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Municipal water pricing and tariff design: a reform agenda for South Asia

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Abstract

The water tariffs currently in use in most cities in South Asia are not accomplishing their principal objectives. They are not generating sufficient revenues to ensure that utilities can recover their financial costs. They are not sending the correct economic signals to households, i.e., that water is scarce and must be treated as a valuable commodity. They are not helping the majority of the poor households, many of whom are not connected to the piped distribution system. This paper describes the major elements of a package of pricing and tariff reforms that are needed in the municipal water supply sector in many South Asian cities. The recommended set of reforms has three distinct parts: (1) expanding the customer base and making sure connections are metered so that pricing policies can be implemented; (2) changing the way water bills are calculated for households, and for industrial and commercial customers; and (3) putting in place the policies to protect poor households during the reform process. The following pro-poor policies are recommended: (1) ensuring that poor households (and others) can have a private water connection when they want it; (2) subsidizing upfront connection costs, not volumetric water use; (3) providing public taps as a water source of last resort for the very poor; (4) legalizing water vending and selling by neighbors; and (5) not giving private operators exclusive rights to provide water within a service area.

Keywords: Increasing block tariffs; Pro-poor policies; Seasonal tariffs; Subsidies; Tariff designs; Water pricing

1. Introduction

There is a famous science experiment concerning the nervous system of a frog. If a frog is placed in a pot of very hot water, it immediately jumps out: its nervous system receives and then relays the signal that the frog is in serious danger. However, if placed in a pot of cold water and the water is gradually heated, a frog will be cooked. The increase in heat is too gradual for the frog's nervous system to perceive the danger. With respect to its water supply situation, the urban population of South Asia is a bit like the frog in the pot of water that is slowly heating.

The urban water supply situation in South Asia is deteriorating, and the urban population continually adjusts to the worsening situation. Many people only have water in their pipes a few hours per day. Households who can afford it drill their own wells and install both in-ground and overhead storage tanks. They increasingly buy bottled water, or treat their drinking water. They spend scarce resources on medical care for water-borne diseases that result from groundwater infiltration into the piped distribution system. State governments can no longer afford to subsidize municipal water providers.

The status quo is bad, but the situation is deteriorating and the future for municipal water supply services looks even worse. The population continues to increase. Lack of maintenance results in more broken pipelines and higher levels of contamination and unaccounted-for water. The groundwater table falls, and people have to drill ever deeper to reach water. Cities must go further and further away to find new, more costly sources of water. Industries and agriculture compete for increasingly scarce water resources.

Gradual, piecemeal reform programs for the municipal water supply sector are unlikely to turn this deteriorating situation around. The urban population of India needs to jump out of the pot and get on a path of comprehensive municipal water sector reform. Fortunately, serious high-level policy deliberations are currently underway in many cities in South Asia regarding the pros and cons of policy initiatives designed to improve the delivery of municipal water and sanitation (as well as other urban) services. An important part of these policy discussions is the reform of current water pricing practices and tariff structures.

A water tariff is an important management tool that can be used to assist with the reform of the municipal water and sanitation sector. The pricing of water services is, however, controversial, and it is important for reformers to understand three of the many reasons why there is so little consensus on municipal water tariff issues. First, there is disagreement over the objectives of water pricing and tariff design. Water pricing decisions affect several different objectives or goals of policymakers, often in conflicting ways. This means that if one person is looking solely (or mostly) at the consequences of a particular water pricing policy in terms of one objective, and another person is looking at the same water pricing policy in terms of its impact on another objective, they may reach quite different conclusions about the attractiveness of the policy.

Second, there is disagreement over what would actually happen if different water tariffs were implemented. The empirical work is often lacking that would enable someone to know with reasonable confidence how changes in water prices would affect the quantity of water different customers would use, and whether or not price changes would affect customers' decisions to connect (or stay connected) to the water distribution system.

Third, although there is some competition in the water market, there is no market test for different water tariff structures. Many tariff structures are feasible and can partially accomplish some of the competing objectives of water pricing. There are typically an insufficient number of providers of piped water services for customers to reject inappropriate tariff structures. Bad ideas thus do not get weeded out of either the market or the policy discussion[1].

Despite the controversial nature of municipal water pricing, given the current poor performance of the municipal water supply sector in most South Asian cities, pricing policy reforms are possible that will

[1] Even in different private sector participation arrangements, water tariff structures are typically set by the regulatory agency, and the private sector operator has to treat them as a given and manage the system as best he can (given this constraint).

benefit almost everyone[2]. In the next section of this paper I discuss the four main objectives of pricing and tariff design. In section 3 I examine the current water supply situation in many South Asian cities to see the extent to which these objectives are being achieved. Section 4 describes the major elements of a package of pricing and tariff reforms that are needed in the municipal water supply sector in many South Asian cities. Section 5 presents the policies needed to protect the poor during this reform process. In the sixth and final section I offer some concluding remarks. Due to limits of space, this paper concentrates on municipal water supply and not on sanitation and sewerage services.

2. Objectives of municipal water tariff design[3]

Setting water tariffs requires that one strike a balance between four main objectives:

1. *Revenue sufficiency*. From the water supplier's point of view, the main purpose of the tariff is often cost recovery. The revenue from water users should be sufficient to pay the operation and maintenance costs of the water utility's operations, repay loans undertaken to replace and expand the capital stock, provide a return on capital at risk and maintain a cash reserve for unforeseen events. The revenue stream must thus be adequate to attract both equity capital and debt financing. Ideally the revenue stream should be relatively stable and not cause cash flow or financing difficulties for the utility.
2. *Economic efficiency*. Economic efficiency requires that prices be set to ensure that consumers face the avoidable costs of their decisions. In other words, water prices should signal to consumers the financial and other costs that their decisions to use water impose on the rest of the society. From an economic efficiency perspective, a tariff should create incentives that ensure, for a given water supply cost, that users obtain the largest possible aggregate benefits. This means that volumetric water charges should be set equal to the marginal cost of supplying water. When capacity is constrained and water is scarce, it is commonly assumed that the marginal cost of supplying water can be approximated by the average incremental cost (AIC), i.e. the average cost of water from the next water capacity expansion project. Alternatively, the AIC of additional water may be the unit cost of reducing unaccounted-for-water.
3. *Equity*. Equity means that the water tariff treats similar customers equally, and that customers in different situations are not treated the same. This would usually be interpreted as requiring users to pay monthly water bills that are proportionate to the costs they impose on the utility by their water use.
4. *Poverty alleviation.* Many people feel that water services are a "basic right" and should be provided to people regardless of whether or not they can pay[4]. This objective leads many people to recommend

[2] Although "almost everyone" can benefit by the reforms suggested in this paper, some groups may benefit more than others. An important political issue is how groups may react if they benefit less in relative terms than others, even if in absolute terms they are better off than before the reforms.

[3] For a more in-depth discussion of the ideas presented in this section, see Boland (1993).

[4] Charging for water may also be perceived as inappropriate on cultural or religious grounds. For example, in Islamic societies it is often considered wrong to charge for water *per se*, although asking people to pay for the infrastructure to deliver water is typically acceptable.

that water services be provided free, at least to the poor. Providing water free through private connections conflicts with the objectives of cost recovery and efficient water use.

The political economy of setting water tariffs requires that one consider carefully this claim that water is a "basic human right" and should be provided free. There has been strong support for this viewpoint in most countries of South Asia for many years. When someone claims a *right*, they attempt to impose a corresponding *obligation* on someone else. The presumption may be that the individual for whom the right is claimed is too poor to pay for water himself, and that someone else should pay these costs. The "someone else" is typically one of three groups: (1) the state, (2) the international community or (3) industry.

It is certainly possible for a strong state to extract tax revenues from sources outside the water and sanitation sector in order to provide water services free. For example, the former Soviet Union was able to provide tens of millions of households with essentially free water services for many years by pursuing such a policy. The real question is not whether this can be done, but whether such a "free water" policy is a good idea. It is of course impossible for everyone to avoid the costs of providing water services to customers; someone must pay the financial and environmental costs.

It is instructive to consider what in fact happened when the former Soviet Union focused water pricing solely on the objective of poverty alleviation and the notion that municipal water service was a basic human right and attempted to provide water for free to everyone. First, because the cost recovery objective was ignored, financial resources had to be obtained from other sectors of the economy. Given the economic planning system used in the former Soviet Union, it is difficult to say precisely where the financial resources came from to pay for the "free" water services. What is clear, however, is that the cumulative effect of such entitlement policies created massive macroeconomic distortions as the economic system struggled to meet such unfunded liabilities. Today these bills are coming due in the form of run-down utilities. One manifestation of these costs is the much-reduced proceeds that these utilities bring from privatization initiatives.

Second, because water was provided free, it was not used efficiently by households (i.e. much water was wasted). There were no prices, so households did not receive a signal to use water for high-value uses. As a result households had no incentive to fix leaking toilets or faulty taps. The water supply system was overly expensive because the public sector attempted to treat and deliver more water to households than they really wanted or were willing to pay for. The water utility did not have its own dedicated revenue streams from households, and it often could not obtain sufficient resources from higher levels of government to supply the quantity of water demanded by households at a zero price. As a result in many cities the water distribution system became unreliable. This further increased inefficiency because households left their taps open in the hope of collecting and storing water when it became available.

So a policy of "free water" not only meant that the cost recovery and economic efficiency objectives were not met, but also that service quality itself declined. The "free" service provided thus ironically became less valuable to households. In South Asia many poor households lack access to services. In such situations the failure to implement sound fiscal policies has even worse consequences because municipal water providers lack the resources to expand services to the poor.

In the next section I examine the water pricing and tariff polices currently in use in South Asia to determine the extent to which they achieve these four objectives.

3. Water tariff designs currently in use in South Asia and their limitations[5]

Historically, fixed charges were the first means used in most countries to calculate monthly water bills for customers on piped distribution systems. In many small and medium size Indian cities they are still the most prevalent way to calculate a household's monthly water bill. A typical practice would be for a household with a connection to the piped distribution system to pay Rs50 (US$1.09) per month, regardless of the amount of water used. For example, in Chennai the fixed monthly charge for an unmetered connection is Rs50, whereas in Hyderabad it is Rs140 (US$3.04).

Occasionally the fixed charge is adjusted to reflect household size so that households with more members pay a higher fixed monthly charge than small households with connections. In some places the household's fixed monthly charge depends upon the diameter of the pipe that a household uses to connect to the distribution line. For example, in Kathmandu a household with a ½″ tap (unmetered) on a branch line of the water distribution system pays a monthly fixed charge of Rs59, while a ¾″ tap costs Rs442 per month[6]. In Dhaka the fixed charge is calculated based on an estimate of the annual valuation of the property.

A recent study of 300 Indian cities found that only 13% used increasing block tariff structures (Raghupathi, 2002). However, in large South Asian cities increasing block tariff (IBT) structures are a common type of volumetric pricing (and all urban centers in Kerala and Rajastan use IBTs). Figure 1 shows the tariff structures currently in place for residential users in six large South Asian cities (Chennai, Bangalore, Hyderabad, Kathmandu, Colombo and Dhaka); for every city except Dhaka, IBT structures are being used. Four aspects of these IBT tariff structures are particularly noteworthy.

First, the size of both the first and second blocks are quite large. For example, in Bangalore the first block is 25 m^3 per month; the second block is also 25 m^3 per month. In Chennai the first block is 10 m^3 per month, while the second is 15 m^3 per month.

Second, the price per cubic meter in the first two blocks, and the resulting monthly water bills, are very low and certainly are less than the average financial cost of producing water. The water use of the vast majority of households in these cities falls into either the first or second block of these tariff structures, and thus most households are paying less than the average cost of water service. Third, the tariff levels in all blocks are below those in effect in many parts of Southeast Asia: water from private metered connections in these six South Asian cities is very cheap.

Fourth, the data in Fig. 1 also show that the actual increasing block tariffs being used do differ considerably from one another. The tariff structures have different sizes of blocks, different numbers of blocks and different prices in each block. For example, in Bangalore a household with a private metered connection using 20 m^3 a month would pay a water bill of Rs70 (US$1.51). In Chennai, a household that uses 20 m^3 per month would pay a water bill of Rs150 (US$3.23).

However, even in large cities using IBTs, not all households with private water connections receive a water bill calculated on this basis. Many households still have unmetered private connections and receive a water bill based on a fixed charge. For example, in Chennai over 95% of households have unmetered connections and receive a monthly water bill based on a fixed charge. In Kathmandu approximately 20% of households with connections are unmetered and pay a fixed charge.

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[5] For a description of different types of municipal water tariff structures, see Whittington *et al*. (2003).

[6] Note that if the reliability of the distribution system is very poor, then water service from a ¾″ tap will not be much better than from a ½″ tap.

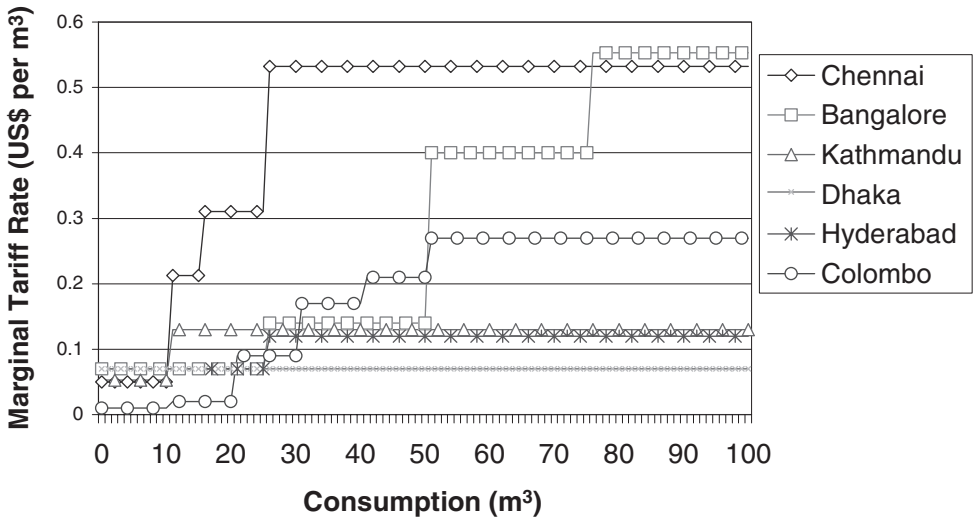

Fig.1. Residential water tariff structures in six South Asian cities.

In Hyderabad about 90% of households with connections are metered, but only about 40% of meters are working.

Current municipal water tariff practices in South Asia have several limitations. First, there are large numbers of households in many cities with unmetered private connections; they are charged a fixed amount per month for water, regardless of the amount they use. This fixed charge gives the household no incentive to conserve water; it sends the signal: "additional water use is free". This is a particular problem in those parts of South Asia where water supplies are scarce, and municipalities are increasingly turning to expensive, distant sources for new water supplies. The sector is thus incurring high costs to bring additional water into cities where at least a substantial portion of it is put to low-value uses.

Second, even households that are connected to the system and face a volumetric charge receive the signal that "water is *almost* free". Given the IBTs in place in many South Asian cities, the majority of households fall into the first or second block, and thus end up receiving heavily subsidized water. For example, it is estimated that in Bangalore 66% of the households with metered connections use less water per month than the upper limit of the first block of the IBT (25 m^3 per month); 94% use less water than the upper limit of the second block (50 m^3 per month). In Hyderabad the story is similar: 70% of households with metered connections use less than 15 m^3; 90% use less than the upper limit of the second block (25 m^3 per month). Because households perceive additional water use to be cheap, many use all the water they can get from the distribution system, and available supplies must be rationed by fewer hours of service. This in turn means that households must incur other costs (e.g. water storage tanks) to deal with the unreliability. As reliability continues to decline, some households engage in the zero-sum game of installing pumps to "suck" the available water from the distribution system into their houses.

Third, low fixed charges and low average prices mean that the monthly water bill paid by the great majority of households with private connections (both those with metered and unmetered connections) is very low. At first glance this appears to be good for households and bad for the utility, but low revenues for the utility rebound to adversely affect households. Low revenues mean that utilities lack

(1) the resources to provide high quality, reliable water services and (2) the financial incentives to extend service to unconnected households. Most cities in South Asia have a substantial minority of households without private water connections—either metered or unmetered. For example, a recent survey conducted in Kathmandu Valley suggests that approximately 30% of the households in the water utility's service area do not have private water connections (Whittington *et al*., 2002). They rely either on shared connections, public taps, traditional stone spouts (a form of public fountain) or water vendors. Low revenues not only mean that water utilities lack the incentives and resources to extend services to such unconnected households (a substantial proportion of whom are usually poor), but also lack the ability to attract capital to finance the development of new water sources.

Fourth, to make matters worse for the poor households who share connections, the water bill for groups of households sharing a connection is often calculated on the basis of an IBT that was designed for a private connection for the exclusive use of a single household. The more households that share a connection, the higher the total water use billed through that single meter and the higher the average cost of water used (Whittington, 1992). Poor households sharing a connection thus typically pay higher average per unit costs than middle and upper income households, although because the tariffs in all blocks are low in South Asia, average costs of water even for households using shared connections are typically still low.

In summary, the water tariffs in use in South Asia are not accomplishing their principal objectives. They are not generating sufficient revenues to ensure that utilities can recover their financial costs. They are not sending the correct economic signals to households, i.e. that water is scarce and must be treated as a valuable commodity. Many households do not have access to water from private connections, so service provision is inequitable. They are not helping the majority of the poor households, many of who are not connected to the piped distribution system. Most of the existing subsidies benefit the middle and upper income households connected to the piped distribution system[7]. In the next section I describe a set of actions to address this unfortunate situation.

4. First steps toward improved municipal water tariffs in South Asia

It is clear that municipal water-pricing practices need to be improved in South Asian cities. How should this process begin? Getting started on the reform of municipal water tariffs requires that government and/or private operators of municipal water utilities understand (1) the financial costs of providing customers with different levels of service, (2) the economic value of water in the sector and (3) household demand for improved services. Only with this information can one assess how changes in municipal water tariffs will affect the welfare of the utility's customers.

It has often been argued that municipal water prices must be kept low (i.e. subsidized) so that poor households can afford to purchase sufficient water to meet their basic needs. The usual corollary is that households are unable and unwilling to pay much for improved water services. If households are not willing to pay for improved services, there is little point in trying to raise prices to generate revenues that can in turn be used to improve services. Higher prices will simply mean that households will

[7] As long as the price a customer pays for water is below the cost to the utility of supplying an additional unit of water, the more water a customer uses, the larger the magnitude of the subsidy he receives. Since most water in South Asia is sold below cost, it should not be surprising that middle and upper-income households receive proportionately higher subsidies.

disconnect from the piped distribution system (or stay connected but be worse off in terms of reduced income). Many will fall back on alternative water sources such as private wells, vendors and public taps that better match their needs for cash flow flexibility.

But is it in fact true that most households in South Asia are unwilling to pay a substantial amount for improved municipal water services? The available evidence is limited, but raises doubts about this conventional wisdom. For example, in a recent survey in Kathmandu, we asked over 1500 households how they would vote on a plan to engage a private water company to help with the management and operation of the municipal water supply system (Whittington *et al*., 2002). Households were asked to choose between (1) a private connection to the present water system (with low prices and unreliable service) and (2) a private connection to an improved water system (with 24-hour service, accurate water billing and potable water quality). We estimated that almost 80% of the 991 respondents who already had a private water connection were willing to pay about *four times more per month for the improved system than their current water bill* (US$1.50 versus US$6.00). Households currently without a private connection were willing to pay almost as much for a private connection to the proposed improved system.

Respondents in this survey were also asked *why* they supported the plan to get a private company involved in the operation and management of the municipal water distribution system. The vast majority simply said they really wanted the improved water service; some said specifically that they were worried about the health risk of contaminated drinking water. When asked what they liked least about the water service from the current piped water system, over two thirds of respondents said "less than 24-hour service".

These results about households' willingness to pay for improved service are consistent with observations throughout South Asia that households are spending substantial amounts of money coping with intermittent, contaminated public water supplies (Zerah, 2000). For example, in Kathmandu, only 77% of those households with a private connection used the water from it on a daily basis. Over 50% of respondents with private connections had overhead water storage tanks (at an average cost of about NR7400; approximately US$100). About two thirds of the population in Kathmandu Valley treat their water before drinking it (e.g. boil, filter, etc).

The reform of municipal water pricing must thus start with an understanding of what would happen if prices were increased and services improved. In Kathmandu it appears that most people—including the poor—would prefer to pay higher prices for better services. In other cities one may find that households relying on both municipal water supply from the piped distribution system and on groundwater from privately owned wells have largely replicated the services provided by a 24-hour, 7-days-a-week service. In such cases, if the municipal water provider tries to raise tariffs, such households may increase their groundwater use.

The next question is: "What will different levels of improved services cost?" Throughout South Asian cities, the provision for 24-hour, 7-days-a-week service will require major new capital investments in system rehabilitation. Without positive pressure throughout the distribution system on a 24-hour basis, the distribution system would continue to be subject to groundwater infiltration and contamination. If it appears that the likely costs associated with 24-hour, 7-days-a-week service are affordable by the majority of the population, then the possibility exists for a win–win situation. In other words, the municipal water utility (or a private operator engaged by government) can improve households' well-being and still recover its financial costs. The reform process can then move to the next stage of planning concrete actions to improve the municipal water tariff structure.

Assuming household demand and system capacity are sufficient to support a reform process leading toward higher prices and 24-hour, 7-days-a-week service, what then needs to happen in concrete terms to municipal water tariffs in South Asian cities? The first priority is clearly to put in place the ability to implement a sound pricing policy; this is a prerequisite to raising the equity capital and debt financing needed for system rehabilitation. This requires that meters be installed on all private connections without them, and that meters be fixed where they are broken. Accurate bills can then be rendered to households and collected. If the available water supplies permit, unconnected households that want a metered private connection should be connected to the piped distribution system. All three of these tasks are things that private operators typically do well. This work cannot be done everywhere at once. It will require a neighborhood-by-neighborhood, district-by-district strategic approach.

In the process of putting in place the ability to implement a sound pricing policy, reformers should tackle two big problems: (1) the fixed charge (nonvolumetric) tariffs for calculating monthly water bills and (2) the inability of many poor households to finance the connection charges to the piped distribution system. Unless unmetered private connections are eliminated as a first step in the reform process, they will become increasingly large centers of revenue loss for the water utility as other reforms are undertaken; they will sharply limit what can be done to effectively and efficiently manage available water supplies.

There are several reasons why many poor and middle-income households do not have private connections for the exclusive use of household members, but one of the most important is often their inability to pay the lump-sum (up-front) connection charges. Many poor households cannot access credit at reasonable interest rates, and without access to credit markets connection charges can be a major obstacle to obtaining a private water connection. Because a well-run water utility should be able to access capital markets much more efficiently than most poor households, an important early step in pricing reform is for the utility to offer households the option to finance the capital costs of a private connection. Such a policy effectively allows households to pay off the connection charge over time as part of their monthly water bill. This financing probably does not need to be offered at concessional rates; just the ability to access long-term capital markets at globally competitive interest rates is often a significant benefit to poor households and should be more than enough to ensure high rates of connections by unconnected households.

Once the utility has established a large customer base and the ability to accurately determine how much water most of its customers are using (and to render and collect bills), it is time to change the way that water bills themselves are calculated. Because the increasing block tariffs currently being used in many large cities in South Asia are not achieving their intended objectives, three changes are needed. First, shared connections should not be billed using an increasing block tariff. Owners of shared connections should be charged a single volumetric rate for each unit of water used. In situations where available water supplies are scarce and there is no excess capacity in the system, this single volumetric rate should be at least equal to the average financial cost of supplying the water; from an economic perspective it should reflect the full marginal cost of additional water supply (including the opportunity cost to potential users who must forgo further water use). Ideally this single volumetric rate for shared connections should not be different from the volumetric rate faced by households with private connections for their exclusive use because the marginal cost of serving both types of connections is essentially the same.

Second, the IBT structures common throughout South Asia for calculating monthly water bills of households with private, metered connections should ideally be discontinued. The goal of the new tariff

structure should be to balance three main objectives: (1) to send as many customers as possible the correct signal about the economic value of water, (2) to collect sufficient revenues to put the utility on a sound financial basis (but not more revenue than is necessary) and (3) to ensure that most poor households are better off than they were before the tariff reform. When demand for improved services is strong, this balancing task is often not as difficult as it might at first appear.

The correct economic signal to send to customers will vary by location and season (i.e. marginal costs may be either below or above average costs depending on local conditions). However, it is likely that for many municipalities in South Asia the marginal costs of water supply are higher than average costs, and the marginal costs are rising over time until capacity is added to the system[8]. In this case the signal must be sent to consumers that water is an economic good in scarce supply and must be treated as such. Sending this price signal does not need, however, to result in a household's bill increasing to an amount equal to this price times the quantity of water consumed. It is the price that customers pay when they decide to use additional water that is important for this signal, not the aggregate monthly water bill (the monthly bill is, of course, important for the financial solvency of the utility).

When marginal supply costs exceed average costs, there are two principal ways that the tariff can be structured so that most households face the higher incremental costs of supply without having to pay water bills that generate revenues for the water utility far above their financial costs. Option 1 is to simply calculate the water bill by multiplying a single uniform volumetric price by the quantity consumed and then subtract a fixed amount from the water bill. We have termed this type of tariff a "Uniform Price with Rebate (UPR)" (Boland & Whittington, 2000). Option 2 is a simple form of increasing block tariff. In this case the number of blocks should be reduced to two. The size of the first block should be reduced to 5–6 m^3 per month (a realistic estimate of basic needs for a household of 4–5 members), and the price of water in the second block should be set equal to the marginal costs of supply[9]. If a marginal cost pricing policy would generate more than enough revenues to recover the costs of the service provider, instead of returning these excess revenues to households with private connections, these funds could alternatively be used to subsidize the use of public taps by poor households (see below).

In many of the water-scarce regions of South Asia, the marginal cost of supplying water will vary by season. The marginal cost will be higher in the dry season because water demand will be higher, and where water supplies are constrained, the cost of one user of the municipal system abstracting water should include the opportunity cost to someone else of not getting that water. In such cases it will make sense to adopt seasonal water pricing to allocate the available water supplies to high-value users and forestall the need for water supply capacity expansion created by the peak dry season demands.

Third, the common discrepancy between industrial (and commercial) and residential water tariffs should be eliminated. Industrial water use is typically much more price-elastic than residential water use. This means that prices to industrial customers must be raised a great deal to raise funds for cross-subsidies, resulting in significantly reduced, inefficient water use by industries. Moreover, charging industrial users more than the real resource cost of providing them service often drives them off the distribution system altogether, thus eliminating the possibility of any cross-subsidy. In the long run

[8] See the appendix for a discussion of why marginal costs change over time.

[9] For a discussion of the pros and cons of these two options, see Boland & Whittington (2000).

charging industrial and commercial users prices above marginal cost probably increases the prices of their products and hurts their competitive position. There is little evidence that this practice of charging industries prices for water above the real resource cost actually helps the poor.

5. Protecting the poor during the reform process

In most South Asian cities the pricing reforms outlined above will benefit the majority of poor households. Like nonpoor households, poor households need reliable, high quality water supplies. In the present conditions in South Asian cities, many poor households are not connected to the piped distribution system, and thus end up paying high prices to water vendors, high costs in terms of collection time and high health-related costs from drinking contaminated water. Poor households that share water connections are penalized further by increasing block tariff structures because they end up paying higher average costs than households with private connections for the exclusive use of household members. System-wide improvements in reliability and quality, and sound tariff reform, are thus an important means of serving the poor.

But what about the minority of poor households that might not be helped by this package of pricing reforms? What can be done to assist them? There are in fact a number of pro-poor policies that can be used to ensure that the poor have sufficient water to meet their basic needs at a reasonable cost without sacrificing the objectives of economic efficiency and cost recovery. However, none of these pro-poor policies involve tinkering with the volumetric charge for water sold to households (or firms) with private connections.

It is perhaps important to ask a prior question: "Why do many people (both those working in the water supply sector and elsewhere) assume that it is a good idea to deliver subsidies to the poor by reducing the price of water sold to households with private connections?" What is it about a piped water distribution network that makes it a good candidate for the delivery of subsidies to the poor? It does not follow that because water itself is a basic need that a piped water distribution system provides an efficient, effective way to deliver subsidies to the poor. After all, people also have basic needs for food, health services and housing. The relevant question is: "Which subsidy mechanisms reach the poor most efficiently and effectively?", not "How can piped water services be subsidized most effectively?"

In fact, the evidence from around the world suggests that private connections to a piped water distribution system are particularly poor candidates for a mechanism to deliver subsidies to poor households. If subsidizing the volumetric price of water sold from private connections is a bad idea, what other policies can be put in place in the municipal water sector to protect poor households from the higher prices of water from the piped distribution system that are required for the effective reform of the sector? Numerous regulations or policy initiatives can be coupled with the tariff structure to protect poor customers. The most obvious is simply to identify poor households and give them cash assistance to pay their water bills. This is essentially the approach now used in Chile. Even without such means testing, there are three main sets of pro-poor policies that are appropriate:

5.1. Subsidize connections, not volumetric water use

Rather than subsidize volumetric water use, any subsidies that are available to the sector are more appropriately targeted at reducing the up-front connection costs than used to reduce volumetric

charges[10]. Even without means testing, such subsidies will reach many poor households because unconnected households are likely to be poor. Subsidizing connection costs will enable many poor households to enjoy the benefits of an improved, reliable water system. Even if they can only afford to use a small amount of water after they are connected, poor households will have ready access to a convenient, high quality source of supply, and will be clear winners from the reform process.

5.2. Create a well-run system of public taps as a safety net for the poor[11]

Reformers need to look carefully at the system of public taps. In many locations public taps will in fact become obsolete. This is because in a situation where the majority of households have piped water connections, households without private connections will work out efficient ways of obtaining water from their neighbors at relatively low cost (Whittington *et al*., 1998). This solution depends on improvements in the reliability of the piped distribution system so that connected households do not have to worry about running out of water if they give or sell water to their neighbors[12].

However, public taps may still have an important role to play because they may serve as a water source of last resort for the very poor. In some cases it is even possible to provide water free from public taps without substantially reducing the revenues of the water utility. This can occur when free water from public taps does not affect the number of households desiring private connections for the exclusive use of household members, and when only small numbers of households cannot afford private connections[13]. As noted above, one source of potential revenue for financing a subsidized system of public taps is the excess revenues that are available if the volumetric price of water from private connections is higher than average costs (as would be the case if prices are set equal to marginal costs, and marginal costs are higher than average costs).

5.3. Preserve options for the poor

Poor households are hurt most when they have few options to help themselves and when others have restricted their choices. In such cases it is common to find poor households being exploited. This is as true in the municipal water supply sector as elsewhere. One important way to protect poor households is to preserve their choices so that local mafia or other rent-seeking groups cannot exploit them. There are three main things that can and should be done.

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[10] It is important to emphasize that this recommendation pertains to the *intrasector* allocation of any available subsides; it is not an argument for subsidizing poor households' connection costs to a water distribution system instead of subsidizing other kinds of infrastructure or social services. Indeed, the limited evidence available seems to suggest that poor households place a higher value on obtaining electricity than on piped water (Komives *et al*., 2001).

[11] I use the term "public taps" to mean a system of fountains outside of peoples' residences where anyone can go to collect water—perhaps for a per-bucket charge or a fixed monthly fee. These "public taps" do not necessarily need to be run by a public sector utility; they could be efficiently built and managed by a private operator.

[12] Public taps will become relatively high-cost sources of supply compared to neighbors selling water because most unconnected households will have to walk further to collect water from public taps than to neighbors, and because the fixed costs of an attendant at the public tap will be large relative to the revenue if only low volumes of water are sold.

[13] This is in fact the situation in many industrialized countries today. Water is often available free from public fountains, but the vast majority of households still demand private connections in their residence. See World Bank Water Demand Research Team (1993).

(a) Ensure that poor households (and others) can have a private water connection when they want it. Pro-poor policies should not trap poor households into always accepting a low level of off-site water service. If a poor household always has the option of choosing a private connection, when they can afford it, there are limits to the degree they can be exploited by rent seekers.

(b) Legalize water vending and selling water by neighbors. Vendors and neighbors with private connections create options for poor households; they promote competition in local water markets, limit the reach of spatial monopolies, and drive down water prices. The poor will benefit most from these lower prices. The system of public taps described above also adds to the choices available to poor households, fosters competition, and thus protects the poor from exploitation.

(c) Do not give private operators exclusive rights to provide water within a service area. Contracts with private operators should not contain exclusivity clauses; these limit competition and typically end up restricting the choices of poor households. Small-scale providers can often lower the cost of providing piped water to poor households; they should be permitted to operate within the contract areas of larger private operators.

6. Concluding remarks

Table 1 summarizes my specific recommendations for municipal water pricing and tariff reform in South Asia. As shown, the recommended package of pricing reforms has three distinct parts: (1) expanding the customer base and making sure connections are metered so that sound pricing policies can be implemented; (2) changing the way water bills are calculated for households, and for industrial and commercial customers; and (3) putting in place the policies needed to protect poor households during the reform process. There are certainly managerial and political challenges involved in implementing these changes, but this set of pricing and policy reforms is doable, and would greatly enhance households' welfare and firms' economic competitiveness if it were implemented in South Asia.

But the question remains, *who* should tackle these pricing reforms? Comprehensive sector reform will likely require a different institutional framework for the delivery of urban services such as water supply. In other words, the necessary changes in tariff levels and structure will be implemented by new organizations, including both regulatory agencies and private sector providers. There is something of a "chicken and egg" problem here: what comes first? Institutional reform, with pricing and subsidy reforms to follow? Or does a consensus need to be reached on pricing and subsidy reforms before institutional changes can happen?

It is my view that the political decisions necessary to effect the changes in institutional arrangements for the delivery of urban services need to be informed by the substantive issues involved in tariff and pricing reform, such as outlined in this paper. Without sound pricing and tariff reforms, institutional reforms cannot work. It is thus necessary that political leaders in South Asia have a clear vision of the major elements of the pricing and tariff reform program that will be necessary to make the institutional reform process successful.

Table 1. Summary of recommended actions

Goals	Recommended actions	Comments
(a) Establish the ability to implement a sound pricing policy	1. Install meters on all private connections.	
	2. Fix broken meters.	
	3. Establish a program to finance household connection charges.	Need to connect households currently off the piped distribution system.
	4. Eliminate fixed charge (nonvolumetric) tariffs.	Requires the installation of meters.
(b) Establish a tariff that balances four objectives: (i) revenue sufficiency, (ii) economic efficiency, (iii) equity, and (iv) poverty alleviation	1. Discontinue the use of increasing block tariffs (IBTs) for calculating water bills for shared connections.	Shared connections should be charged a single volumetric rate at least equal to the average financial cost of supplying water, assuming water supplies are scarce and there is no excess capacity in the system.
	2. Discontinue the use of IBTs to calculate water bills for households with private metered connections.	If IBTs are not discontinued, they should be greatly simplified. The number of blocks should be reduced to two. The size of the first block should be reduced to 5–6 m^3 per month, and the price of water sold in the second block should be set equal to the marginal cost of supply.
	3. Eliminate the discrepancy between industrial (and commercial) and residential water tariffs.	In the long run, charging industrial and commercial users prices above average cost probably increases the prices of their products and hurts their competitive position.
	4. Set volumetric price of water from private connections equal to the marginal cost of water supply.	Revenues in excess of full costs can be returned to customers in the form of a rebate and/or used to subsidize the system of public taps (see below).
	5. Adopt seasonal water tariffs, charging higher prices in the dry season in order to reduce peak demands.	In water-scarce areas, peak loads will drive water system capacity expansions in the dry season.
(c) Protect poor households during the reform process	1. Subsidize connections, not volumetric water use.	Such subsidies will reach many poor households.
	2. Create a well-run system of public taps as a safety net for the poor.	Public taps can serve as a last resort for the urban poor. In some situations water from public taps can be provided free without substantially reducing the utility's revenues.
	3. Preserve options for the poor by (a) providing access to private connections, (b) legalizing water vending and (c) not granting private operators exclusivity.	Poor households are hurt the most when they have few options, and become vulnerable to exploitation.

Appendix. A note on dynamic marginal cost pricing

Defining the relevant marginal cost of water supply for the decision at hand requires careful thought. When available water is in short supply (i.e. capacity is limited), and price must be used to allocate water to the highest value users, then the marginal cost must include the opportunity cost of not supplying the user with the highest willingness to pay for water who does not receive the last unit of water allocated. This sends the user who does receive water the correct signal as to the opportunity cost of his additional water use.

It also sends the correct signal as to whether the incremental cost of adding new capacity to the system is worthwhile. When users' willingness to pay for incremental water supply exceeds the full costs of the new water supply project, then it is economically justified to make the additional investment. Users need to be faced with the full costs of developing new water supplies; they can then decide whether the project is worthwhile at this time, i.e. they may conclude that they are willing to pay these costs.

However, once the new water supply project is finished, its capital costs become sunk, and in theory should no longer be part of the relevant marginal costs. Price should be set equal to short-run marginal costs and thus, perhaps counter-intuitively, the volumetric price of water should fall. The economic logic here is that more water should be supplied as long as someone is willing to pay the short-run marginal costs of the additional supply. After the new project is finished and there is excess capacity in the system, no one loses if the last user is willing to pay the short-run marginal costs (because the last user is not taking water away from someone else).

But there are two practical problems. First, someone must still pay for the capital costs of the project. This means that *ex-ante* (i.e. before the project) customers should vote to tax themselves or agree upon some other way to pay for the project (rather than include the capital costs in the volumetric charge after the project is completed). Second, this procedure could result in dramatic fluctuations in the relevant marginal costs, i.e. high marginal costs before the new project, followed by low marginal costs after the new project is completed (with marginal costs then rising again as the new capacity is exhausted and water must again be rationed by price). As a result, as long as the capacity of the new project is "small" relative to aggregate water use, most analysts have concluded that it is sensible to charge customers the long-run marginal cost both before and after the expansion in capacity.

However, it is important to keep in mind the caveat here: that the new project is small relative to aggregate water use. In fact, some municipalities in South Asia are contemplating very large new water supply projects (e.g. Kathmandu). In such cases, the capital costs are likely to be very large, and *ex-post*, after such a project is finished, there would be much excess capacity in the system. In this case, short-run marginal cost pricing is appropriate. Attempting to recover the capital costs in the volumetric charge could result in the water provided by the project not being used for a long time, a very inefficient and undesirable result. A political consensus (and a careful demand assessment) is thus needed as to who will bear the capital costs of the capacity expansion before the project is started so that users do not *ex-post* exit the system. For a more in-depth discussion of some of these issues, see Saunders *et al*. (1977).

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