer)	8.52	5648	1.5
Private waterworks	7.92	7249	1.9
Individual tubewell	n.a.	5031	n.a.
Public faucets	0	729	. . .
Water vendors			
MWSS water			
Pick-up	30.45	1168	4.2
Hose (container)	48.29	1223	6.2
Hose (fixed charge)	21.80	1325	2.7
Delivered	71.93	1359	11.9
TBW water			
Pick-up	40.16	854	5.7
Hose (container)	44.00	2500	4.8
Hose (fixed charge)	58.90	2245	3.8
Delivered	62.32	1850	4.3

n.a. = not available
... = not applicable

Table 8
Average Price of Water, Water Consumption, and Ratio of Water Bill to Income by Annual Household Income, Metro Manila, 1995 (%)

Income Class (in Pesos)	Average Price (₱/cu m)	Water Consumption (cu m/hh)	Water Consumption (cu m/capita)	% Water Bill to Income
Under 30,000	36.38	6.0	1.6	8.2
30,000-39,999	15.89	14.3	3.2	4.4
400,00-59,999	15.88	18.4	4.0	4.2
600,00-99,999	15.92	19.5	3.7	2.9
100,000-149,999	13.94	26.0	4.0	2.2
150,000-199,999	9.16	32.0	4.8	1.6
200,000-249,999	5.94	38.5	5.8	1.4
250,000-499,999	8.04	36.1	5.4	0.8
500,000-749,999	6.04	63.9	7.8	0.8
750,000-999,999	9.27	71.4	13.6	0.8
Over 1,000,000	7.14	90.2	13.4	0.6

higher, ranging from ₱22 per cubic meter (when buying MWSS water indirectly through plastic hose at fixed charges) to as high as ₱72 per cubic meter for MWSS water delivered to the households.

The data clearly show that the price difference between water from an MWSS connection and MWSS water delivered by vending is about 13 times. While MWSS water picked up from households with MWSS connection is the more common mode of buying water among poorer households, the average price per cubic meter does not include the cost of time and effort to queue and carry the water from the source to the household, as well as the inconvenience of not having tap water. Even assuming a lower opportunity cost of labor among the poorer households, total cost of such vended water, when those factors are considered, may easily reach ₱45 to ₱55 per cubic meter or 8 to 10 times more than the cost of water from a MWSS connection.

Table 7 also shows that the average income of households with MWSS connection, private waterworks, and individual tubewells are significantly higher (by about three times) than households relying on vended water. *With the higher cost of vended water, poorer households therefore have to spend a much greater proportion of their income for water than wealthier households. Poorer households without MWSS connections not only pay a much higher price for the same MWSS water; they also experience an even greater inconvenience for not having tap water in their own homes.*

Cost of water by income class

Table 8 indicates the regressive nature of actual water price structure as the average price, water consumption, and ratio of water bill to income is presented by income class. Average price of water declines from about ₱36 per cubic meter for households with annual average income under ₱30,000 to only about ₱7 per cubic meter for households with incomes of

over ₱1,000,000. Water consumption for the poor average about 6 cubic meters per household in contrast to about 90 cubic meters for the rich household. And the percentage ratio of water bill to income ranges from 0.6 percent to 8.2 percent between the rich and poor households, respectively. Clearly, the progressive nature of the official MWSS water tariff structure does not benefit the poor. *In reality, the policy of maintaining low water price by limiting the expansion of water supply leads to water rationing that inevitably favors the rich over the poor*.

A comparison of water rates among ASEAN countries is quite revealing (Table 9). With the exception of Kuala Lumpur where 84 percent of capital investment is subsidized, MWSS has the lowest water charges while Singapore has the highest. In practice, however, because the relatively poor in Manila cannot be provided with official MWSS water connections, *these households end up paying a much higher price at lower quality of water service than the higher income households in Singapore ($14 per 10 cubic meter compared to $3.26, respectively) for better quality of water service*.

Concluding Remarks

The findings from the household survey of water use indicate the following:

, The public sector has failed to provide an efficient (and equitable) system of supplying household demand for water under the MWSS service area. A fairly large proportion (over 30 percent) of the population is not reached by any public water service. And within the service area, the quality of service in terms of hours served and water pressure has been quite poor. Nearly one-third of households with MWSS connection receive water for less than 12 hours per day and only 56 percent have day-long water supply. Forty percent of households suffer from low water pressure.

, Inadequate water connections throughout the water service area, inadequate supply to those with water connections, and MWSS' willingness to institutionalize the provision of water among squatter households have induced the growth of private water vending activities. Ironically, over 80 percent of this privately vended water is MWSS water that is actually part of the nonrevenue water and paid for by household consumers at a much higher price than MWSS rates. Assuming that the average water consumption of households using vended MWSS water (24 percent of hh) is just 40 percent of those with MWSS connections, and that only about 10 percent of water produced is lost through illegal connections and tampered meters, MWSS may still easily increase its revenues by at least 30 percent through proper management or institutional reforms, with little investment capital. By casual observation, the private water vending of MWSS as well as the illegal connections and tampering of meters are activities that are relatively obvious. Thus, the cost of enforcement of rational water dis-

Table 9
Structure of Water Tariffs for Household and Grant Element of Capital Investment in Public Waterworks System in ASEAN Countries, 1990

	Cost of Water ($)				Grant element of Capital Investment (%)
	10 m^3	20 m^3	30 m^3	50 m^3	
Manila	1.05 (1.44)*	2.32 (3.13)	3.87 (5.12)	8.07 (10.32)	22
Bangkok	1.57	3.14	4.71	8.15	nil
Jakarta	1.72	4.18	7.38	15.76	< 1%
Kuala Lumpur	0.99	1.58	2.97	5.75	84
Singapore	3.26	6.52 (7.82)	11.13 (13.36)	22.50 (27.00)	nil

* Figures in parenthesis show the total charges. For Manila, this includes a currency adjustment factor, an environmental fee of 10% of the tariff plus the currency adjustment factor and a 2.00 flat meter service fee. For Singapore, this includes a water conservation charge of 5% on all consumption above 20 cu. m. We do not have any information at this time if similar surcharges are levied in Bangkok, Jakarta, and Kuala Lumpur.

Source: Asian Development Bank (1993). *Water Utilities Data Book*, Manila.

tribution policies should be minimal. For example, MWSS should be able to legally sell water directly or indirectly to squatter households. Doing so, however, would of course only lead to increases in nonrevenue water, higher cost of water to poor consumers, and corruption in the MWSS bureaucracy. Under the present management or institutional arrangement, there appears to be very little incentive to address the very high NRW rates through improved management.

, The government had decided to privatize MWSS (i.e., contracting two private concessionaires to operate the MWSS) as the best way to achieve the management reforms necessary to improve the efficiency of public delivery of water. The process of privatization, however, should be made more transparent to ensure the most favorable terms of contract for the public. For example, this study suggests that potential revenues for the MWSS can be substantially raised with little additional cost. Yet, the MWSS is already proposing to raise water rates before privatization in order to cover its operational cost. Clearly, by management reforms such as privatization, revenues may be increased and cost reduced substantially. However, no comprehensive and independent studies that evaluate the value of such reforms are now available to all contracting parties and to the general public. Though contracting parties are provided with technical and financial information about MWSS operations, they will have to do some additional studies by themselves . A fairly accurate estimation of the various causes of NRW in various MWSS districts, for example, is one of the basic analyses that should be provided to all concerned. It is critical that independent analysts concerned only with the public interest be allowed to monitor and evaluate the process of privatization.

, Despite privatization of MWSS operations, the government will continue to have some regulatory role in the pricing of water delivered by MWSS because of the natural monopoly elements in water production and delivery. Apparently, there has been no major effort to develop estimates of marginal cost and marginal revenue of producing and delivering water in Metro Manila, considering the cost of supply, scarcity cost of water, environmental and health factors, and others. Early determination of socially optimal water pricing policy would improve the quality of the contract for MWSS privatization. There has been no effort to estimate the scarcity cost of groundwater and to institutionalize a market-based system of regulating groundwater use in Metro Manila, despite definitive studies of groundwater mining. Clearly, the optimal management of water resources for urban use in Metro Manila should take into consideration the tradeoff in the use of surface water (MWSS) and groundwater (mostly privately). Government's role is to look closely into this.

, On the MWSS's proposal to raise water rates only at higher levels of consumption and for industrial establishments to alleviate the public's concern about higher water rates (a progressive and dual water rate structure has been justified by MWSS in terms of equity and conservation objectives), this study indicates that ***the progressive rate structure does not really benefit the poor and may mostly encourage households, commercial and industrial establishments to tamper with meters or to shift to groundwater use which may be more socially costly. Moreover, the poor are paying much higher water prices (2 to 5 times more) than the better-off households who typically have MWSS connections simply because they do not have access to MWSS water connections***. Most households with MWSS connections generally incur higher cost of water than the MWSS rates because they may have installed booster pumps, tubewells pumps, and purchased supplementary water from private vendors. And even those who cannot afford additional water supplies also incur higher cost involved in managing intermittent supply of MWSS water.

The relevant issue to consider in setting water prices is not so much whether or not it will allow MWSS to recover its cost nor whether or not it is "affordable" which is a very subjective concept. Rather, efforts must be made to determine the level of price that will equate demand for water to the supply of water produced considering the marginal cost of extracting/delivering good quality water, scarcity cost of water, and other factors involved in the production and consumption of water.

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