

# WATER

## TARIFFS & SUBSIDIES IN SOUTH ASIA

# Can subsidies be better targeted?

*REFORM OF THE WATER AND SANITATION SECTOR is occurring in many countries, and offers the potential to improve services to all. Of particular concern, however, is the situation of the poor, and reform must be designed so that they receive increased access to affordable services. A key issue in this regard is water pricing, which is one of the main variables affecting the distribution of benefits between different stakeholders. However, experience shows that water pricing, and the subsidies which are often delivered through water tariffs, can be a source of major inefficiencies in the sector.*

*While affordability has been one of the prime concerns of those setting tariffs and designing subsidies, there may be significant flaws in many common pricing strategies and subsidy delivery mechanisms. Rather than providing affordable water to the poor, these may in fact be leading to financial unsustainability of utilities, lack of access to services, and inequity. The reform process provides the opportunity to rationalize and reconsider the design of tariff and subsidy structures, and seek new ones which may provide better results.*

*This series of papers is designed to examine these issues in South Asia. It is designed to present the basics of tariff and subsidy issues, to disseminate recent research findings, and to stimulate debate on the subject.*

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Picture by Indo-US AID FIRE-D Project

An earlier paper in this series examined the extent to which current water subsidies in two south Asian cities — Bangalore and Kathmandu — succeeded in reaching poor households. The paper concluded that subsidies to private taps were very poorly targeted; since barely 30% of the beneficiaries are poor, and only 25% of the subsidy resources are captured by poor households. A key underlying reason for this is that more than half of poor households in these cities do not have private water connections at all. Subsidies to public taps perform considerably better in equity terms, in that around 70% of the beneficiaries are poor and they in turn capture around 70% of the subsidy resources. However, even in the case of public taps, a significant proportion of the poor in the two cities fail to benefit from the subsidies.

The poor targeting of subsidies for water consumption from private taps raises the question of whether anything can be done to improve the way subsidies are designed. Building on the same information base for the cities of Bangalore and Kathmandu, it is possible to

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simulate alternative subsidy systems and examine whether they perform any better than the status quo. In particular, it is interesting to investigate whether use of geographic or individual targeting mechanisms that select subsidy beneficiaries on the basis of poverty criteria perform any better in delivering subsidies than the traditional Increasing Block Tariff (IBT) structure currently used in both cities. Another important issue is whether it is easier to reach the poor by subsidizing private water connections rather than water consumption.

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three and fivefold in the two cities in the cases considered. Moreover, the various forms of targeting considered prove to be extremely successful in reducing the leakage of subsidies towards households that do not really need them. Indeed, targeting on the basis of geographical location or housing characteristics can double the share of subsidy expenditure that reaches the poor.

However, unfortunately, targeting criteria also have the effect of mistakenly excluding households that are genuinely poor, and this may be a major drawback if the ultimate policy objective is to ensure that *all* poor households can afford to meet their subsistence needs for water. Targeted connection subsidies on the other hand do an equally good job of avoiding leakage to undeserving households, while at the same time reaching a much higher proportion of the poor. Connection

subsidies essentially prove easier to target because there is already a much higher concentration of poor people among the unconnected population than among those who already enjoy access to piped water.

## How were the simulations done?

This discussion is based on the results of two city-level household surveys conducted in Kathmandu (Nepal) in April 2001, and Bangalore (India) in August 2001. Both surveys collected a wide range of information including household water expenditure, type of water supply, physical characteristics of the dwelling, and socioeconomic characteristics of the household (including overall income or expenditure). A more complete description of the data, and the water supply situation in the two cities can be found in an earlier paper in this series<sup>1</sup>.

Using the survey data, it was possible to estimate the amount of water consumed by each household in the two cities. Different methods were used depending on the type of customer. For those relying on public taps, consumption was estimated from reports about the number of containers that they filled on average each day, and the volume of those containers. For those with metered private taps, consumption was inferred from reported water expenditure by applying the current tariff structure. For those with unmetered private taps, consumption was imputed based on other household characteristics (family size, type of dwelling, etc), using a statistical water consumption model developed with data from metered households.

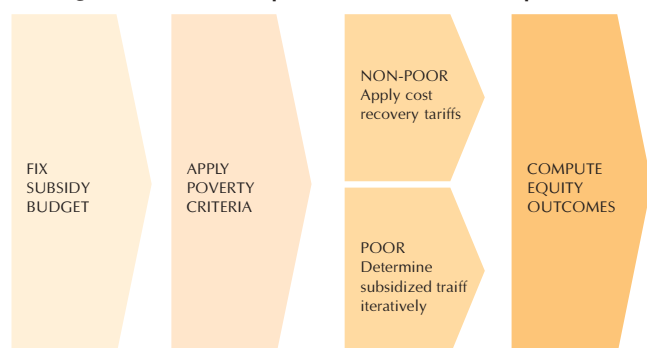
It is important to note that, due to the intermittent nature of water supply in South Asia, meters can often become damaged, either under-recording true consumption or breaking down altogether. This clearly makes it difficult to achieve reliable estimates of water consumption from water expenditure, particularly since

<sup>1</sup> Paper #4 Do current subsidies reach the poor?

there are no reliable estimates of the extent to which meters malfunction or under-record. The likely effect of this phenomenon is to dampen the variation in water consumption estimates between households. However, as long as there is no systematic relationship between meter malfunctioning and income level, the phenomenon should not necessarily affect measurements of the distribution of water consumption across income groups, which is the primary focus of this analysis.

These consumption estimates provide the basis for a simulation process that explores the distributional impacts of targeting subsidies in a variety of different ways. The key steps in the process are summarized graphically in Figure 1.

**Figure 1: Schematic representation of simulation process**



All the simulations involve dramatically reducing the total volume of subsidies relative to the status quo. Specifically, they are reduced to 36% of current levels in Kathmandu, and 18% in Bangalore. As a result, utility revenues increase by threefold in Kathmandu and fivefold in Bangalore. This reduction in subsidies is achieved by applying tight eligibility criteria for subsidies. Customers who meet these criteria face prices that are only a little higher than those currently charged for the first consumption block in each city.

The exact level of subsidized tariffs for these customers is determined iteratively to ensure that the

overall volume of subsidies remains within a fixed subsidy budget. From a methodological perspective, it is important to ensure that the total amount of subsidy given is held constant across each of the different tariff structures that are simulated for each city. Since it is much easier to reach the poor with a larger subsidy budget, it would be unfair to make comparisons across different targeting criteria unless the subsidy budget were the same in each case.

Customers that do not meet the poverty criteria are charged full cost recovery tariffs. This is in contrast to the status quo, where the use of Increasing Block Tariffs (IBTs) with large initial blocks and only small increases in the upper blocks (never reaching cost recovery levels) means that subsidies are effectively being allocated indiscriminately to all customers. For the purposes of these simulations, cost recovery tariffs are taken from recent engineering studies that quantify operating and maintenance costs as well as debt service charges. Information on capital depreciation was not available, and hence the values of NPR 13/m<sup>3</sup> (US\$ 0.17/m<sup>3</sup>) in Kathmandu, and Rs. 17/m<sup>3</sup> (US\$ 0.34/m<sup>3</sup>) in Bangalore still fall significantly short of full cost recovery.

Nonetheless, they represent increases of 300 to 400% over the tariff currently charged for the first consumption block, and increases of 33 to 50% over the marginal tariff currently faced by most customers. An earlier paper in this series looked at the extent to which cost recovery tariffs were affordable for Indian households<sup>2</sup>. The results showed that at the proposed tariff level, about 95% of Indian households could afford a basic subsistence consumption of five cubic meters per month, but only 60% could afford to buy 10 cubic meters. This is consistent with data from the Kathmandu study, which suggests that the poor could afford to pay more than 7 times the price of the current 'lifeline' block of water<sup>3</sup>. Indeed, the willingness to pay by the poor, reported in

<sup>2</sup> Paper #2 A Scorecard for India

<sup>3</sup> Based on a median income for the poor of NPR 6000, a lifeline block priced at NPR 40, and an affordability threshold of 5% of income. S.K. Pattanayak, J.C. Yang, D. Whittington, and B. Kumar K.C., 2002, "Willingness to Pay for Improved Water Supply in Kathmandu Valley", Nepal, RTI, North Carolina

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the study, was as high as NPR 620 per month (about US\$ 8.00) for a reliable piped water supply<sup>4</sup>.

Since the simulations involve changing prices for just about all customers, it was essential to make assumptions as to how people's demand for water would change in the light of rising prices. Based on the economic literature, a price elasticity<sup>5</sup> of  $-0.5$  was used, meaning that consumers reduce water consumption by 5% for every 10% increase in prices. In some cases, price increases were large enough that demand would theoretically drop to zero if this assumption were applied. To avoid this problem, a maximum demand reduction of 33% was arbitrarily imposed for large price changes.

Finally, for the purpose of evaluating whether subsidies reach the poor, the people in the bottom 40% of the income distribution for each city are considered to be living in poverty. The simulations deliberately avoided the use of official poverty lines, preferring to apply a relative rather than absolute concept of poverty. This has the advantage of ensuring that the definition of poverty is consistent across the two city cases. Using this definition of poverty, the equity outcome of each subsidy simulation is evaluated on the basis of a number of standard indicators. These include the leakage rate (or proportion of total subsidy resources captured by the non-poor), the errors of inclusion (or proportion of total subsidy beneficiaries who are not poor), and the errors of exclusion (or proportion of the poor who are not subsidy beneficiaries). A full set of results are provided in the Annex, and the main highlights are summarized as follows.

### Does it help to target consumption subsidies?

A key question is whether it is possible to improve upon



Picture by Indo-US/ID FIRE-D Project

current IBT tariffs as a way of targeting subsidies to the poor. Evidently, the ideal would be to allocate subsidies to households on the basis of their actual income, also known as 'means-testing'. However, in practice it is very difficult to estimate a household's income with any degree of accuracy, particularly in developing countries where there is a high degree of informality. For this reason, targeted subsidy schemes typically rely on more readily observable indicators, or 'proxies' for poverty. In this case, three types of poverty proxies are considered: the volume of water consumption, the characteristics of the neighborhood, and the characteristics of the dwelling.

The first approach is to modify the IBT structure so that the size of the first block is reduced to a level more consistent with the idea that this is an amount needed for subsistence consumption. The initial subsidized block is thus reduced to six cubic meters per month for both cities, with all consumption above this threshold charged at cost recovery levels. Two problems still remain: given that the difference in average water consumption between rich and poor was only around 20% for both

<sup>4</sup> In India, willingness to pay studies have shown that households in several cities are willing to pay more than the current tariff for reliable water services: for instance 1995 studies in Dehradun and Baroda showed a willingness to pay of 2 times and 3.4 times the current tariff, respectively. Water and Sanitation Program, *Willing to Pay but Unwilling to Charge*, Fieldnote, June 1999

<sup>5</sup> Price elasticity is defined as the responsiveness of quantity demanded to a change in price, with all other factors held constant, defined as proportionate change in quantity demanded divided by proportionate change in price

cities, there is no reason to assume that the consumption of the poor falls entirely into the subsistence consumption block, particularly if they share a connection between several families.

The second approach is to introduce geographical targeting, by limiting subsidies to residents of neighborhoods that satisfied certain poverty criteria. In Bangalore, this meant limiting subsidies to residents of officially designated slums. Since such officially designated slums do not exist in Kathmandu, the subsidy was applied to neighborhoods where at least 60% of residents lived under the poverty line. Initial explorations showed that such geographical criteria are able to correctly classify around 62% of the population as either poor or non-poor. However, the proportion of the poor who live in geographically defined slum areas is less than 20%.

The third approach is to introduce individual targeting by identifying a number of variables that are good predictors of poverty at the household level but at the same time are relatively easy to observe and difficult to misrepresent. In both cases, a formula based on housing characteristics was developed.

For Bangalore, a statistical model was developed to predict the probability that a particular household was poor based on the nature of floor and roof materials, the size of the dwelling, the type of dwelling, the presence of a separate kitchen, and the presence of a flush toilet. Prior tests showed that this formula correctly identified 64% of households as either poor or not poor; however only a quarter of the poor live in deficient housing of this type.

For Kathmandu, subsidies were applied to any household that met at least two of the following three characteristics: lacking a telephone; living in a dwelling that does not incorporate cement in either floor, walls, or roof; using traditional fuels rather than gas or electricity for cooking. This formula correctly identified 82% of the households it was applied to as either poor or not poor. However, once again, it does much better at identifying

non-poor households than poor households. In fact, only a third of poor households meet these criteria.

The results of applying these different targeting schemes can be compared in a number of different ways (Figure 2). An important criterion is the share of total subsidy *resources* that leak away to non-poor households in each case; shown as the light yellow columns in Figure 2. These are closely related to the errors of inclusion or the percentage of total subsidy *beneficiaries* who are not poor; shown as the darker yellow line in Figure 2, which follows the light yellow columns quite closely. Finally, it is also important to look at errors of exclusion, which give the percentage of the poor who do *not* benefit from the subsidy; these are represented

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by maroon lines in Figure 2. Since all of these indicators capture failings in the subsidy system, the lower their value the better the performance of the subsidy.

The conclusions that emerge from this analysis are clear, and also very consistent across the two cities.

On the one hand, the modified IBT tariff barely performs any better than the original IBT, indicating that it is not possible to improve targeting simply by playing around with the design of the IBT structure. Nonetheless, it is important to note that the modified IBT generates *three to five times more revenue* for the utility than the status quo, without worsening the targeting performance of the tariffs.

On the other hand, use of explicit targeting schemes — be they geographic or individual — leads to major improvements in performance. The proportion of subsidies leaking away to non-poor

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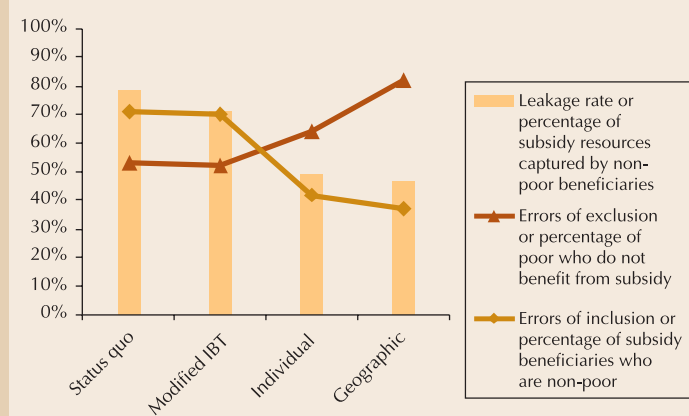
households, as well as the errors of inclusion, fall to approximately half of their original levels (see the yellow lines and columns in Figure 2). The difference in results between geographic and individual targeting is not that great; although geographic targeting performs slightly better in Kathmandu and individual targeting slightly better in Bangalore. The fact that the accuracy of geographic targeting is just as good as individual targeting is an important finding given that the administrative costs of geographic targeting are substantially lower – all that would be required is for the utility to include in its customer database an indicator of whether a customer lived in a designated slum.

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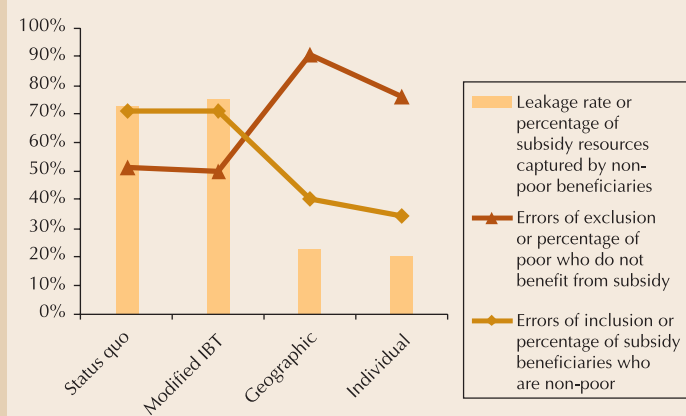
Unfortunately, there is a downside. The price of lowering the errors of inclusion is to substantially raise the errors of exclusion, to a point where as many as 80 to 90% of the poor are excluded from the subsidy (see the maroon lines in Figure 2). There is thus a trade-off between errors of inclusion and errors of exclusion – this is visually evident from the ‘X’ shape that appears in the graph. However, since only about 50% of the poor are connected, the errors of exclusion cannot, by definition, be any lower than 50%.

The intuition behind this trade-off is straightforward. In order to avoid the major problems associated with direct means-testing of beneficiaries, poverty proxies have been used that are based either on neighborhood or housing quality. However, while there are very few rich people that live in slums or very basic housing, there are plenty of poor people who live outside slums or have managed to secure slightly more decent housing, perhaps as poor tenants in better-off neighborhoods. Hence, by applying targeting criteria of this kind, both rich and poor are being excluded from the subsidy, leading to the results that have been seen for errors of inclusion and exclusion.

Figure 2: Comparison of alternative forms of targeting



(a) Kathmandu



(b) Bangalore

Given these trade-offs, which is the best approach? The answer, of course, depends on the relative importance one attaches to errors of inclusion and exclusion. If the policy objective is to deliver resources as cost-effectively as possible to the poor, then the most important consideration is to minimize the errors of inclusion, and targeting subsidies would therefore make sense. If, on the other hand, the policy objective is to ensure that all the poor have a basic safety net of affordable access to water, then errors of exclusion become the overriding consideration, suggesting an IBT approach.

It is important to put these results in perspective. The problem of effectively targeting subsidies is neither unique to South Asia, nor unique to the water sector. A recent study of water subsidies in Chile and Colombia found errors of inclusion in the 60 to 80% range, while a number of studies of electricity subsidies around the world have found that barely 10 to 35% of these subsidy resources reach poor households. Moreover, a study by the Indian National Institute for Public Finance and Policy (NIPFP) concluded that food subsidies allocated via the Public Distribution System (PDS) suffered from errors of inclusion between 34-52%, and errors of exclusion between 25-98%.

### Are connection subsidies any more equitable?

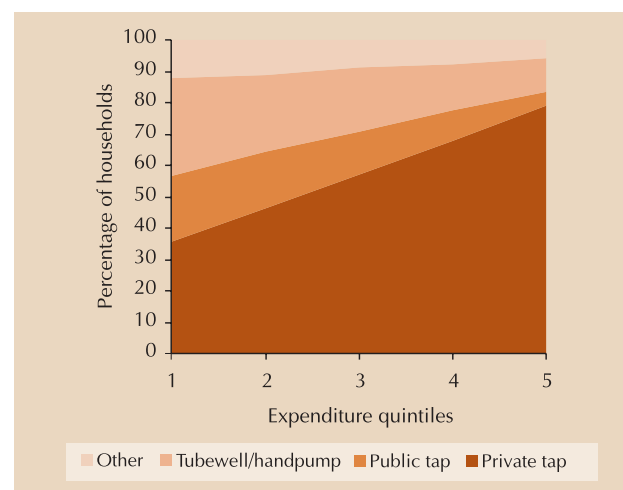
Given the problems that have been seen with targeting of consumption subsidies, it is relevant to ask whether connection subsidies would perform any better in targeting terms. There are reasons to think that they might.

In particular, it is noteworthy that almost all higher income households are already connected to the water network, whereas a high proportion of unconnected households tend to belong to lower income groups (see Figure 3). For example, according

to the Indian National Sample Survey (50<sup>th</sup> Round) 1993/4, 68% of non-poor households in India have private taps, whereas 55% of unconnected households are poor. Moreover, an earlier paper in this series<sup>6</sup> found that connection subsidies were, in practice, widely used in India, given that connections are typically charged at Rs. 1,000 (US\$ 20), which is likely to be only about 10% of the full cost.

In order to evaluate this hypothesis, an additional set of simulations were performed. They involve eliminating all subsidies for water consumption, so that all consumers are charged full cost recovery tariffs on all units of consumption. The subsidy budget that is thereby saved is then allocated in its entirety to subsidizing new connections, at an estimated cost of US\$ 75 per connection in Kathmandu and US\$ 150 in Bangalore. This policy is pursued consistently over a number of years until universal coverage is reached. Given the available subsidy resources, it takes no more than a decade to reach universal coverage in both cities, although this assumes that parallel investments in network expansion and densification could also be financed.

Figure 3: Coverage of water services in India



Source: National Sample Survey (50<sup>th</sup> Round) 1993/4

<sup>6</sup> Paper #2 A Scorecard for India

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Both targeted and untargeted connection subsidies are considered. In the absence of targeting, connection subsidies are allocated at random to unconnected households. Under the other scenario, the same individual targeting scheme developed for consumption subsidies (based on housing characteristics) is used, so that connection subsidies are only granted to households that comply with these criteria.

To facilitate comparisons, the results for targeted and untargeted connection subsidies are presented alongside those for the status quo, as well as the best performing of the targeted consumption subsidies for each of the two cities (Figure 4). As before, the performance of the different schemes can be evaluated in terms of leakage

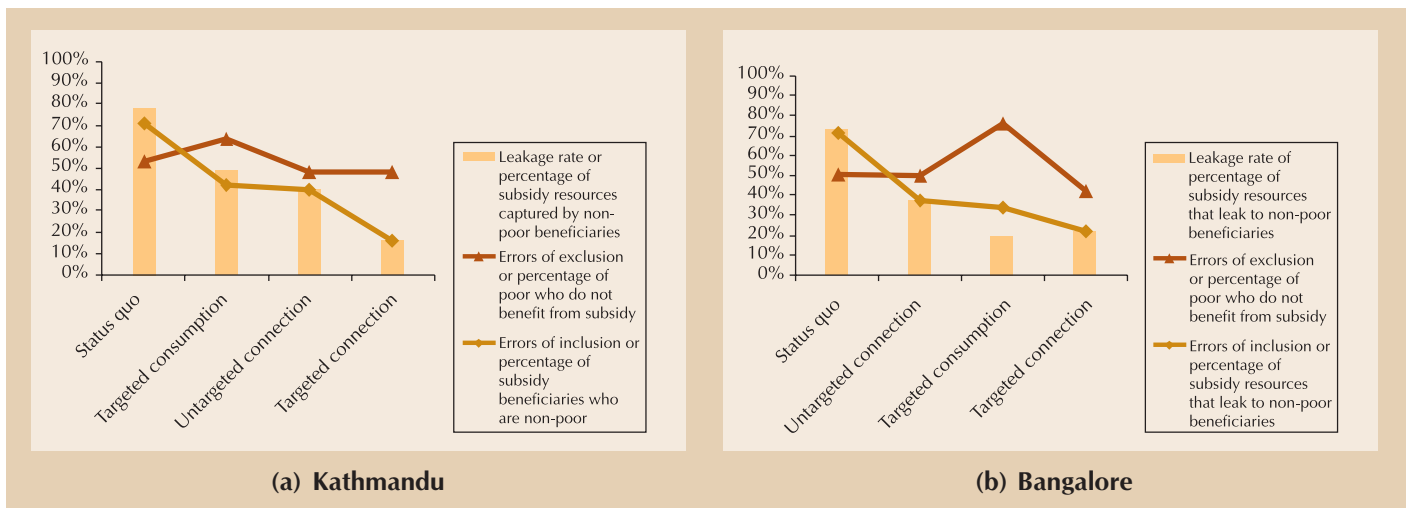
rates, as well as errors of inclusion and exclusion. To recap, the leakage rates (represented by light yellow columns on the graph) indicate the percentage of subsidy resources that fail to reach the poor, and are related to the errors of inclusion (represented by the yellow lines on the graph), which capture the proportion of subsidy beneficiaries who are not poor. Finally, it is also important to evaluate the errors of exclusion (represented by the maroon lines on the graph), which capture the proportion of the poor who fail to receive any subsidy.

Once again, the conclusions are comparatively clear and consistent across the two cities.

The most striking feature of the results is that the trade-off between errors of inclusion and exclusion essentially disappears. That is to say that targeted connection subsidies have leakage rates and errors of inclusion that are barely a quarter of those associated with the status quo IBT, *but most importantly they also have lower errors of exclusion*. Targeted connection subsidies also perform significantly better than targeted consumption subsidies, across all three performance indicators, *even though the same targeting mechanism is being used in both cases*. Even untargeted

**Targeted connection subsidies have leakage rates and errors of exclusion that are barely a quarter of those associated with the status quo IBT.**

Figure 4: Comparison of consumption and connection subsidies



connection subsidies perform considerably better than the status quo.

## Conclusions

To summarize, the study finds that targeting of subsidies to poor consumers and introduction of cost recovery tariffs has a major impact on utility revenues, raising them by three to fivefold for the specific cases considered here. At the same time, targeting on the basis of geographical location or housing characteristics can reduce the extent of subsidy leakage by about a half, thereby doubling the share of subsidy expenditure that reaches the poor. However, unfortunately, targeting criteria also have the effect of mistakenly excluding households that are genuinely poor, so that errors of exclusion rise from 50% to around 80%.

This creates a trade-off that can only be resolved with reference to ultimate policy goals. Essentially, targeting subsidies makes sense if the objective is to deliver resources to the poor as cost-effectively as possible. On the other hand, if policy makers are particularly worried that poor

households without subsidies may not be able to afford to meet their subsistence needs, or if means testing is administratively complex or prone to corruption, then IBTs may provide a 'second best' solution in that at least all the connected poor receive some subsidized water. However, in order to improve the financial health of the utility by containing subsidy expenditure, IBTs need to be much better designed, with shorter initial blocks and steeper gradients, ensuring that the upper blocks reach cost recovery levels. Nevertheless, IBTs do nothing to assist the unconnected poor who must often make do with a much less adequate water service potentially at higher cost (and in fact a redesigned IBT with steeper gradients puts poor households who share connections at a disadvantage).

The only way to ensure that these people benefit from government subsidies to water utilities is to increase coverage of private connections. The simulations show that targeted *connection* subsidies perform much better than targeted *consumption* subsidies, even when the same targeting mechanism is used. They are significantly

## Annex

### Summary of Results

Subsidy scheme	Quasi-Gini		Poor get percentage subsidy		Errors of exclusion		Errors of inclusion	
	Kath.	B'lore	Kath.	B'lore	Kath.	B'lore	Kath.	B'lore
<b>Status quo</b>								
Private taps	0.243	0.217	22%	27%	53%	51%	71%	71%
Public taps	-0.301	-0.588	61%	86%	72%	61%	38%	23%
<b>Improved targeting of consumption subsidies</b>								
a. Modified IBT	0.116	0.190	29%	25%	52%	50%	70%	71%
b. Geographic targeting	-0.196	-0.516	53%	77%	82%	91%	37%	40%
c. Individual targeting	-0.183	-0.514	51%	80%	64%	76%	42%	34%
<b>Connection subsidies</b>								
a. Untargeted	-0.277	-0.315	60%	63%	48%	50%	40%	37%
b. Individual targeting	-0.512	-0.479	84%	78%	48%	42%	16%	22%

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more effective at avoiding leakage to undeserving households, while at the same time reaching a similar overall percentage of the poor. As much as 80% of subsidy resources can be delivered to the poor by this means — and with a similar subsidy budget to that used for consumption subsidies — it may be possible to reach all of the unconnected poor within a decade. Connection subsidies essentially prove easier to target because there is already a much higher concentration of poor people among the unconnected population than among those who already enjoy access to piped water.

In practice, however, it may not always be possible to choose between consumption and connection subsidies. In the two South Asian cities studies, approximately half of the poor were connected and half unconnected, so that any policy that aims to reach all of the poor will need to consider both of these approaches.

Finally, it is important to note that subsidizing prices of basic goods such as water is essentially just an indirect way of redistributing income. Precisely for this reason, economists argue that it is far preferable to meet income distribution goals through a comprehensive, government-administered social safety net, in the form of targeted income transfers. This avoids the side effect of distorting the prices of goods and services. It also gives the beneficiary household the freedom to determine how these resources should be spent. However, in many developing countries, the administrative obstacles to such a system are often too great, and subsidies to specific essential services may therefore become justified. While there is no easy solution to the problem of targeting subsidies in the urban water sector, the simulations presented here have shown that there are relatively straightforward ways of making significant improvements; these mechanisms offer the potential for substantially reducing subsidy budgets while still providing assistance to the poor.

*Prepared by: Vivien Foster, Subhrendu Pattanayak, and Linda Stalker Prokopy. The paper is based on the following consultants' reports: Prokopy, L. 2002 'Distributional Incidence of Current and Potential Water Tariffs and Subsidies in Bangalore, India', University of North Carolina; and Pattanayak, S.K. and Yang, J.C. 2002 'Distributional Incidence of Water Tariffs and Subsidies in Kathmandu, Nepal', Research Triangle Institute, North Carolina*

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