A Framework for Analyzing Tariffs and Subsidies in Water Provision to Urban Households in Developing Countries

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Abstract

The aim of the paper is to present a basic conceptual framework for understanding the main practical issues and challenges relating to tariffs and subsidies in the water sector in developing countries. The paper introduces the basic economic notions relevant to the water sector ; presents an analytical framework for assessing the need for and evaluating subsidies ; and discusses the recent evidence on the features and performance of water tariffs and subsidies in various regions, with a special focus on Africa. The discussion is limited to the provision of drinking water to urban households in developing countries. Among the issues examined are: (i) What are the main questions that arise when governments want to subsidize access to and consumption of water? (ii) What are the key features of water tariffs and subsidies that have been implemented around the world? (iii) How can we assess the performance of various subsidy programs? (iv) How well have subsidies performed in practice? The final section of the paper briefly attempts to draw some lessons from the review of evidence undertaken in the previous sections.

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Contents

List of figures

List of tables

1 Introduction

Access to improved drinking water has long been recognized as one of the main challenges of development. One of the targets of the Millennium Development Goals (MDGs) is to reduce by half the proportion of people without sustainable access to safe drinking water by 2015. For Africa, achieving this objective is likely to represent an even greater challenge than in other regions of the world. A crucial challenge in improving the coverage of water services in poor countries is the financing of investment in water production and distribution capacity. This issue has received considerable attention among the development community (see e.g. World Water Council, 2006). The issue of water tariffs and subsidies has perhaps received less attention, although it is also crucial to the matter. This paper focuses on water tariffs and subsidies, both from a normative and a positive side.

The aim of the paper is to present a basic conceptual framework for understanding the main practical issues and challenges relating to tariffs and subsidies in the water sector in developing countries. It introduces the basic economic notions relevant to the water sector ; presents an analytical framework for assessing the need for and evaluating subsidies ; and discusses the recent evidence on the features and performance of water tariffs and subsidies in various regions, with a special focus on Africa. The discussion is limited to the provision of drinking water to urban households in developing countries.[1] Among the issues examined are: (i) What are the main questions that arise when governments want to subsidize access to and consumption of water? (ii) What are the key features of water tariffs and subsidies that have been implemented around the world? (iii) How can we assess the performance of various subsidy programs? (iv) How well have subsidies performed in practice?

Rather than in producing new messages, the value added of the paper lies in its bringing together concepts and evidence from distinct fields of literature. On the one hand, theoretical publications on utility tariffs and subsidies have focused heavily on optimal incentive schemes for utility management as well as broader regulatory issues (see Joskow, 2005, for a synthesis). On the other hand, empirical publications, mostly from development institutions, tend to focus on specific projects or countries and do not necessarily make explicit links or references to the theory. In the middle, the public finance-oriented literature, which has been used to provide analytical frameworks for the evaluation of subsidies in various sectors such as education and housing, has rarely been used in the context of water provision. This paper, by bringing together those three strands of literature, aims at offering practitioners a compact and unified framework to think about tariffs and subsidies in the water sector.

Among various sources, the paper relies on two recent studies. The first one, published in 2005 by Paul Joskow, reviews the theoretical underpinnings of water cost structure and tariffs (Joskow, 2005) and their implications for regulation. The second one, published in 2005 by the World Bank, carefully reviews most of the existing studies of water tariffs and subsidies in developing countries, with a view to assess their performance in targeting the poor (Komives et al, 2005). The reader is referred to these two comprehensive papers for a more complete treatment of some the issues examined.

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[1] Broader problems of water allocation across sectors, in which tariffs play an important role, are not elaborated upon. However, it should be kept in mind that allocation of water between sectors has been and remains a pervasive policy issue, in developing and developed countries alike. Inefficient allocations sustained by distorted prices or subsidies to, e.g. agricultural water use, may generate waste of water and/or unsustainable water consumption. The problem is exacerbated in countries or regions where water is scarce. In those circumstances, re-allocation of the available water supply between customers may already go a long way to alleviating water scarcity problems; and getting incentives right for an efficient use of water by different users may prove to be the most urgent question to tackle.

The paper is constructed as follows. Section 2 introduces the framework of drinking water provision in developing countries. It introduces the various ways by which water is supplied, the variety of water providers, as well as the institutional setting in which water distribution takes place. It then briefly recapitulates the economics behind costs and tariffs in the water sector, with an emphasis on utilities. In section 3, water subsidies are introduced. This section also presents public economics criteria by which subsidy programs may be evaluated. Section 4 examines the performance of tariffs and subsidies, as analyzed from real cases. The final section of the paper briefly attempts to draw some lessons from the review of evidence undertaken in the previous sections.

2 Provision of Drinking Water: Basic Notions

This section presents the basic environment in which potable water provision occurs, with an emphasis on contexts found in developing countries. It also examines in more details the economics behind costs and tariff structures in water provision and highlights the main factors influencing the observed discrepancy between costs and tariffs.

2-1 Institutional Setting

Water provision in the urban context takes place in a legal and regulatory environment which typically combines several levels of intervention.

At the international level, the Millennium Development Goals (MDGs) include several targets directly or indirectly related to water management. The target which has the most direct impact on national policies relating to access to drinking water is target 10, which reads : "*Halve by 2015, the proportion of people without sustainable access to safe drinking water and improved sanitation*".

At the national level, the following entities usually have a say in defining the environment in which provision of drinking water takes place:

- The State, through line ministries in charge of water and sanitation, and sometimes through ministries in charge of social programs (mostly for the subsidy aspect),
- The regulating agency, which may be part of the sector ministry or independent,
- Intermediate levels of government, which may intervene for example in the implementation of water subsidies,
- Municipalities, which are typically responsible for basic service provision in their jurisdictions, and may own local utility companies.

Other stakeholders may be associated to policy-making to varying degrees depending on the country considered; they include in particular:

- Water utility companies (public or private);
- Alternative providers (communities, private sector entities);
- Households, as well as other types of consumers (agricultural, commercial and industrial), directly or through intermediaries, e.g. community representatives.

It is not the subject of this paper to dwell on the relations between these different stakeholders, nor to examine how their interaction results in particular sets of policies, tariffs, and subsidies for water supply. However, the mere mention of this variety of stakeholders should make clear that political economy

considerations play a key role in the outcomes observed at the national and local level.[2] In the context of this paper, which aims at examining the nature and performances of tariffs and subsidy programs, two specific points are worth emphasizing:

First, the degree to which international goals such as the MDGs are integrated into national policies and percolate to local level actors such as utilities is highly variable. In some cases, the connection is minimal or even non-existent; that is, national goals in terms of access to potable water are not disaggregated into ground-level objectives and operational programs that would allow the achievement of these goals.[3]

Second, at the national level, the different actors (e.g. in a simple configuration, the State, the regulator, the utility companies, and municipalities) have different and potentially conflicting objectives.[4] In a context of private utility companies, these problems are exacerbated by asymmetric information, i.e., the utility has more information on its technology and costs than the regulator does. This generates informational rents, which the regulator has to minimize by designing adequate mechanisms. An associated problem is so-called "regulatory capture", by which the regulator may collude with utilities at the expense of the taxpayers.

The problems associated with asymmetry of information between utilities and their regulators have received a lot of attention in the economic literature. It is not the subject of this paper to describe them in detail, and the reader is referred to e.g. Joskow (2005), Laffont and Tirole (1993). For the purpose of this paper, it suffices to note that these problems translate concretely into a question of credibility of regulators. In developing country contexts, where capacities may be limited, the independence of the regulator both from the Ministry of Water and from the utility companies (public or private) which operate the services has been a recurrent stumbling block in water sector reforms.[5]

2-2 Different Forms of Access and Provision

In contrast with developed countries where the provision of drinking water to households is overwhelmingly achieved through utilities, access to drinking water in developing countries encompasses many forms. Indeed, rates of connection to the public network vary a lot across countries, as well as within countries. Other forms of provision include:

- Direct access to a water source (underground or surface);
- Access to alternative sources of water, typically provided by the private sector (e.g. water tankers, water carts, kiosks, bottled water);

[2] The focus here is on the supply of drinking water to urban households. When broader problems of water allocation, say between different types of consumers, are considered, the number of stakeholders increase dramatically, and so does the importance of political economy considerations over economic considerations in the outcomes in terms of tariffs and subsidies.

[3] This could stem from a number of factors, including: (i) the fact that the set of people who attend international meetings devoted to MDGs does not intersect with the set of local stakeholders implementing water policies on the ground, such as utility managers; (ii) the lack of comprehensive water policies, implementation plans, and related budgets; (iii) deficiencies in the local implementation of national policies reflecting the MDGs.

[4] For example, the State may be concerned with universal access to piped water; with ways of ensuring that the poor benefit from minimal standards of service; and with avoiding adverse environmental outcomes from water sector activities. The regulator will tend to focus on enforcing minimal standards of quality of service and norms for extension of the network. It may impose obligations of universal service upon the providers (see below). Municipalities will be concerned by aspects relating to provision in their jurisdiction. Lastly, utility companies will aim at maximizing profits under the prevailing regulatory constraints.

[5] For an introduction to the challenges of pro-poor regulation in a developing country context, see Trémolet and Halphern, 2006.

- Access to piped water through community taps or standpipes.

In economic terms, water provision can be categorized as a multi-attribute product. Water services can be defined by (at least) three dimensions: price, quantity, and quality. Price refers to the price of a unit of drinking water (liter or cubic meter). Quantity refers to the number of such units. In the case of water services, quality must be added to the list, reflecting the fact that different forms of water provision are imperfect substitutes. Quality is a vector of attributes, which encompasses *inter alia* the following dimensions:

- composition in terms of toxins, pollutants, etc., hazardous to health;
- degree of privacy and availability of the service (private house tap – yard tap – tanker – kiosk – well, etc.);
- physical characteristics of the service (water flow at the tap; water pressure; etc.);
- reliability of the service over time (predictability / advance notice for disconnection; shortage periods; pressure variations; etc.).

It is important to note that in many countries, households have to rely on more than one source of water. This is the case even for families connected to the public network, because of limitations to the services provided by the utility, which take many forms depending on the local context: rationing of certain areas; low water pressures; periodic shortages; or leaks in the network. The implications of this diversity in terms of social policies will be elaborated upon in this paper.

2-3 Costs

We will mainly discuss the structure of costs for water utilities. This is a well studied domain, notably because knowledge of the cost structure of the water industry has for a long time been critical to regulatory institutions in developed countries. Moreover, the utility model is still seen as the standard paradigm for water services delivery in urban contexts and, as such, has received a lot of attention from governments, economists, financiers, and development institutions. By contrast, the cost structure of alternative forms of provision is far less well known and has only recently come under scrutiny (see Kariuki and Schwartz, 2005).

Water utilities typically engage in the production, treatment, transport and distribution of drinking water to customers located in their service area. These activities typically have increasing returns to scale, at least up to a certain size (see Joskow, 2005). Compared to other utilities like telecommunications and electricity, water production is very capital-intensive (see Komives et al, 2005, p33).[6] Moreover, the capital assets used in water supply cannot be moved to another location and are generally unusable for any other purpose; they represent an extreme type of fixed capital, associated with sunk costs.

As a consequence of these two features, water production is typically thought of as a natural monopoly. That is, it is typically the case that long-run marginal costs are below long-run average costs. A well known but very important consequence of this feature of the production technology is that, supposing it were possible to precisely define a "marginal cost " that customers had to pay (see the discussion below), one-part tariffs based on marginal costs would not allow the utility to break even, since marginal costs are lower than average costs. Hence, water utilities tend to produce structural deficits. This feature is at odds with the objective of cost recovery, needed for the long-term financial sustainability of the utility.

[6] In the USA, for example, the ratio of capital investment to revenues in the water industry is double that in natural gas, and 70% higher than in electricity or telecommunications (Hanemann, 2006).

Theoretical solutions to this problem have long been known. Generally speaking, the solutions consist in engaging in some form of price discrimination, i.e. having different consumers pay different prices for the marginal unit of water (so-called "third-degree price discrimination"); having different units sold at different prices for any given consumer ("second-degree price discrimination", or non-linear tariff); or a combination of both.

Boiteux (1971) showed that the optimal uniform one-part tariff for a utility subject to a break-even constraint involves Ramsey pricing, i.e. consumers pay a markup over marginal cost which is inversely proportional to their price elasticity of demand.[7] A practical consequence of this finding is that industries, which have been found empirically to have higher price elasticities than individual consumers (see Komives et al., 2005, p18), should be charged less per unit than the latter. In practice, it is very often the contrary which occurs. It was later shown (Brown and Sibley, 1986) that two-part tariffs consisting of a fixed charge plus a variable charge reflecting water consumption, where water is priced at marginal cost, could do even better than Boiteux pricing in terms of efficiency. Among this class of tariffs, the most familiar structure is the one whereby customers share the fixed costs equally, and pay the marginal price of the units they consume (see section 2-4 below).

In practice, it is difficult to apply those concepts as precisely as one would like. The main problem is to define a marginal cost which should be applied to a particular consumer.

First, for the utility, short-run and long-run marginal costs of production differ widely. The short-run marginal cost of producing an additional cubic meter of water for a utility is typically very low, unless production capacity limits are reached (in which case there is the need for additional investment). The determinant of capacity needs will be the aggregation of individual consumer demands. This is analogous to electricity, where it is peak-load demand that really determines capacity needs. Relevant marginal costs of production should be the long-run costs.

Second, strictly speaking, short-run marginal costs vary across time. For example, water is scarcer during the dry season. To the extent that water has to be allocated between competing uses, tariffs should reflect the associated varying opportunity cost. In practice though, it has not been judged practical to price water so as to reflect all the sources of change in the costs of production.[8]

Third, the marginal cost of distributing an additional cubic meter of water for the utility varies, depending on which consumer gets it. This is because the cost of distribution varies with location, sometimes importantly. For example, marginal, mountainous areas located at the fringe of the city will be more expensive to service than centrally located, flat areas. Moreover, a large portion of the costs incurred by the utility is not easily attributable to particular consumers. This is the case of the costs of operation and maintenance for the water mains and the secondary network. Deciding who should pay for what portion of the expenses involves a large degree of arbitrariness. In practice, tariff structures tend to be uniform over large areas, and consumers with high access costs are subsidized by low-access cost customers. This lack of spatial differentiation of tariffs can stem either from political unwillingness to differentiate tariffs, or from explicit non-discrimination obligations imposed by the regulator.

[7] See Laffont and Tirole (2000) for a complete exposition of this result and generalizations.
[8] Water scarcity is reflected by higher tariffs in summer in some developed countries. For example, Maryland has a winter tariff and a summer tariff.

2-4 Tariffs

Utilities

As explained in Joskow (2005), if tariffs were to reflect costs, due to the structure of costs of utilities, the prevalent type of tariffs structure could take the form of a two-part tariff, composed of:

- a variable charge reflecting the marginal costs of providing an additional cubic meter of water for the utility;
- a fixed charge intended to cover the unattributable portion of the costs which is independent of the quantity consumed (fixed costs of production and distribution), as well as ensuring that the utility can break even.

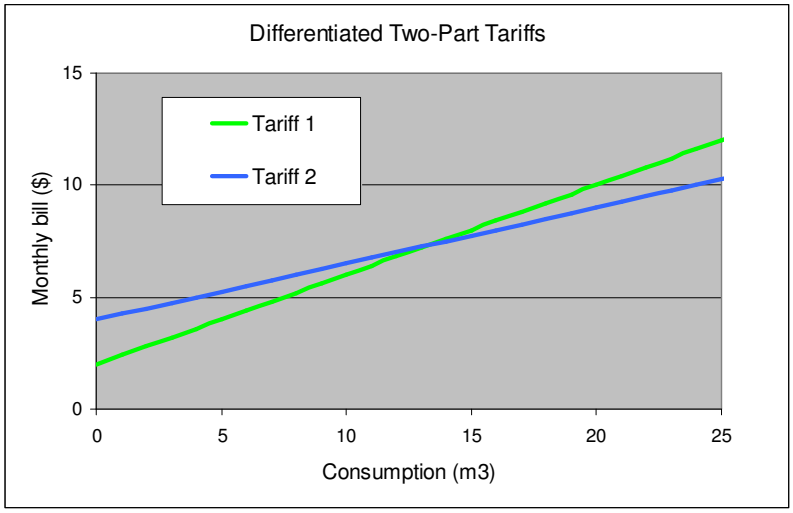
The simplest two-part tariff structure which ensures that the utility breaks even consists in dividing the fixed costs equally among the consumers, and charging the marginal cost on all units consumed. If all consumers were identical, it would make sense to provide the service as soon as the net surplus of consumers is positive. However, in practice consumers differ in income and tastes. In particular, the fixed charge implied by an even sharing of fixed costs may be large compared to the income of the poorest households. Some households facing this tariff structure will find it rational not to connect to the network[9], even though faced with a linear tariff they would consume a small quantity of water. Some households are then excluded from piped water consumption.

Provided the firm or the regulator has some information on the distribution of income and valuation of water services in the population, it is possible to improve on this outcome by combining second- and third-degree price discrimination. One solution is to propose a menu of non-linear tariffs which will better accommodate the heterogeneity of income and tastes in the population, and let households self-select into the tariff structures they prefer. For example, the utility can propose two tariffs: one "high-volume" service, with a high fixed charge and a low marginal rate, and a "low-volume" service, with a lower fixed charge but higher marginal rate. Households expecting to consume high quantities of water should select the former option, while those expecting to consume little water should select the latter (this example is drawn from Joskow, 2005). This tariff differentiation should mitigate the problem of a high fixed charge that could prevent poor households from connecting to the network. Such menus of tariffs have been used for decades in France for electricity. Such a menu is illustrated in Figure 1. In this example, the first tariff has a fixed charge of US $4 and a volumetric rate of US $0.25 per cubic meter. The second tariff has a fixed charge of US $2 and a volumetric rate of US$ 0.4. For consumption above 13 cubic meters, the first tariff is more economical.

In practice however, water tariffs are often very different from this theoretical structure. Table 1 below presents the most common forms of tariffs practiced by utilities. Among the different types of price structures presented here, Increasing Block Tariffs (IBTs) are by far the most common. In Latin America, IBTs frequently also include fixed charges, which makes the traditional distinction between IBTs and two-part tariffs irrelevant (see Komives et al, 2005). Importantly, in the absence of metering, only fixed charge tariffs can be implemented, which has important consequences in terms of subsidies (see below).

[9] In this paragraph we consider only recurrent expenditures on water and abstract from one-shot connection fees incurred at the time of connection. As later explained, when they are large relative to the income of households, connection fees can in fact exacerbate the problem and result in high proportions of households choosing not to connect to the available public network.

Figure 1 : Menu of Two-Part Tariffs



Source: author's elaboration

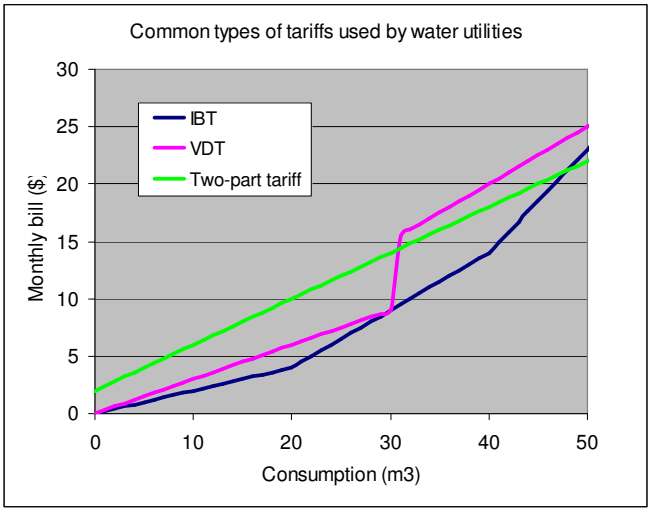
Table 1 : Water Tariff Structures Most Commonly Used by Utilities

Fixed Charge : the bill does not depend on the quantity of water consumed
Volumetric Charge : the bill depends on the quantity of water consumed
Uniform rate : all units (cubic meters) are priced at the same rate, independently of total consumption
Non-Uniform rate : units are priced differently
Block tariff : all units falling into certain bounds ("blocks") are priced the same
Increasing Block Tariff (IBT) : the marginal rate increases with the block
Decreasing Block Tariff : the marginal rate decreases with the block
Volume-differentiated tariffs (VDT) : all units are priced at the same rate, but the rate depends on total consumption
Two-Part Tariff : composed of a fixed charge plus a variable charge which depends on the quantity of water consumed
Uniform two-part tariff : the fixed charge and the volumetric rate are the same for all connections
Differentiated two-part tariff : there is a menu of services with different sets of fixed charges and rates
Fixed Charge plus Volumetric Rate : combine fixed charges with the tariffs above (e.g. IBT)

Source: author's elaboration

An increasingly common form of provision consists of providing a menu of services, differentiated by quality, e.g. private connection and community taps. Another example is a menu of connections with different technical characteristics (pressure, debit, etc.). In those cases, a menu of tariffs will reflect this differentiation. Yet another example is a menu of tariffs as the one described above in the differentiated two-part tariff. Those tariffs will be designed so as to induce households to self-select in the category that fits their needs best.

Figure 2 : Shape of Common Types of Tariffs Used by Utilities as a Function of Consumption



Source: author's elaboration

It is typically the case that subsidies are associated with such differentiated services. For example, consumption at public taps can be provided for free.[10] The objectives of such differentiated services and subsidies are : (i) to target subsidies to the poorer households or neighborhoods, by allowing households to self-select the form of service they prefer to use (the implicit assumption being that poor households are more likely to use the lower-quality service) ; and (ii) to achieve a greater coverage with the same amount of investment, lower quality services such as community taps being less costly to provide and covering the needs of more households than private connections.

Other providers

In the case of other providers, tariffs practiced depend on the nature of the provider. Community-based services or water services provided by NGOs can be expected to cover operation and maintenance costs. The precise way by which these costs are passed on to specific consumers, however, will depend on the local model. It can be assumed that private providers charge households prices that reflect their costs.

2-5 Discussion

In conclusion, there is often a disconnection between the costs incurred by utilities, and the tariffs which are used. We already mentioned theoretical reasons why that is the case. However, technical and political factors come into play as well.

A first factor of disconnection between costs and prices comes from the structure of the water industry. The tendency of water utilities to exhibit structural deficits, associated with the need for cost recovery, has often implied transfers from outside the utility. These transfers can be implemented in many forms (see section 3 below). Concretely, in many countries capital expenditures are subsidized or paid for by municipalities or other levels of government. Cost recovery tends to be based on recurrent costs, not on capital costs; tariffs typically do not take into account the opportunity cost of capital. The important point is that, almost by construction, revenues collected from the consumers are not expected to cover total expenditures from the utility as they should from a financial sustainability point of view.

[10] This is the case in Kathmandu, Nepal.

Another reason why prices do not reflect costs is technical. Implementing variable tariffs based on volume consumed by individual households supposes metering. In many countries, the proportion of connections which are metered is low. In many developed countries, the trend has been towards the generalization of metering, motivated by better incentive structures. Under a fixed charge tariff, the water bill being independent of the quantity consumed, there is no incentive to save on water use.[11] However, in many developing countries, metering is not yet common. Moreover, in some cases, systematic metering may not be the best approach because the associated costs may be greater than the associated benefits.

Lastly, water tariffs, on top of economic considerations, frequently reflect policy objectives.[12] The "natural monopoly" characteristics of water utilities, together with the politically sensitive nature of water provision, have often provided a rationale for government involvement in water provision. In some countries, government intervention tended to take the form of public ownership of utilities, with no separate regulation function. In many countries, this is still the dominant paradigm. Elsewhere, however, government intervention has evolved towards regulation, with production and distribution increasingly left to independent operators (public or private). Historically, regulation has given substantial consideration to the way monopoly rents are shared between utilities and the consumers, with an emphasis on consumers' interests. This implies a drive for "fair" tariffs, associated to policies such as universal service obligations aimed at ensuring access to "basic" services to the majority of or all the population.

Moreover, in large parts of the world, and especially in poor countries, the concept of water as a social good prevails over that of water as an economic good. As a result, it is often commonly admitted that full cost recovery is not an adequate objective in the case of water services. The transition from one concept to another may be driven by changing perceptions, higher incomes, or water shortages.

Whatever the precise form of institutional arrangement prevailing in a given country, public involvement in water matters means that water tariffs are not the direct product of market forces. Rather, tariffs (and subsidies) are determined by a number of factors, only some of which are related to costs. This explains the wide variety of tariffs schedules encountered across cities, regions, and countries.

3 Subsidies

This section reviews the various aspects of water subsidies. It begins with a short overview of the rationale for such subsidies (3-1) and their potential effects on the economy (3.2). The next sections examine who the recipients of water subsidies should be (3.3), and how subsidies should be financed (3.4). The most common forms of water subsidies are presented in section 3-5. Section 3.6 presents criteria commonly used to evaluate water subsidies. Subsidy measurement issues are considered in section 3.7.

[11] The effect of a change to a volumetric tariff can be sizeable. Available data show that the decrease in water consumption following the introduction of meters can be high (quoted figures are 10 % in England, 20 % in Senegal).

[12] A recent review of practices in developing countries concluded that tariffs are increasingly used to satisfy other objectives than cost recovery (OECD, 2003).

3-1 The Rationale for Water Subsidies

Access to safe drinking water has been recognized internationally as one of the basic needs of human beings. Access to safe water has tremendous direct and indirect impacts on poverty-related outcomes, the main of which are:[13]

- An improvement in health outcomes, and in particular infant mortality rates, and a corresponding reduction in health expenses;
- A reduction in the time spent on fetching water (a task mostly accomplished by women and children); the time thus freed can be used for education (children) and income-generating activities (women);
- At the aggregate level, a reduction in the incidence of epidemics whose propagation is facilitated by lack of water for drinking and basic health practices[14];
- In the urban context, from the household's point of view, access to the public network often translates into a reduction of the costs of accessing basic water requirements, which in the absence of such supply must be acquired from more costly alternative sources.

The relative importance of these benefits varies across locations, depending *inter alia* on the nature of alternative water resources available to households. However, there is no doubt that, in most cases, projects offering access to drinking water supply have very high social returns.[15] Moreover, from an examination of the various benefits provided by a connection to the water network, it appears that a lot of them are purely private.

This combination of public and private benefits from clean drinking water suggests it is a "merit good" which would be underconsumed if left entirely to the market. This is especially true in developing countries where a large portion of households does not have access to basic utilities or shelter. This may be considered the main reason for including access to safe drinking water in the Millennium Development Goals (Target 10, see above), and it explains why water has typically received a lot of attention from policy makers.

Another reason for government intervention is economies of scale. Economies of scale in water provision justify bulk provision of water, as opposed to individual provision, such that it is collectively rational to invest heavily, something individual households cannot do. This is compounded by the fact that water utilities are a highly capital-intensive activity, requiring investments at a scale only governments or private companies can achieve.

Other rationales for government intervention relate to market incompleteness, or to the mere poverty of households, all conditions that may prevail in the context of many developing countries.

Market incompleteness: This may apply to the time spent on fetching water. If no income generating activity is available as an alternative to fetching water, time and money are not substitutes and the household is better off fetching water than connecting to the network and incurring cash expenditures for

[13] For an extensive discussion of the positive effects of access to safe water, see e.g. UNDP (2006).
[14] This externality is in fact stronger in the case of sanitation than for water provision. Provision of water without associated basic sewage and sanitation can in fact exacerbate health problems locally, as untreated wastewater serves as a vector of transmissible diseases (see Lauria, Hopkins and Debomy, 2005, for a discussion of this in Dakar, Senegal).
[15] See Poverty-environment Partnership, 2005.

which there is no corresponding additional income. This may also be the case for children sent to fetch water instead of attending school. In that case, households cannot borrow against the future income generated by a better education of their children to pay for the expenses of safe water. Again, the household is better off opting for the status quo. In such cases, the benefits provided by access to safe drinking water cannot be monetized. In the absence of additional cash to pay for safe water provision, households are caught in a liquidity trap that prevents choosing better water systems.

Poverty: Households can be so poor that they are at a corner solution for a particular category of goods or expenses (i.e. the utility-maximizing consumption bundle does not contain some of the goods). This is typically the case of luxury goods. For example, households may be too poor to face the health expenditures occasioned by a deficient source of water. The fact that they are better off when safe water is provided constitutes a net welfare gain, but it does not follow that the households, even if they recognize it, would be willing to incur the corresponding expenditure, because they have no money to allocate to it.

Lastly, cultural factors are also important. In many contexts, low observed demand for improved water services is likely to come at least in part from lack of awareness of the benefits associated to drinking safe water, especially regarding health outcomes.

These considerations strongly make the case for government intervention to facilitate access to safe water. If the poor do not have access to financial markets and relevant information, or are discriminated against, subsidies targeting the most disadvantaged sections of the population are justified. But other forms of intervention could also be contemplated to alleviate liquidity constraints, such as providing for the spreading over time of connection fees, e.g. by dividing the amount into small payments which are added to the periodic bill. This approach, which does not necessarily involve subsidies,[16] has been used in some countries. Awareness campaigns on the benefit of safe water for drinking and basic hygiene purposes are other types of intervention that may usefully complement subsidies.

Other considerations may apply. For a government with a concern for vertical equity, water subsidies may serve as a redistribution device. When the government can observe incomes, an income tax should suffice to achieve redistribution (Atkinson and Stiglitz, 1976).[17] However, this conclusion is of little practical relevance in developing countries where income and wealth are not easily observable for a large part of the population, due to the importance of informal markets and the absence of monitoring systems. In that case, subsidizing water directly could lead to better targeted transfers. The empirical relevance of redistribution as a justification for water subsidies is examined further in section 4 below.

Through the lessons learned by specific countries, there has also been a growing consensus that the institutional and regulatory environment in which water provision develops is of primary importance to understand its shortfalls or successes in reaching the poor. Reflecting this new consensus, in complement to intervening directly through investment and/or subsidy programs, enabling the reform of institutions and providing related capacity building to government staff has been a growing activity of international donors during the past decade (see Trémolet, 2006, for a study of four African countries).

[16] An interest rate can be charged, so that the advance of the connection fee amount is equivalent to a loan.

[17] This conclusion does not hold if there are positive externalities associated to safe water. In that case water subsidies could perform better than income subsidies, because they directly affect the water prices perceived by households.

3-2 Potential Effects of Water Subsidies

The effects of government taxes and expenditures (or other policies) on the economy are generally considered from the angles of allocation and redistribution (see e.g. Musgrave, 1959).

Allocation

As a result of any policy, the allocation of resources is changed, i.e. the mix of goods and services produced by the economy is altered. In the case of water subsidies, another dimension which has practical importance is the impact of subsidies on the quality of water services provided to households.

Compared with other household subsidies (e.g. housing subsidies) which potentially affect many allocations in the economy, the primary impact of subsidies to drinking water is to affect the consumption choices of households. It can be expected that water subsidies to households will have smaller effects on the rest of the price system and the economy than housing subsidies, because the importance of water in the households' expenditures is limited. It typically represents between 1 and 5% of average household expenditures (see Komives et al, 2005, p 41-42). Thus, on the household side, water subsidies can be expected to have significant effects mainly on the margin between the consumption of water and the consumption of other goods. Generally speaking, water subsidies lower the price of water relative to the price of other consumption goods. If water is a normal good, both the substitution effect and the income effect are positive, and water is consumed in greater quantity. This should affect positively both the uptake (the number of households deciding to connect to the network, given access to it), and the consumption of water for connected households.

Another margin that can be affected is labor supply (or school enrollment). As piped water replaces water fetched from distant sources, household members are able to supply more work time (intensive margin), or even to enter the labor force (extensive margin). The effects of access to water programs or projects on, say, women's labor supply have unfortunately received little attention, as far as we are aware.

On the production / supply side, the margins most likely to be affected are:

i. The overall investment in water and sanitation achieved in the economy. Depending on the way subsidies are delivered and financed by the government, they can alter the returns on investment in the sector and potentially deter investment in that sector.
ii. The type of water providers operating in the market. Subsidies to public water companies, in the form of tax rebates, financial support of current expenditures, or subsidized financing, distort competition in the sector. It can affect the willingness of non-utility providers (e.g. private alternative providers) to enter the market.
iii. The total quantity of water produced and consumed. In practice, it is difficult to say in which direction the quantity of water produced changes, compared with a situation without subsidies. First, in a typical developing country, utilities may be under-financed and in a situation of rationing (either through limiting the number of connections or through rationing the supply to certain days / hours in the day / geographical zones, etc.). Higher demand in this case does not translate into higher supply. Second, the crowding out effects mentioned in point ii above will affect the overall size of the market, and hence the quantity of water produced and distributed.
iv. The quality of water services provided to households. As mentioned above, subsidy programs can be expected to have an impact on service quality. Indeed, some performance-based subsidies are explicitly aiming at improving some aspects of service quality. Those could also

be the indirect consequences of subsidies based on other targets [like a decrease in unaccounted-for water (UfW), or better collection rates].

These factors must be taken into account for developing sound policies in the water sector, as in many developing countries coverage by the public piped network is not universal and public budgets do not allow enough investment to achieve full coverage, and alternative providers are effectively providing for the basic water needs of an important part of the population.

Distribution

Government policies explicitly or implicitly redistribute resources. The fundamental issue is then how policies change the distribution of income within the economy. This generic question can be broken down into several specific sub-questions. In particular, one is often concerned with *vertical redistribution* (are the transfer flows induced by the subsidy going from the rich to the poor, from decile *y* to decile *z* of the income distribution, etc.) and *horizontal redistribution* (comparing the situation of different household sub-groups in a particular income range before and after the redistribution caused by the subsidy).

3-3 Defining Efficiency, Equity, and Coverage

The questions of allocation and distribution can be given a more practical sense. The economic analysis of social programs usually relies on three criteria: efficiency, equity or targeting, and coverage.

Efficiency:

The notion of efficiency relates to the allocation of resources in the economy. Thus, the general question to be asked is "Can the same resources be used more efficiently, and to what extent?". However, the very sensitive question of optimal water allocation has often been relegated to general macro-economic discussions. Within the water sector, efficiency is often examined in a "restricted" sense and relates to the technical and commercial efficiency of utility companies.

Technical efficiency relates to the cost of providing a cubic meter of treated water. As discussed in section 3, there are multiple determinants to this cost, and the government or regulator often has to rely on indirect information in order to assess the efficiency of production of a particular utility company. Benchmarking, i.e. examining the performance of utilities sharing "similar" characteristics, has been a popular technique to overcome, at least in part, problems of asymmetric information. Benchmarking can also be associated to incentive mechanisms, by linking subsidies or government funding to the performance of the utilities, as measured by comparisons between them. This system has been popular in other sectors such as hospitals and is often referred to as "yardstick competition" (Schleifer, 1985).

Commercial efficiency relates to the efficiency of the stages going from the distribution of the water produced to the collection of payments from customers. Ultimately, the ability of the utility to limit the physical and financial losses from distribution and commercialization will determine the degree of sustainability of the company. It is customary to distinguish:

- The proportion of water which is billed (the complement of which is the unaccounted-for water, UfW). Losses can be due to physical problems (leaks); to illegal connections; and to lack of billing for certain connections;
- The proportion of billed consumption which is collected.

As will be explored below in section 5, commercial efficiency has been an almost universal problem for developing country utilities. The proportion of water which eventually gets paid for is often very small, which jeopardizes the financial health of utility companies. In the case where water services are provided by the private sector, it is often the case that contracts between the delegating authority and the provider explicitly include targets (and associated penalties) in terms of indicators related to efficiency, such as UfW or collection rates.[18]

In the context of subsidies, the relevant question is whether a particular subsidy program gives incentives to utility companies or other providers to improve technical and commercial efficiency. As far as policy evaluation is concerned, major outcomes will be water production or consumption changes occurring as a result of the policy. A notion related to efficiency appropriate in such a case is the *leverage effect* of a program, i.e., how much supplemental investment (in water treatment capacity for a utility, or in equipment for safe water provision for a household) will be generated by one dollar of subsidy.[19]

Targeting / Vertical Equity:

Vertical equity relates to the redistribution of income due to the subsidy system and can be explicit or implicit. Targeting, on the other hand, refers to the degree to which subsidies go to those who need them most.[20] It is traditionally measured by the proportion of transfers which reaches the intended beneficiaries. It is clear that the ability to define intended beneficiaries assumes the existence of a strategy in the first place, which is not always the case.[21] Computing (or qualitatively assessing) the distribution of transfers implied by a subsidy is necessary for assessing its targeting, coverage and efficiency. Thus, it is worth drawing the attention of policymakers to this broader issue, instead of focusing only on targeting.

Coverage:

Coverage refers to the proportion of the target population effectively reached by the subsidy. As the numerous evaluation studies for water subsidies make clear, this may be the most important factor to take into account to analyze the performance of water access strategies in developing countries. Low coverage by the public networks considerably limits the outreach and redistributive power of subsidies through utility tariffs (see Komives et al, 2005, and section 4 below). It also generates horizontal equity problems, since similar households are treated differently depending on whether they are connected or not. By contrast, in a developed country context where coverage is almost universal, the quality of targeting of water subsidies becomes the most important criterion.

As with other subsidy programs, coverage and targeting are somewhat antagonistic goals in the sense that a government may have difficulties to achieve good targeting and high coverage simultaneously. A convenient way to summarize this antagonism is to visualize it in terms of a matrix crossing the type of households with the outreach of the subsidy (see e.g. Coady, Grosh and Hoddinott, 2004). To simplify, suppose that the population can be divided without errors into two categories of households, “Poor” and “non-Poor”. Suppose also that the “Poor” category is the official target of subsidies. For any given subsidy program, a two-by-two table (see Table 1) can be constructed, giving the partition of the population depending on the poverty category and the benefit of the subsidy program.

[18] See e.g. Lauria et al., 2005, for the case of Senegal.
[19] There are many ways to estimate this type of impact, i.e., marginal or average impact, short-term vs. long-term impact, etc.
[20] From a semantic point of view, "Targeting” refers to a normative policy objective, whereas “distribution” refers to a positive analysis tool.
[21] For example, strategies for extension of the network may be dictated by considerations of easiness and financial feasibility for the utility company, and not so much by priorities based on income or poverty criteria.

Table 1: Targeting and Coverage of Subsidy Programs

	Poor	Non-Poor
Reached	Ideal case	Leakage issues
Not reached	Coverage issues	//

If the program were perfect, cells off the diagonal of the table should be empty sets. On the contrary, the presence of households in the upper right cell of the matrix indicates problems of targeting, or leakages, i.e. households not included in the target group benefit from the subsidy. The presence of households in the lower left cell of the matrix indicates problems of coverage, i.e. populations included in the target group are not reached by the subsidy.

In practice, the problem is compounded by measurement issues (see Table 2). Owing to the difficulty of measuring poverty and income in general, eligibility for subsidies often has to be determined based on proxy variables. Inevitably, the use of proxies will cause two types of errors. First, some poor households which belong to the target group will be classified as non-poor and thus left out of the subsidy scheme. By analogy with statistical tests, it is common to refer to these errors as "Type 1 errors" or "errors of exclusion". Second, the opposite will also happen, i.e. non-poor households will be inappropriately classified as poor on the basis of the proxies. This is often called "Type 2 error".

Table 2: Impact of Measurement Errors on Targeting and Coverage of Subsidy Programs

		Real situation	
		Poor	Non-Poor
Assessed (measured) situation	Poor	Correct classification	Type 2 error
	Non Poor	Type 1 error	Correct classification

Finding good proxies is thus crucial to good targeting, both *ex ante* (e.g. in designing the subsidy scheme) and *ex post*, in order to check that Type 1 and Type 2 errors are kept under control.

In the context of water consumption subsidies distributed through low tariffs by utilities to households connected to the network (e.g. through an IBT with subsidized first block), reaching the intended beneficiaries is complicated by a series of hurdles. More precisely, the final distribution of consumption subsidies to different groups of households will depend on:

- The proportion of households having potential access to the network;
- The proportion of households living in an area with access to the network that choose to connect;
- The consumption of water of connected households, which determines the amount of subsidies they receive.[22]

For policy purposes, it is very important to understand which of those hurdles are really constraining the outreach of subsidies to target beneficiaries. The World Bank review paper (Komives et al, 2005) introduces a neat framework to measure the targeting performance of subsidies based on this decomposition. It turns out that such decomposition allows powerful insights on the ways to improve subsidy performance. For example, it allows one to answer questions like: "How would the distribution of subsidies be modified if connection rates in the poor neighborhoods were increased to a certain level?". Some illustrations of this analysis are presented in section 4.

[22] The proportion of connections which are metered is also a determinant factor, since it conditions the use of differentiated tariffs, the only alternative in the absence of metering being fixed charges.

3-4 Who Should Get Which Subsidies?

As mentioned above, the dominant paradigm in the thinking about water subsidies is the utility model. Although subsidies can be provided by other channels which will be examined in detail below, it is necessary to spend some time on the case of subsidies conveyed through the utility model, because they constitute the bulk of existing subsidies, both in developed and developing countries.

By definition, consuming drinking water through the piped network necessitates a connection to the network. Thus, there are two economic margins to consider: (i) the extensive margin, i.e., the decision to connect to the network or not; and (ii) the intensive margin, i.e. the decision on how much water to consume given connection. Correspondingly, subsidies to households through the utility can take two different forms (or a combination of them): (i) subsidies to connection; and (ii) subsidies to consumption, e.g. through reduced unit prices. The latter kind of subsidies is by far the most common. It is often implemented through IBTs or VDTs.

For public policy purposes, the difference is particularly important. How should the public effort and monies be divided between helping utilities to extend the network, and helping connected customers to pay their water bills? Ultimately, the answer to this question should come from the examination of local situations. In a very schematic way, one can think of decomposing the population in a given area in four groups, depending on whether they would have difficulties to pay the monthly bill corresponding to a subsistence consumption level[23], and whether they could afford the fees for an individual network connection.[24] Depending on the local distribution of income and the tariffs practiced by utility companies, the relative importance of the four categories will vary.

This classification and the suggested way to come to it oversimplify and thus are potentially misleading. More adequate strategies for examining the needs for subsidies will be discussed below. However, the important point is that public interventions should target the different categories of households in different ways. Table 3 below illustrates this point.

Table 3 : Public Interventions Should Target Different Groups in Different Ways

Households		Group	Need for Government intervention
Could afford connection	Could pay monthly bill		
Y	Y	1	Group does not need subsidies
Y	N	2	Water needs to be provided at low tariffs
N	Y	3	Need for connection subsidies, or payment facilitation
N	N	4	Subsidized provision needed, through e.g.: Lower connection fees and volumetric rates for individual connections; or differentiated service (e.g. free community taps)

How to improve the determination of groups needing subsidies and of needed subsidy levels? There are several tools at the disposal of policy makers. First, household consumption and expenditure surveys are common in many countries and can be replicated locally. Information on water consumption by households, about the price they pay for piped water and water from other sources, can be used to

[23] There are varying definitions of what a subsistence level of water consumption should be. A commonly accepted level is 40 liters per day per capita. For a 5-person household, this corresponds to 6 cubic meters per month.
[24] Again, this involves some degree of arbitrariness. However, measures of willingness to pay can be recovered directly from potential beneficiaries (see below).

compute the proportion of the total budget that is devoted to water expenditures by different income groups. From this, estimates of the needs for water subsidies can be constructed.

Second, the willingness to pay (WTP) of households for network water services can be assessed, either directly through specific surveys (the so-called "contingent valuation" approach), or indirectly through data on consumption of and expenditures on alternative water services (the so-called "revealed preference" approach). Although there are methodological difficulties associated to WTP surveys, and one must be careful in designing the surveys and interpreting the results (see e.g. Komives et al., 2005), reliable estimates of the WTP for network connection or service improvements can be retrieved from local surveys. The examination of results from such surveys in various contexts suggests that the willingness of households to pay for upgraded water services may be higher than what the reluctance of politicians to make beneficiaries pay would lead one to believe, suggesting that some degree of cost recovery is not necessarily incompatible with provision of services to poor areas or populations.

The difference between connection and consumption subsidies is important for another reason. Connection subsidies are one-shot subsidies, akin to subsidies to any capital investment. By contrast, subsidizing consumption entails a continuous flow of money towards the utilities or the recipient households, and corresponding recurrent expenditures (for the government) or losses (for the utility). It is clear that the consequences of each type of subsidy for the government budget (or for the financial health of the utility company) are not the same. Lastly, politically speaking, connection subsidies may be more visible than consumption subsidies, but may yield lower long-term payoff, since households will quickly tend to forget that their connections were subsidized and focus on their paying the full tariff.

3-5 Who Should Pay for Subsidies?

The question "Who should pay for subsidies?" is ambiguous, but intentionally so. Indeed, it may be interpreted in two ways. The first one refers to an equity issue, and corresponds to the question "Who should bear the burden of water subsidies?". There is no normative answer to this question. In practice, depending on the political context, the answer could be the general public; the beneficiaries; particular groups of the society; etc. The second one refers to a financing issue, and the underlying question is "How can the subsidies be financed?". Depending on, e.g., the development of the local finance markets, and the financial status of utility companies, the answer could be through private loans; through general taxes; through specific taxes or user fees; through cross-subsidies; etc.

In the context of developed countries, the frontiers between the two questions are (or should be) distinct. However, in many developing countries, those frontiers get blurred, because of:
(i) the sometimes precarious financial state of utility companies, and
(ii) the weak development of financial markets.
Both factors combine to give financing issues the front stage, whereas the equity (incidence) issue is relegated to a secondary status. For the rest of the discussion, it is convenient to distinguish connection subsidies and consumption subsidies.

Due to the precarious financial state of utility companies, consumption subsidies, which directly impact on the revenues of the utility, are a direct threat to its sustainability. If the latter is to be assured, subsidies must be compensated in some way. There are two usual and non-exclusive ways to achieve this: transfers from the government, and cross-subsidies. Cross-subsidies describe a mechanism by which a group of consumers pays a price for the service higher than the cost to the utility, thereby subsidizing other groups

of consumers (e.g. the poorest ones) or activities of the utility (e.g. expansion of the network).[25] Cross-subsidies, at least in theory, have the attractive political feature that the compensation occurs within the utility and does not necessitate budget transfers from the government. However, in practice, achieving this goal supposes a careful balancing of subsidized and unsubsidized groups, so that the latter can effectively pay for the former. As explained below in section 5, this equilibrium is sometimes hard to maintain.

Due to the combination of the two factors mentioned above, utilities rarely manage to free up resources or mobilize finance for new investments. Financing network extension, which is often a prerequisite for a program of connection subsidies, then becomes the crux of the matter, and the most pressing problem is to find practical means of enabling utilities to mobilize cash to finance their investments costs. Cross-subsidies have been one way to achieve this, see Laffont and N'Gbo, 2000. In many countries, it has been customary to make developers finance the costs of bringing water to new developments. A proportion of those costs, which varies across countries, is then repaid to the developer by the utility afterwards.[26] Other *ad hoc* solutions include dedicated Funds financed by surcharges on bills (Côte d'Ivoire, Argentina). However, in many countries, utilities or municipalities still have to rely on grants by the Government or by donors to finance network extension.

3-6 Implementing Common Forms of Water Subsidies[27]

Given well-defined objectives for a subsidy program (and in particular, supposing that intended beneficiaries are clearly defined), designing the program essentially entails two generic questions:

(i) how to channel subsidies to beneficiaries?
(ii) how to target beneficiaries?

These two issues are examined in turn.

Channels for water subsidies

As should be clear from the variety of tariffs which have been presented in section 2-4, there is also considerable variety in the types of subsidies to consumers. Moreover, tariffs are only one way to subsidize water services. It is conceptually useful to distinguish two channels for subsidies:

- indirect subsidies through prices of water services;
- direct subsidies to end consumers.

Examples of indirect subsidies comprise block tariffs and volume-differentiated tariffs, which have built-in subsidies. These subsidies are called "indirect", because they are not paid directly to the end consumer. Rather, the utility company is generally compensated by the government for losses arising from below-cost tariffs. In an increasing block tariff (IBT), consumers consuming less than a threshold quantity of water (often the first block limit, but in certain cases the second and subsequent blocks may also be subsidized) pay a discount unit price on this volume. The justification for adopting such tariff structures is that "basic" consumption should be provided at a discounted rate, whereas consumption above basic

[25] Cross-subsidies can also arise as the optimal way to fund universal service obligations (USOs), by which service companies have to operate under certain obligations such as universal coverage or non-discrimination over prices. See Choné, Flochel and Perrot (2002) for a rigorous exposition.
[26] An example of such a system is the *aportes financieros reembolsables* (AFR) in Chile.
[27] The reader interested in a more systematic overview of the main forms of water subsidies is referred to the wide body of literature on the topic (in particular, see the references in Komives et al., 2005).

needs should be priced at full cost, or even cross-subsidize users that stay in the first blocks. The performance of IBTs as a subsidy mechanism will be discussed in section 4.

Example of the second channel comprise connection subsidies, and direct consumption subsidies. Direct consumption subsidies are paid directly to households meeting certain eligibility criteria to cover part of their water bill. The main advantages of direct subsidies are that they are transparent, explicit, and minimize distortions in the behavior of water utilities and their customers. The main drawbacks of direct subsidies are the difficulty of defining suitable eligibility criteria as well as the administrative cost entailed in identifying eligible households. The direct subsidy system was pioneered by the Chilean government in 1990, when it was successfully used to soften the distributional impacts of a convergence towards cost-reflective water tariffs.

Targeting methods

Whereas subsidies through tariffs can be applied to all customers irrespective of their condition, it is often the case that some degree of targeting is involved: subsidies do not apply across the board, but are limited to consumers meeting certain criteria. It is customary to distinguish explicit targeting from implicit targeting.

Explicit targeting is based on a priori classification of consumers into groups eligible for different subsidies, based on observed variables. Ideally, such classification should be based on individual household status in terms of income (and perhaps other socio-economic characteristics), in order to target subsidies to those households who really need them. However, this supposes that income is easily observable, and that an administrative system to monitor it is put in place. In many countries, these two conditions are not met. On the one hand, due to the importance of the informal economy, household income is hard to estimate. On the other hand, putting in place an administrative system for the purpose of administering water subsidies often proves very costly. These obstacles have prevented most countries from going into that direction. In countries whose informal economy is not too important, one way to circumvent the difficulty associated with the costs of the income monitoring system is to utilize multi-purpose systems, which serve to define the eligibility criteria for multiple social benefits. The *Ficha CAS* system in Chile is one example of such a system (for a description, see Box 6.2 in Komives et al, 2005, p 109).

In the absence of a system to monitor income directly, selection of eligible households has to rely on proxy variables for income. The most commonly used systems are geographic targeting and community-based selection. Geographic targeting consists in defining the eligibility for subsidies based on the residence in certain zones or neighborhoods (e.g. districts) which are identified as “poor”, while residents of “non-poor” districts are not eligible. Community-based selection consists in letting community members decide which of their members “merit” the subsidy the most. This system has been used in Cambodia. The performance of these selection devices as proxies for income will be discussed in section 4.

Implicit targeting refers to mechanisms where households self-select into the different categories of service (subsidized or unsubsidized), rather than being selected *ex ante* by the government. This approach is increasingly used to deliver subsidies or benefits in a variety of sectors (see Coady, Grosh, and Hoddinott, 2004). An example of implicit targeting is the case of the multiple two-part tariff discussed in section 2-4, which can be designed so as to allow low-consumption users to be separated from high-consumption users. Another example is when the utility company offers, in parallel with private connections, yard or community taps in which consumption is priced below cost. In that case, achieving a

good targeting of the poor supposes that a majority of rich households having the choice between the two services will opt for the individual connection, while the poor will use public taps.

Implicit and explicit targeting are not mutually exclusive. On the contrary, they are often combined. A typical example would be differentiated services such as individual connections and community taps, where community taps are offered as a possibility only within certain targeted neighborhoods.

3-7 Other Criteria for Evaluating Subsidies

Apart from core economic criteria such as efficiency, equity, and coverage, other public finance criteria are commonly used to analyze subsidy programs. The criteria vary and may bear different names from one author to another (for a discussion, see Le Blanc, 2004). It is convenient to group the most utilized criteria into two groups. The first group gathers criteria which relate to the political economy dimension, and include administrative simplicity, incentives, and transparency. The second group comprises criteria related to the long-term management of subsidy programs, such as visibility, sustainability, and flexibility. Those criteria and their importance in the context of water subsidies are briefly discussed below.

Administrative Simplicity

Administrative simplicity can be seen from the governments or consumer's sides. From the administration's point of view, other things being equal, subsidy programs should be designed so as to minimize total costs, which include the government's administration, monitoring and enforcement costs but also indirect costs, such as those cost associated with legal disputes arising from the implementation of the program, e.g. from private utilities wanting to renegotiate their contracts with the government or municipality. From the beneficiaries' perspective, administrative costs include the time required for applicants to locate the appropriate office where to apply, to understand and to fill out the requested forms, and to participate in the program. From a practical point of view, it has to be noted that very often only direct costs are known. Since they are of no significant interest to governments, indirect costs are rarely known without *ad hoc* studies, even in the case of budgeted programs.

Transparency

Transparency refers to the clarity of the program's eligibility and participation criteria and effective implementation by the responsible entities. Since this criterion is more qualitative than others, it might best be defined it through a number of questions: How clear are the rules for allocation of public funds to the various states, to local governments? At the local government level, how are beneficiaries identified and selected under the programs? Are there well-defined eligibility criteria for the subsidies? Are responsibilities in subsidy allocation clearly defined? Is subsidy distribution managed by an independent entity?

The degree of transparency of subsidies provided through utilities is highly variable. Chile, for example, has a highly transparent system of direct water subsidies. Cross-subsidies, which are prevalent in the water context, are often far less visible than that, except to the utility which manages them. The geographic variability of water tariffs is also an impediment to the readability of subsidies through water tariffs. That is, most subsidies are implicit to a certain degree, and only the utility companies and the government/ regulator are able to estimate precisely how they work and to whom they apply.

Incentives / political responsibility / popularity:

This criterion is perhaps the most qualitative of all. However, from a policy point of view, it is perhaps one of the most important in the water context. The questions underlying this criterion might be the following: Are the incentives of the different stakeholders compatible with public policy goals? e.g., given the financial arrangements between the government and the utility, do utilities have an economic incentive to extend the network, service poor areas, increase metering, decrease unaccounted-for water (UFW)? Are individuals or institutions responsible for choosing participants in the subsidy program accountable, and to whom? Are institutions in charge of the program's implementation given adequate financial and technical means? E.g., are subsidies passed on to consumers through lower tariffs compensated by the government in a way that is financially sustainable for the utility? Do entities in charge of the program have incentives to keep the program under control (total cost for public budgets, cost recovery, etc.)? Does the program receive substantial support from the public and from politicians?

The importance of these questions to water subsidies compared to e.g., housing subsidies or direct budget support, is accentuated by the fact that intermediaries such as utilities stand between the government and the end consumer. Therefore, a complex range of incentives exists, which have to be taken into account when designing subsidy programs. In particular, regulation is of key importance to mitigate potential adverse incentives to provide low-quality services. Another relevant factor is that physical capital in the water industry is very long-lived.[28] Therefore, a lack of appropriate maintenance translates only very gradually to decreased quality of services. On the other hand, one-shot investment expenditures, e.g. to extend the network, are politically very visible. As a result, this feature generates incentives for short-sighted, resource-constrained governments to under-provide and delay necessary financing of operation and maintenance expenditures of water utilities.

Visibility:

This criterion refers to the degree of visibility of all costs of the subsidy for taxpayers and citizens. In order to measure visibility, one must first determine the actual subsidy cost and then determine how explicitly defined these costs are in the government's budget. From a policy point of view, improving the visibility of a program has significant benefits, such as better understanding of the *full economic cost* of providing assistance, better targeting in practice, and potentially less corruption. As a rule, costs are better known for subsidies on the State budget.[29] In the case of water, which necessitates high levels of capital investment, the visibility of the costs of public investment programs can be expected to be low, since these programs will consist in one-shot infusions of capital (often financed by donors), which are to be reimbursed in the long term as part of the country's or municipality's debt.

Flexibility:

This notion corresponds to the ease with which a particular program can be modified (parameters and / or implementation) or even terminated. In the context of water subsidies, this is best understood in the political sense: can the program be modified or terminated without major political unrest?

[28] The infrastructure associated with surface water storage and conveyance and the pipe network can have an economic life of 40-60 or more years, longer than that of capital employed in the manufacturing industry or in other public utility sectors.

[29] However, this is often only true for direct costs, e.g., the amount of subsidy budgeted or distributed to beneficiaries during a given year. Indirect costs are rarely known without *ad hoc* studies, even for on-budget programs.

Sustainability:

It can be argued that "sustainability" is meaningless for an isolated policy because the government's budget constraint implies a tradeoff between policy choices.[30] However, this criterion can be applied in the following sense: given the present economic situation and reasonable forecasts, will the policy still be feasible in ten years, or will it require major changes in design, or even be dropped? In the water context, sustainability problems are notably driven by the highly capital-intensive nature of the industry. The main issue is the compatibility of investment programs with the subsequent expenditures that must be incurred (typically by local governments) on operation and maintenance to sustain the investments. This has been a pervasive problem in many developing countries.

Sustainability can also refer to technical capacities at the country or local level to manage the utilities or, in the case of public-private partnerships, the relations with the private providers, once initial investments or projects have been delivered.

3-8 Subsidy Measurement Issues

As the discussion above illustrates, some of the criteria used for the analysis of subsidy programs are not easily identified through quantitative indicators, except at times on a case-by-case basis. Moreover, some criteria have multiple dimensions, and various indicators may be required to identify a particular criterion. Moreover, even when quantitative indicators come to mind, their practical computation may be complicated, and as such, not easily available. Thus, in most cases, qualitative or semi-quantitative information summarizing program performance under specific criteria must be identified.

This section is concerned with two of the most common problems analysts face when examining water subsidy programs, namely:

- measuring the total amount of subsidies received by households;
- measuring the distributional impact of those subsidies.

Once again, in this section our framework of reference is the utility model. In some cases, subsidies are on-budget, direct transfers to the end consumer, and the utility receives no subsidy. It is then relatively straightforward to answer the two questions above, because it can be assumed that the tariffs paid by the households reflect the full costs to the utilities.[31] [32] Usually, though, money transfers go from the government to utility companies, not to households. The basic problem here is to identify the benchmark price (tariff) that should be used to compute the value of the subsidy received by the households. Due to the presence of the utility between the government and end consumers, not all of what comes out of government budget may reach the household's pocket. Inefficiencies at the production and distribution levels can result in a "waste" of money. The issue, then, is to measure these inefficiencies. Also, transfers from the government may be combined with cross-subsidies. In such cases, how is it possible to calculate the share of the amount transferred that is passed on to households?

[30] Alternatively, sustainability could be defined as whether the government can scale up the subsidy program to effectively address all the intended beneficiaries. This definition would be in the middle of our concept of sustainability and coverage.

[31] Even though, even in Europe or in the US, water tariffs often fail to reflect environmental costs (OECD, 1999).

[32] However, as seen above, there are conceptual problems with the definition of a "marginal cost" in the case of water services, because : (i) temporal variations typically not reflected into prices ; (ii) high-cost and low-cost customers are typically paying the same price for water, at least locally ; (iii) a high proportion of costs are not attributable to specific customers.

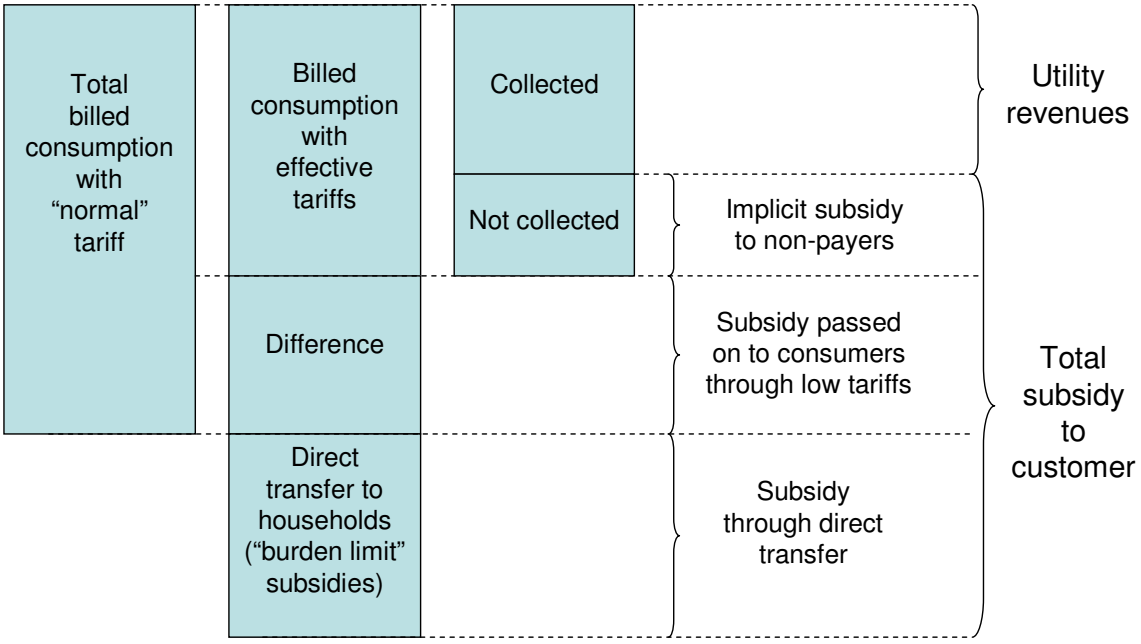
Demand-side (consumer) approach

In this approach, which relies on household survey data, including consumption of water and price paid for it, one typically computes the subsidy amount as the difference between what the consumer actually paid and the price that "should have been paid", given observed consumption and a "normal" price" (see Figure 3). Aggregation across consumers by quantiles of the income distribution then yields a measure of distribution of the subsidy across income groups. This is the approach taken by most of the studies reviewed in the World Bank study (Komives et al., 2005).

The main difficulty of this approach is to define a "normal" price or tariff that should reflect the full economic cost of water provision of the utility. This variable is not available in most household survey datasets. Usually, the rate of the highest block in the IBT schedule is taken as a proxy for it; however, direct examination shows that those rates overestimate or underestimate costs, depending on the case. Apart from the difficulties of defining the "normal" price or tariff, this calculation amounts to a static, tax expenditure-style amount – i.e. it neglects the changes in consumption that would occur, should the household face the "true" tariff. Depending on the precise nature and implementation of the subsidies, it can be expected that changes in consumption would not be negligible in most cases.

Another methodological problem encountered is that subsidies are often measured with reference to water bills, not amounts effectively paid to the utility. Given the sometimes huge differences between billing and collection, this can result in both an underestimation of effective subsidies and biases in the estimation of their distributional effects.

Figure 3 : Demand-Side (Consumer) Approach to Water Subsidies

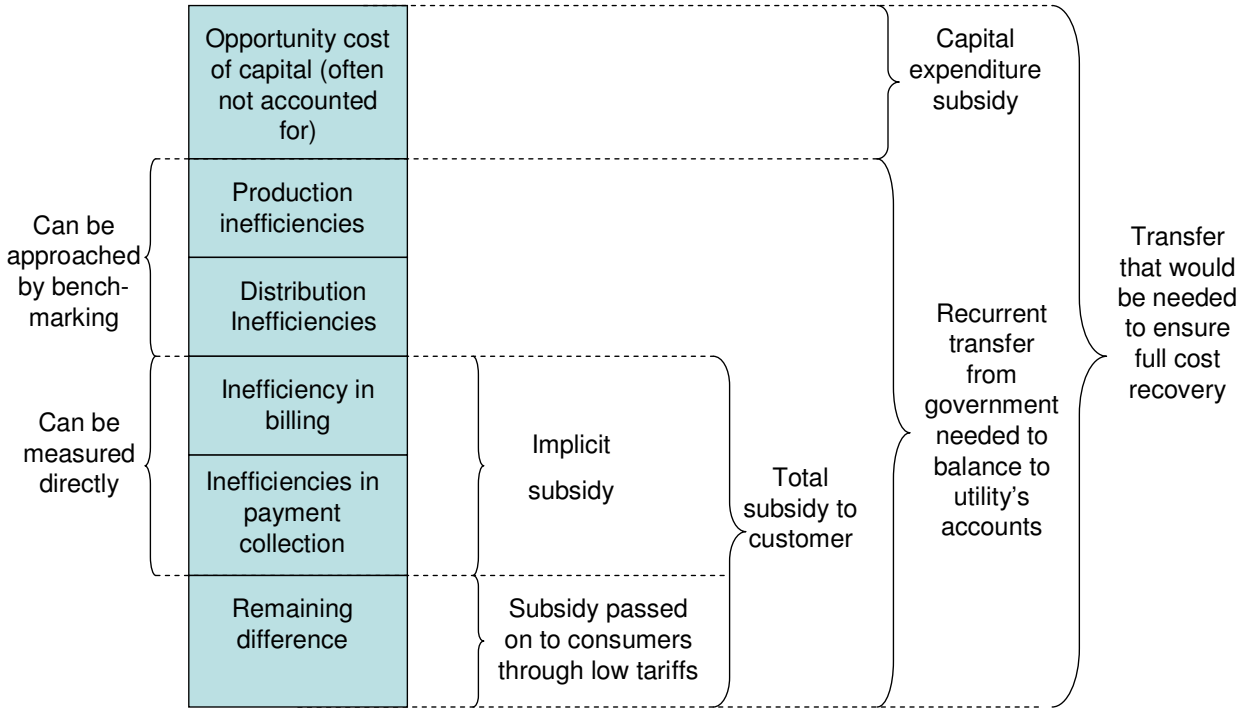


Source : Author's elaboration

Supply-side (utility) approach

In this approach, the point of view is that of the government and the unit of observation is the utility. This can be called the "difference method", because subsidies to consumers are calculated as the difference between transfers from the government to the utility, minus all the losses incurred by the utility due to inefficiencies (see Figure 4). The government provides a transfer to the utility to help it cope with current expenditure requirements (either to break even or to achieve profit). The proportion of this amount that goes to end consumers is negatively affected by any loss of efficiency occurring from production, distribution, billing or collection of payments. The problem is then to measure these losses. The latter two can be measured directly; the former two can be estimated by benchmarking.[33]

Figure 4 : Supply-Side (Utility) Approach to Water Subsidies



Source : Author's elaboration

This approach is interesting because its results allow policy makers to separate out efficiency considerations from consumer subsidy problems. With very inefficient utilities, it may well be the case that most of the government transfers are wasted; it could even happen that consumers end up subsidizing the utility, compared to a more efficient situation. Note that in this approach, cross-subsidies are netted out because they represent transfers internal to the utility. As a result, distributional impacts of the subsidy cannot be obtained.

[33] This approach corresponds directly to the one taken by many projects in the water and sanitation sector, which heavily focus on the physical and commercial performance of utilities. Benchmarking is of primary interest in such cases, in order to examine the structure of costs and revenues, as well as to locate inefficiencies in production, distribution, metering, billing, and collection.

In conclusion, getting an accurate idea of the real impact of subsidies built in water tariffs implies examining both the economic (i.e. technical and commercial) performance of the utilities delivering those subsidies, and the distribution of water consumption at the household level. Results obtained from micro, demand-side approaches are dependent on the "normal price" taken into account for the subsidy calculation. Supply-side approaches, and benchmarking in particular, can help assessing what this "normal price" would be.

4 How Do Subsidies Fare in Practice?

This section examines the various aspects of the performance of water subsidy programs implemented across the world. We concentrate on a group of criteria outlined in the previous section, especially efficiency and equity. Those criteria focus on the direct effects of subsidies. Thus, unless otherwise stated, we do not look in detail at the effects of subsidies on important outcomes such as health and children's education. The section follows the plan of sections 2 and 3. It successively examines the issues of access to piped water; water prices; subsidy beneficiaries; financing of subsidies; coverage targeting of subsidies. A final subsection tries to place the debate on the effectiveness of water subsidies within a broader context.

4-1 How do the Poor Fare in Terms of Access?

A look at aggregate regional figures shows that access to an improved source of water is far from universal. Another striking feature is the contrasts between urban and rural areas (Table 4). A more disaggregated look at country figures (Figure 5) confirms that Africa is lagging behind the other continents, both for urban and rural access.

Table 4: Percentage of the Population With Access to Improved Water Supply and Percentage With a Household Water Connection

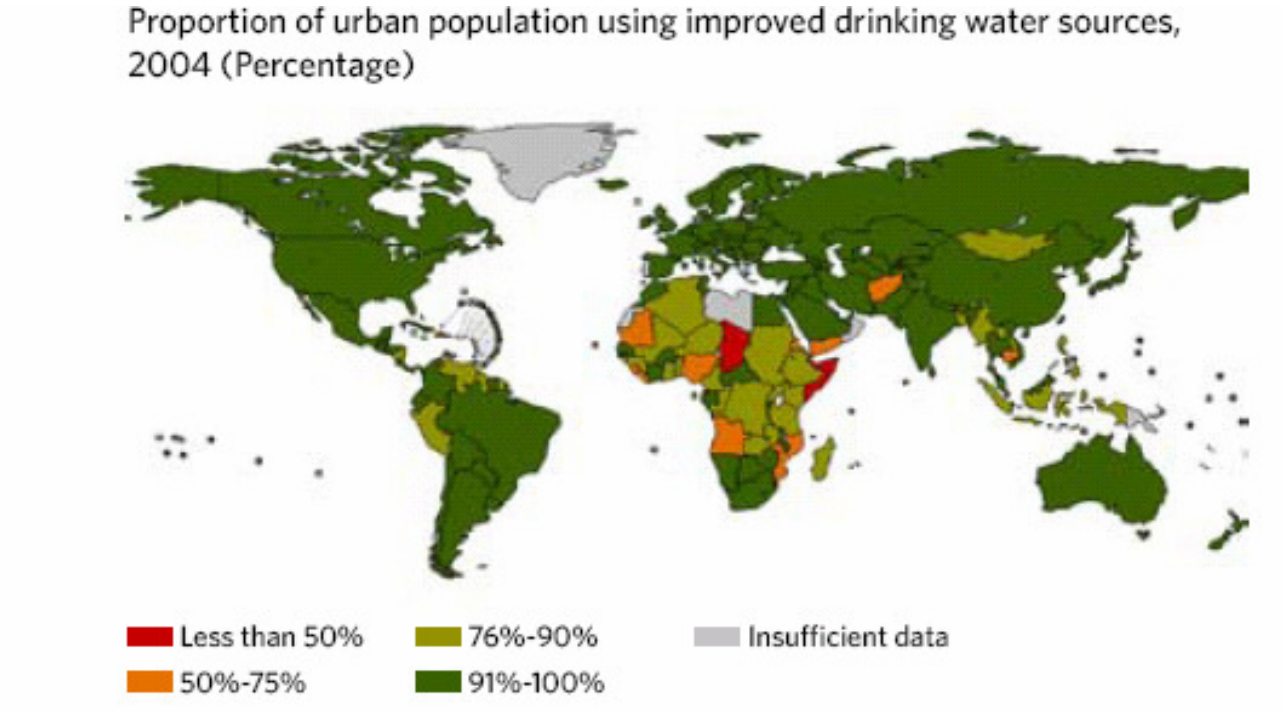
	Urban	Urban – individual connection	Rural
East Asia	92	70	69
South Asia	93	53	80
Sub-Saharan Africa	82	39	46
Middle East / North Africa	96	92	78
Eastern Europe / Central Asia	98	98	78
Latin America	96	95	69
OECD	100	100	94

Source: Komives et al., 2005.

Data on African capital cities shows the extent of variation in access rates, measured by access to piped water. In 2000, the proportion of households having access to piped water varied from 27% in Cotonou (Benin) to 85% in Dakar (Senegal). Moreover, connections to the network are often more frequent for households having higher incomes (see Komives et al, 2001, and Komives et al., 2005). Figure 7 illustrates the difference in access to private water connections between poor and non-poor for some cities in Asia, Latin America, and Africa. Although the magnitude of the gap between poor and non-poor varies, it is a common feature of all the places analyzed in the studies reviewed by the World Bank paper.

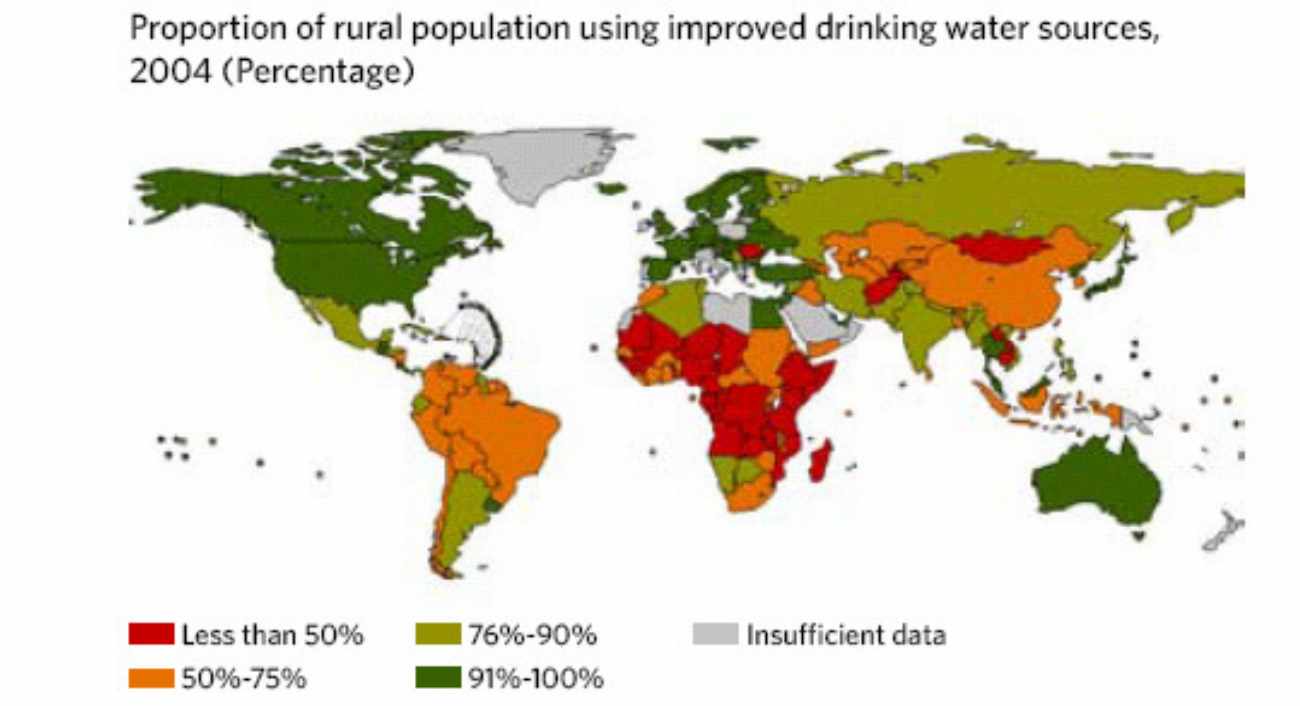
As a result, by construction, consumption subsidies delivered through the utility network (i.e. to connected users) miss a substantial part of the potential beneficiaries. This feature can have huge impacts on both the targeting of water subsidies and their redistribution effects in developing countries.

Fig 5a : Access to Improved Water Source, Urban Areas



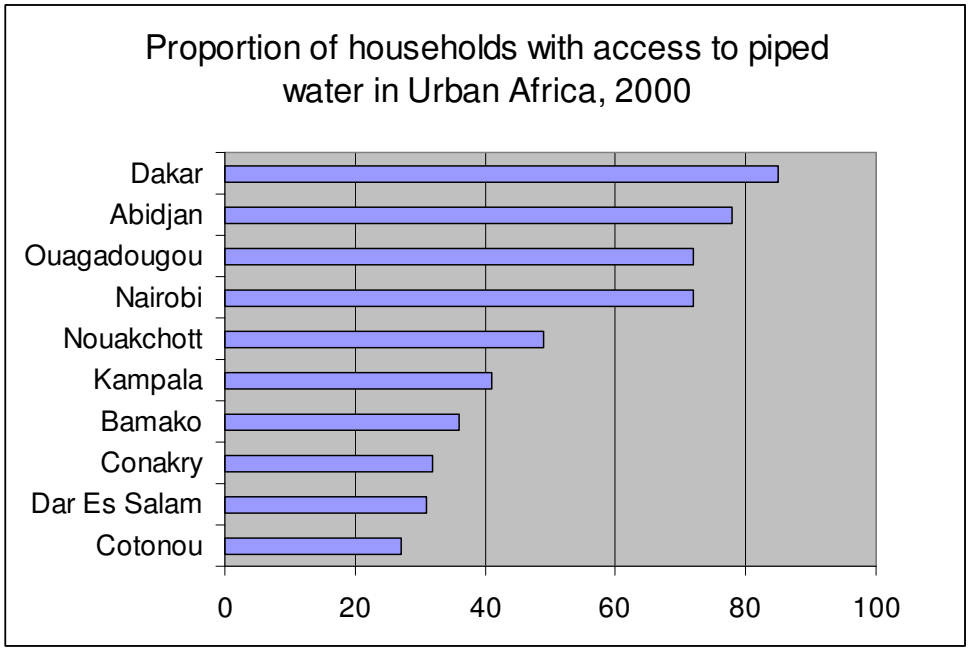
Source: United Nations (2006).

Fig 5b : Access to Improved Water Source, Rural Areas



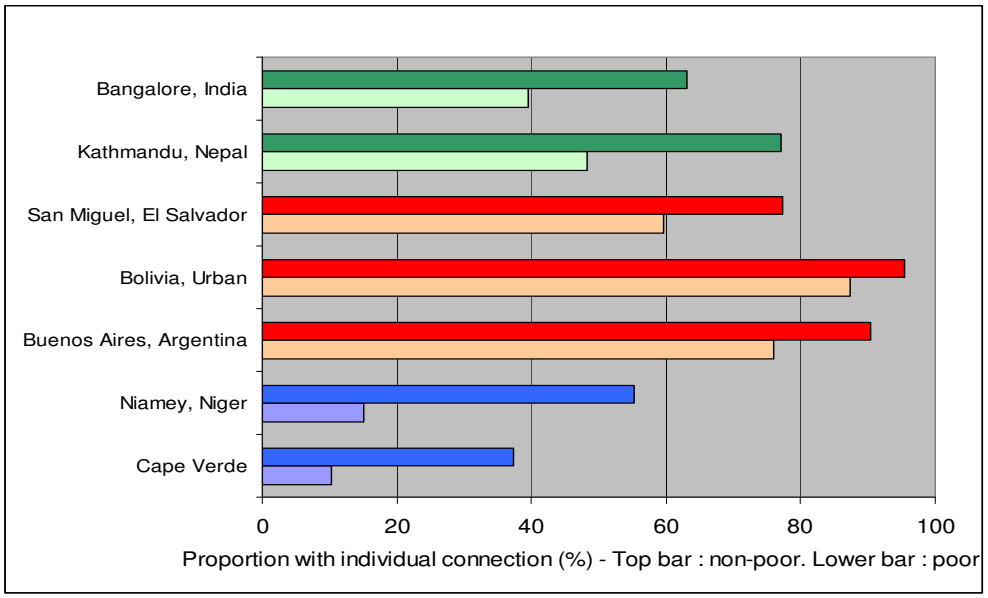
Source: United Nations (2006).

Fig 6 : Access to Piped Water in Selected African Capital Cities



Source: Gulyani et al. (2005)

Fig 7 : Proportion of Poor and Non-Poor Households with Private Water Connections for Selected Countries and Cities



Source: Komives et al., 2005.

4-2 The Price of Water

Utilities

Utilities often charge an initial connection fee, after which the household has to pay periodic (typically, monthly) bills that may or may not depend on its water consumption. Available evidence on connection fees presented in Komives et al. (2005) found that water connection charges varied widely across cities and countries, ranging from only US$2 to US$450 (table 5).[34]

Table 5 : Connection Charges for Water Observed in a Sample of Utilities

	East Asia	South Asia	Latin America
Number of utilities	22	18	21
Highest	450	129	387
Average	101	42	128
Median	83	35	125
Lowest	10	2	20

Source: Komives et al., 2005

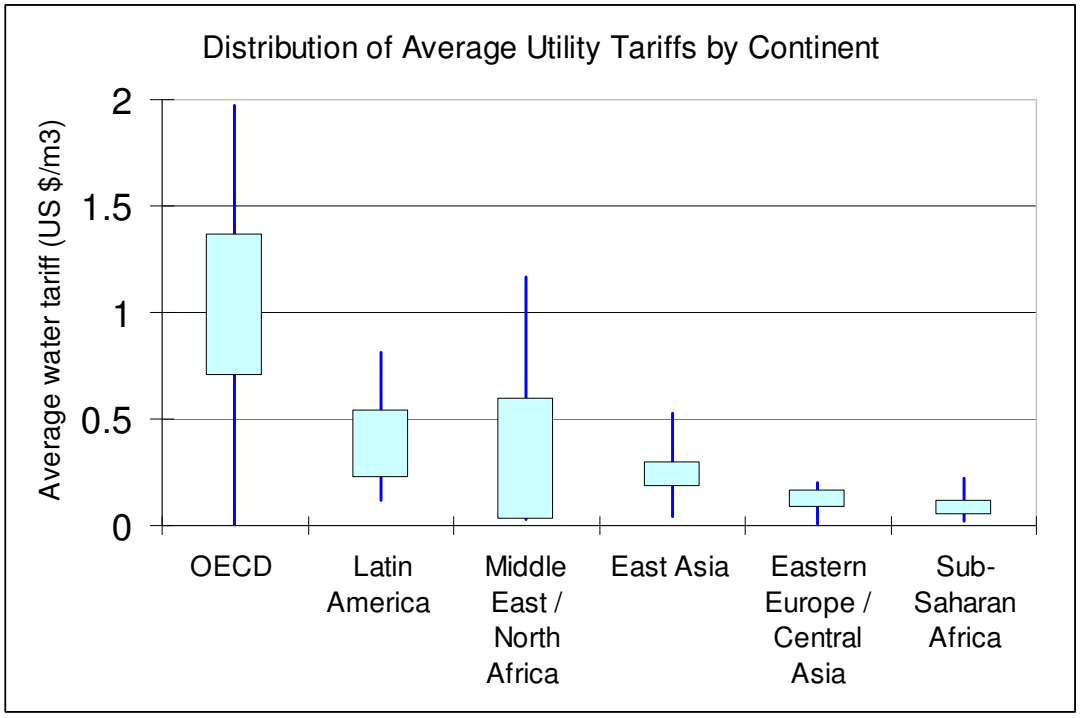
As for water use charges, they also exhibit high variation. Results from a worldwide survey of utility companies by Global Water Intelligence, documented in Komives et al (2005), are represented below in Figure 8. The figure shows the distribution of average water tariffs charged by utilities by continent. Boxes represent the part of the distribution comprised between the 25th and 75th percentiles, while the extremities of the bars show the observed minimum and maximum tariffs. From this figure, it is apparent that apart from OECD where water tariffs are above US$1/m3 for half of the utilities included in the sample, tariffs in the other regions of the world tend to be significantly lower than that level. Whereas tariffs in Latin America and Middle East and North Africa may sometimes reach the US $0.50/m3 level, virtually all utilities surveyed in East Asia, Eastern and Central Europe, and Subs-Saharan Africa are below this level. This has implications for the sustainability of the utilities (see below).

Alternative providers

As frequently mentioned in this paper, alternative providers of water services have until recently received far less attention than utilities. It is thus difficult to assess with precision their numbers, market shares, etc. in various countries. However, a systematic review of the literature undertaken by the World Bank (Kariuki and Schwartz, 2005) provides precious information about the ranges of prices charged by private alternative providers. This information is summarized in the following graph, taken from that study (Figure 9). The study confirms that prices of alternative sources of drinking water tend to be higher than the price of water provided by utilities. Water provided by carters and tanker trucks is more expensive than that provided by point-source vendors, which in turn are more expensive than private or public networks. The ranking of sources by price that can be deduced from Figure 8 proves to be robust across continents (Kariuki and Schwartz, 2005).

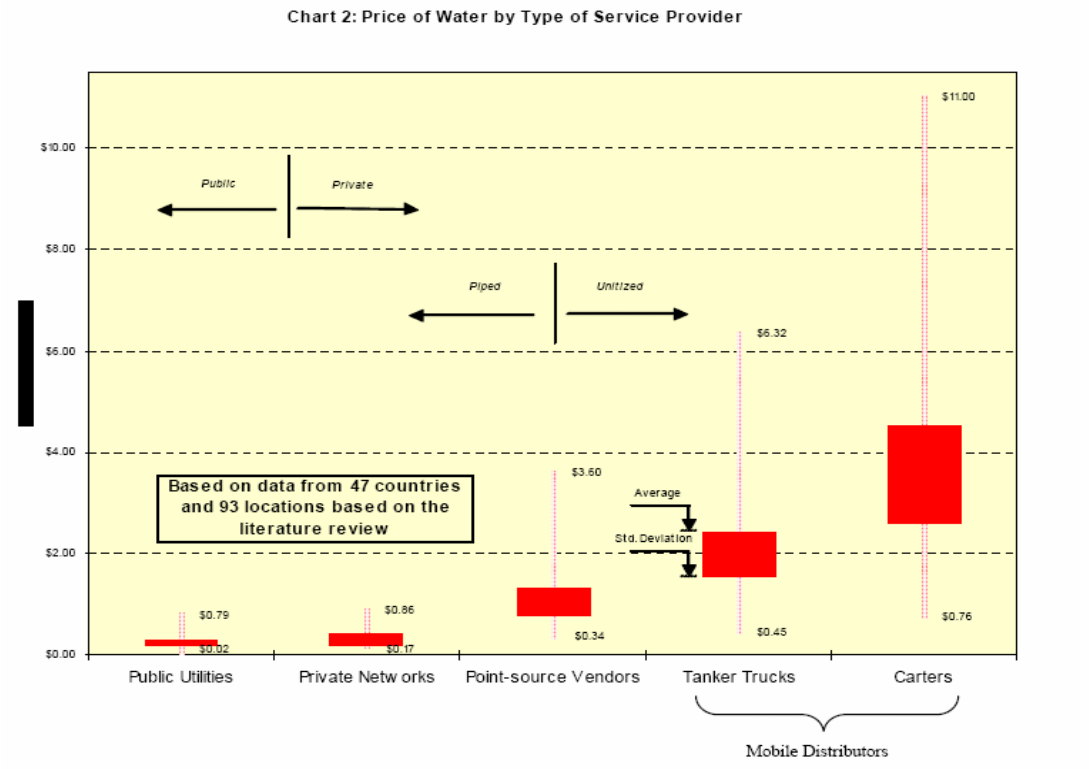
[34] In many countries, there may be "parallel" charges beyond official connection fees. Side payments are frequently mentioned as necessary to obtain a connection in the first place.

Fig 8 : Distribution of Average Water Tariffs Observed in a Global Survey of Water Utilities



Source : GWI, 2004, quoted in Komives et al. (2005).

Fig 9 : Observed Price of Water by Type of Service Provider, Compiled from the Literature



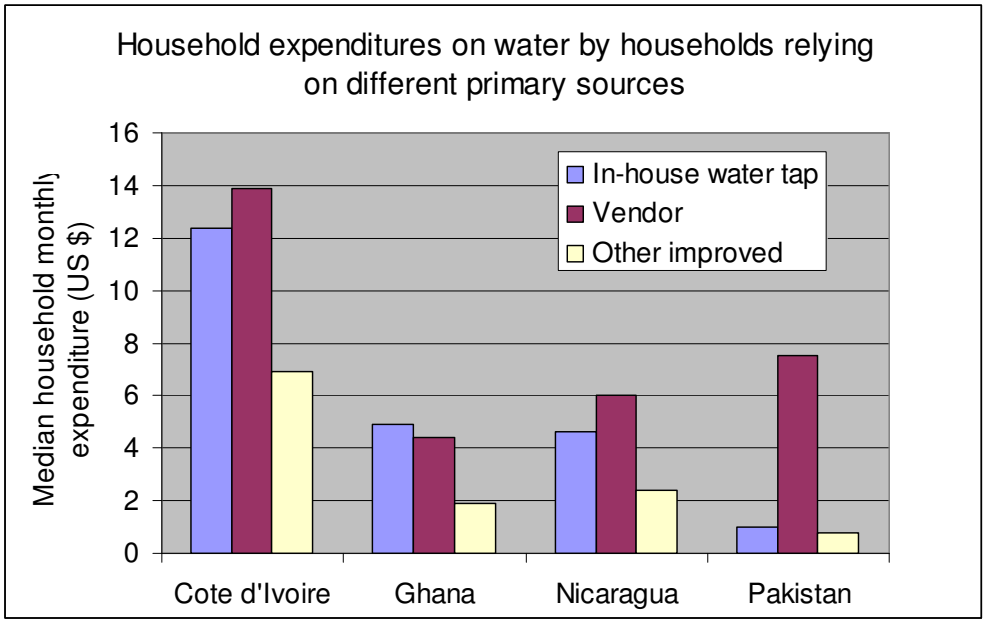
Source: Kariuki and Schwartz, 2005.

4-3 Household Expenditures on Water

Evidence presented in Komives et al. (2005, p43-44) on three continents (South Asia, Eastern Europe, and Latin America) shows that monthly water expenditures of households tend to increase with income. However, the proportion of total income that is spent on water decreases with income. For households in the bottom quintile of the income distribution, the study reports average expenditures ranging between 2% of income in South Asia and around 3.5% of income in Latin America and Eastern Europe. For households in the top quintile of the income distribution, those figures drop to, respectively, less than 1%, 1.5% and 2%. Thus, overall, water expenses do not represent a high proportion of household incomes. In low-income countries, expenditures on food, for example, represent a far greater proportion of total expenditures.

Given the huge differences in the price of water from public or private networks and alternative sources, one could think that households connected to the network incur lower expenditures on water than unconnected households. In fact, it turns out that being connected to the public network is not synonymous with having lower expenditures on water services, as Figure 10 illustrates. Figure 10 shows that in three of the four countries examined, expenditures on water are roughly comparable for households having access to private connections and households relying on vendors. Only in Pakistan are the latter paying much more than the former. For the four countries, monetary expenditures tend to be lowest for households relying on other improved sources such as wells.

Fig 10: Household Expenditures on Water by Type of Primary Source in Selected Countries



Source: Komives et al., 2005, from LSMS studies.

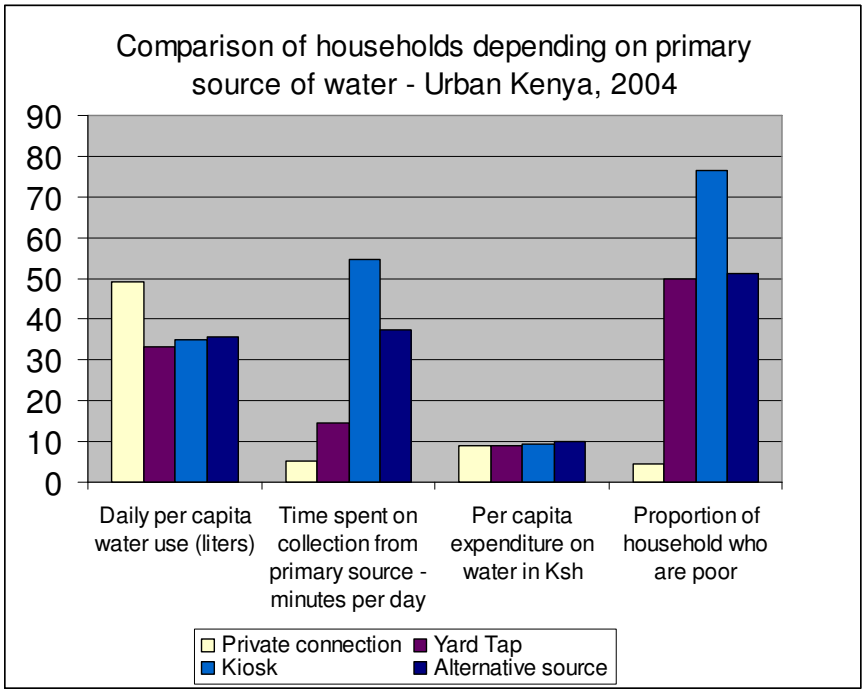
Many effects are at work:

- Lower water prices translate into higher water consumption. The magnitude of this effect depends on the price elasticity of demand for water.
- Easier physical access also translates into a lower opportunity cost of water, which tends to increase consumption.

- Households having access to alternative improved sources such as wells often do not incur cash expenditures for them (there may be a cost associated with the time spent in fetching the water, but it is not recorded in the household expenditures).
- Lastly, there are selection biases in the sense that the choice to connect to the network is not exogenous. First, households paying less than others before a network connection is made accessible will have fewer incentives to connect; hence, the average expenditures of those not connected may be lower than what the average expenditures of all households would be if no household were connected. Second, as argued in section 3-1, some very poor households may prefer to trade time for money and choose not to connect, because they could not afford the monetary outlay implied by a connection.

Those intuitions are broadly consistent with the picture that emerges from a study of three cities in Kenya undertaken by the World Bank (Gulyani et al, 2005). Figure 11 illustrates differences in outcomes between households depending on their primary source of water. Very few poor households have a private connection. Daily water use is about the same for all types of households, except those with private connections that consume 40% more water than the others per capita. In spite of this, per capita expenditures are about the same for all types of households, regardless of their being connected or not. Lastly, the survey also reveals that all households connected or not, have to access water from different sources, due *inter alia* to the poor reliability of piped water service. Nonetheless, there are significant differences in average times spent to fetch water for the different categories of households. The study found that some households chose to trade off time savings in exchange for low monetary costs. Specifically, unconnected households with long collection times were more likely to opt for the status quo, rather than pay for an improvement in their water service.

Fig 11 : Comparison of Households depending on Primary Source of Water, Urban Kenya, 2004



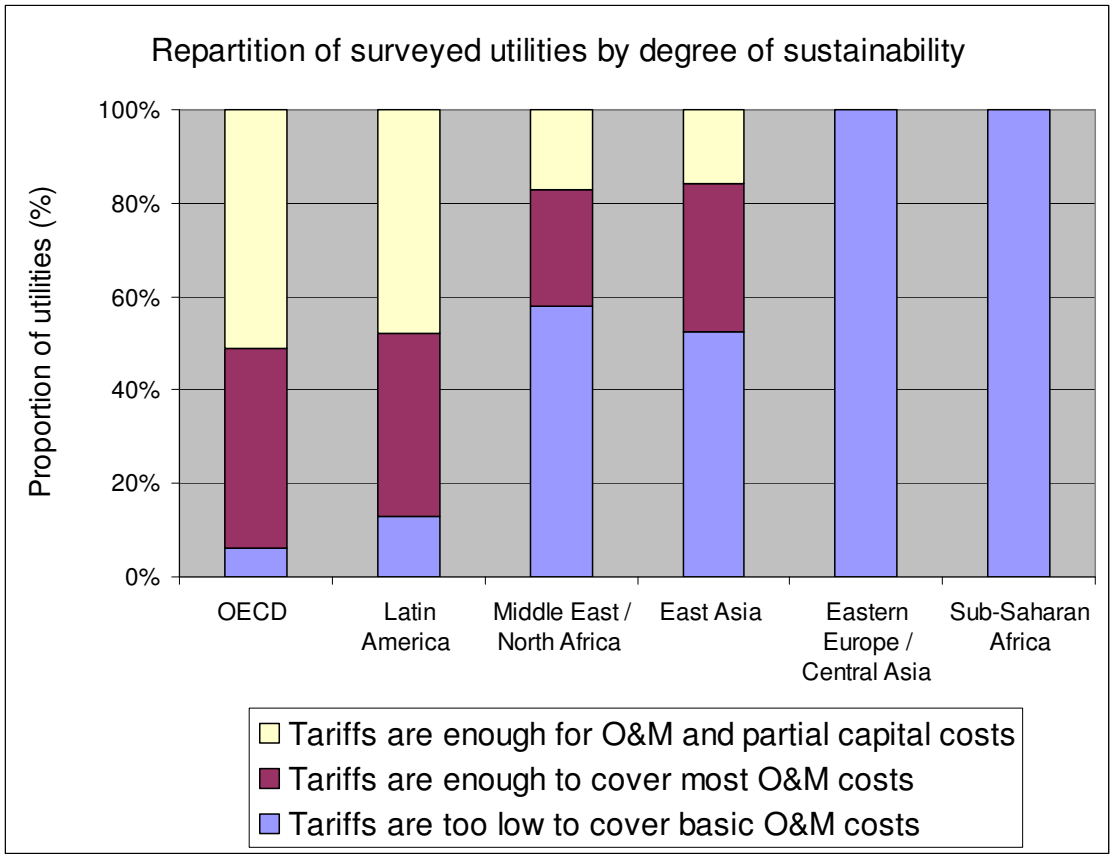
Source: Gulyani et al., 2005.

4-4 The Performance of Utilities

In most of the regions of the world, prices charged by utilities are lower than costs. The aforementioned worldwide survey of utility companies by Global Water Intelligence used the information on tariffs to assess the degree of sustainability of utilities, based on normative criteria. The study found that, overall, only 39% of utilities were charging tariffs that allowed them to fully recover short-run and long-run costs (Komives et al., 2005). Even in the OECD, only half of the utilities achieved this target. By contrast, among the utilities surveyed in Africa, none covered even their operating and maintenance costs (Figure 12). These findings, although they may not reflect particular cases of well-run utilities not included in the survey sample,[35] provide a useful benchmark and complement and confirm those from earlier, more localized, studies.

Thus, due to the low tariffs practiced, utilities worldwide are in structural need of subsidies to balance their budgets. This is not, however, the whole story. Additional subsidies are needed because of technical and commercial losses that drive a wedge between the theoretical revenues that utilities could achieve, given the prevailing tariffs, and their real revenues.

Figure 12: An Assessment of the Sustainability of Water Tariffs Across Regions



Source: GWI, 2004, quoted in Komives et al., 2005

[35] Africa is very heterogeneous in this respect. For example, some utilities in South Africa have been running for decades without government subsidies. Nevertheless, compared to other countries of Sub-Saharan Africa, South Africa is a very specific case.

Available studies suggest that the efficiency of utilities varies massively between countries. In Africa, the technical and commercial performances of utilities are often very low. As an illustration, a report from IUCN (IUCN, 2002) on South Africa puts numbers on the various stages between production and revenue collection for a typical water utility in that country (figure 13). Technical and commercial losses represent 60% of total water produced. Figures mentioned for other African countries are even higher than those. In Kenya, it has been estimated than less than 17% of water is paid for in Mombasa and less than 32% in Nairobi (Gulyani et al., 2005).

The logical consequence of these losses is that the portion of the subsidies paid by governments to utilities (assuming they effectively maintain utilities solvent) which actually reaches households is very low. Put differently, most of the government transfers are wasted, due to technical and commercial inefficiencies.

Figure 13 : Typical Components of a Domestic Water Supply Balance in South Africa

Water supplied per month kilolitres/household	11	Revenue water	11	Metered, billed, paid for and used efficiently	21%
			10	Unmetered, billed, paid for and used efficiently	
	7		9	Metered, billed, paid for and used inefficiently	13%
			8	Unmetered, billed, paid for, and used inefficiently	
	3		7	Paid-for leakage on customer's property	6%
	13	Non-revenue water	6	Unpaid bills	24%
	19		5	Unbilled authorised consumption	36%
			4	Unbilled unauthorised consumption	
			3	Leakage on mains	
			2	Leakage on overflows and storage	
			1	Leakage at delivery point connections before any installed meter	

Figure 1: Typical components of a domestic water supply balance in South Africa

Source: IUCN (2002)

The way subsidies are financed varies across countries. We refer the reader to Komives et al (2005) for detailed country examples. It is interesting to note, though, that both cross-subsidies and subsidies financed by external transfers to utilities with the help of *ad hoc* mechanisms have faced difficulties.

Cross-subsidies face three types of problems. First, as mentioned in section 3, the division of consumers into subsidized and subsidizing categories in a way that allows a balancing of the costs (no net deficit for the utility from cross-subsidies) is hard to achieve.[36] Over time, such a system faces two threats. First, in some contexts the categories defining eligibility for the subsidy may be subject to manipulation by interest groups. Second, consumers with alternative supply possibilities (e.g. firms, which typically pay higher prices than consumers) and facing high tariffs may opt out of the system. Both occurrences can leave in the system a growing proportion of subsidized consumers. Problems of this nature with cross-

[36] A simple example is when the parameters defining eligibility to the subsidy are defined nationally (or for broad groups of regions or cities) instead of locally. In that case, depending on local income distribution, the proportion of consumers eligible will vary, making local utilities "structurally" better or worse off.

subsidies in Colombia are described in Komives et al. (2005, Box 6.1, p105). In that country, water utilities suffer structural losses as a result of the subsidy scheme (equal to 20 percent of sector turnover in water), and it is necessary for the national government to step in and help cover those losses.

A general problem when subsidies take the form of budget balancing subsidies to utilities is that the possibility of obtaining external budgetary support creates a disincentive for utilities to improve their performance.

4-5 Households' Need for Subsidies and Willingness to Pay for Improved Water Services

As discussed in section 3, the question of which categories of the population should be the target of water subsidies should be answered on the basis of empirical data, relating most of all to local income distributions and patterns of expenditures. It is beyond the scope of this paper to review the available local studies on this issue, and the reader is referred to references in Komives et al. (2005). An alternative approach to evaluating the adequacy of tariffs and the need for subsidies is to assess the willingness of households to pay for improved services. The reader is again referred to Komives et al. (2005) for a review of the existing studies. Interestingly, available studies seem to suggest that consumers would often be willing to pay for significantly higher tariffs than those charged by utilities, in exchange for improved reliability of service.

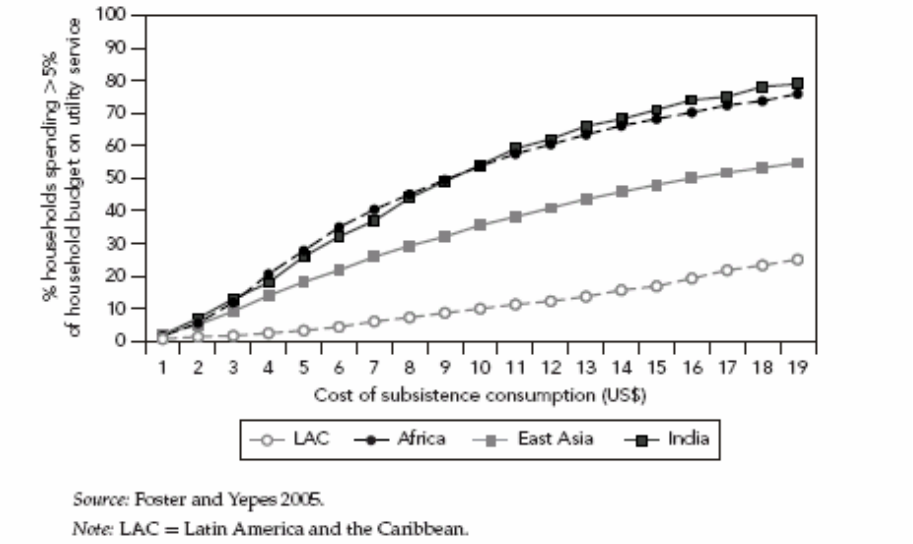
However, normative approaches based on the notion that expenditures for water should not represent more than a certain percentage of income continue to be widely used. This type of approach is interesting in order to compare different countries, regions, and cities in terms of affordability of water services. Such an approach has been used in a study by Foster and Yepes (2005). They start by defining a "minimal" or subsistence water consumption, the provision of which to every household may represent what a benevolent government might think of as a valid policy objective. By varying the cost of this subsistence quantity, the authors assess, on the basis of income distributions, how many households would end up spending more than 5% of their income paying for it. The results, illustrated in the following figure taken from Komives et al. (2005), illustrate the potential sensitivity of water tariff issues, by showing that high tariffs have the potential to bring basic water expenses to levels that may be judged "too high" socially and politically.

It is interesting to compare these results with the actual price of water charged by utilities. If water were priced at levels that ensure financial sustainability for the utility (e.g. US $1/m3), the price of a typical subsistence water quantity (e.g. 10 cubic meters per month) would reach US $10. At this level, more than 30% of households in East Asia, and more than 50% in Africa and India, would pay more than 5% of their incomes for it. However, as we have seen above, tariffs effectively charged by utilities are often far below cost-recovery levels. For example, taking the average of prices reported for Africa in the GWI study (US $0.10/m3), the price of the 10 cubic meters would be only US $1. At this level, according to Foster and Yepes, less than 5% of African households would pay more than 5% of their incomes for it (Figure 14).

Interestingly, this latter figure is much lower than the typical percentage of households connected to the network that are subsidized (see below). Notwithstanding detailed investigations at the country or city level which as argued above should constitute a necessary step to the design of any subsidy mechanism, this result suggests that there is room for improvement in the way tariffs and subsidies are practiced. If subsidies are to address only affordability concerns, they probably could be much better targeted than

they currently are. Utilities could probably increase their unsubsidized tariffs (thus progressing towards cost recovery) without jeopardizing the financial health of most currently subsidized households. .

Figure 14 : Proportion of Households Who Would Pay More than 5 % of their Incomes on a Subsistence Water Consumption Under Different Tariffs.



Source: Foster and Yepes 2005.
Note: LAC = Latin America and the Caribbean.

Source: Foster and Yepes (2005).

4-6 The Performance of Water Subsidies

This section examines various aspects of the performance of water subsidies. We do not attempt a systematic examination of all the criteria identified in section 3.7. Rather, we highlight issues which are prevalent in most of the developing world.

The first important point is that **consumption subsidies delivered through low tariffs (e.g. IBT), which are the most prevalent subsidies worldwide, are typically not well targeted to the poorest households**. This is because, as mentioned in section 3.3, several hurdles distort the distribution of such subsidies away from the poor:

- The proportion of households having potential access to the network is often higher for non-poor households than for poor households;
- The same is true for the proportion of households that choose to connect to the network, given access;
- Non-poor households connected to the network often consume more than poor households. Thus, they will receive a greater proportion of the subsidies, since those are based on unit tariffs.[37]

An example from Cape Verde, drawn from Komives et al. (2005), illustrates the cumulative effect of these hurdles on the distribution of subsidies. The prevailing tariff structure in Cape Verde was an IBT. Poor households had significantly less frequent access to the public network than the whole population. Among those with access, the choice to connect was half as frequent among poor households. These

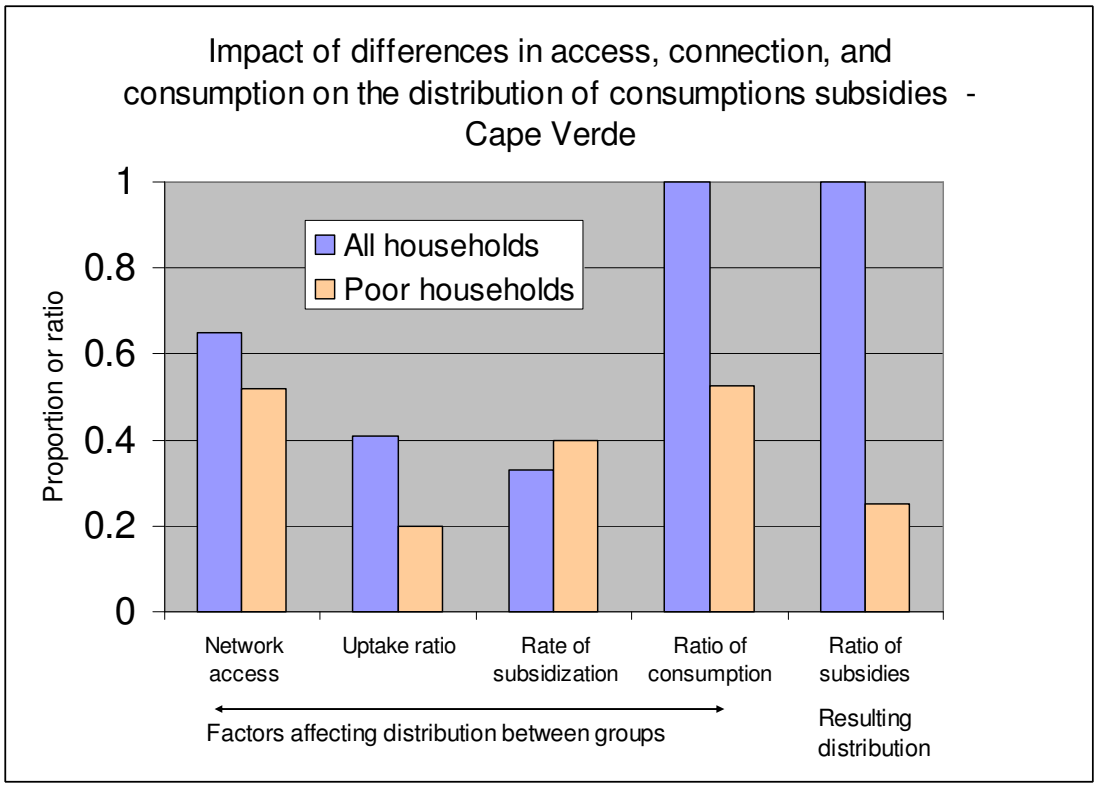
[37] Lastly, it can also be the case that poor households are less metered than non-poor households and thus are unable to benefit from consumption subsidies. In such a case, the outcome would depend on the relative values of the fixed charge for unmetered water use and the tariff for metered use.

"connection factors" alone biased the distribution of subsidies towards non-poor households. Moreover, poor households connected to the network were found to consume only half as much water as the whole population of connected households. Even though, through the IBT structure, the resulting subsidy rate was higher for the former, this did not compensate for the difference in consumption. As a result of these successive hurdles, the ratio of subsidies going to an average poor households to those going to the average household was only 1:4 (Figure 15).

These conclusions are not unique to the case of Cape Verde. Indeed, one of the main lessons from the World Bank review study is that access factors (including metering) constitute the main constraint to reaching the poor with consumption subsidies through low tariffs.

Another feature of the IBTs which are prevalent around the world is that they are inherently badly targeted, because the size of the first block (the most subsidized one) is too large, often well beyond commonly accepted subsistence levels. As a result, a substantial proportion of households, and not only the most poor, fall into the first consumption block and end up paying subsidized tariffs on their whole water consumption.

Figure 15 : Successive Hurdles Affecting the Distribution of Consumption subsidies to End Consumers : Example of Cape Verde



Source: Komives et al. (2005).

The second important lesson is that **administrative targeting can significantly improve the performance of tariff-based subsidies**. As discussed in section 3, there is a range of targeting methods, going from categorical targeting popular in the former Soviet Union, to selection based on family structure and location, with the most sophisticated methods relying on means testing. Selection based on

family size alone is usually found to perform poorly in targeting the poorest households. The power of geographic targeting depends in large measure on the correlation between poverty and location of households. It is thus clear that the level of detail of geographic information available to the administration will play a crucial role in defining adequate priority areas for subsidy eligibility. Geographic targeting has given interesting results in Nepal (Komives et al., 2005), but seems to have limited potential in Colombia and Senegal. In the last country, the examination of individual water consumptions reveals that although the average consumption did not vary much across most of the neighborhoods, there were huge variations of individual consumptions within neighborhoods (Lauria, Hopkins and Debomy, 2005). In such a case, targeting based solely on geography will fail to identify the poorest households.

Another feature that clearly emerges from the review of existing studies is that water consumption subsidies are not a good redistribution tool. First, as mentioned above, water expenditures typically represent a low proportion of the household's budget. Second, access factors biased against the poor make subsidies through low water tariffs very unlikely to reach the poor. Third, correctly identifying poor households is often difficult to achieve in developing country context.

A final point is that **connection subsidies are not very common, although the potential benefits of such subsidies may in many cases be far important than their costs**. As discussed at length in section 3-1, the value to a household of a connection to improved water service can be seen as a stream of benefits which are a complex function of direct net savings or expenses from buying sources from alternative providers or fetching it from elsewhere (potentially allowing a reallocation of consumption); of indirect benefits in terms of time freed up to get water into the household; and of other indirect benefits related for example to improved health or education outcomes.

Studies which try to quantify all those benefits are rare. Most of the existing studies only consider one aspect. At the macro level, a study by WHO (Hutton and Haller, 2004) presents benefit-cost ratios for different types of intervention in water and sanitation for different regions of the world. Their estimates are often high, ranging from 5 to 11 in most cases. However, they do not include the value of savings due to lower water prices.[38] Considering only the savings associated with connection to the water network in Niamey, Niger, Bardasi and Wodon (forthcoming, quoted in Komives et al., 2005) find that the poor would save about US$0.75–$1.00 per cubic meter by connecting to the water system. The yearly savings for a household consuming 10 cubic meters a month is equal to between one-quarter and more than one-half the fee charged to obtain a connection, depending on the definition of poverty adopted in the analysis. In this case, the net present value of these cost savings quickly exceeds the cost of connection.

From these results, it seems clear that the potential of subsidies to the extension of the water network and to connection should be explored more than is currently the case.

[38] Included in their analysis are the value of time savings due to access to water and sanitation; the value of averted deaths ; the value of increased attendance at work and school, and the savings in treatment costs due to lower prevalence of disease.

4-7 Towards A Broader View of Government Interventions Aimed at Increasing Access to Improved Water Services

The traditional paradigm of consumption subsidies passed on to consumers through utilities via low tariffs has repeatedly shown its limits. In many countries, most of the subsidies given to utilities have been absorbed by inefficiencies, rather than passed on to consumers. In Africa in particular, access has remained low and is systematically lower for poor households than for the rest of the population. Due to the need to rely on other types of providers, many consumers pay for their water a substantially higher price than they would if the service provided by the utilities was universal and reliable. Yet, there is generally no subsidy going to households not connected to the network.

Overall, the evidence presented above in this section suggests that:

(i) In many contexts, households would be willing to pay higher prices for improved services, thus potentially alleviating the burden on the utilities (and government) budget;

(ii) Policies should be focused on increasing access to improved drinking water, rather than subsidizing consumption of tapped water provided by public utilities.

Public interventions should aim at balancing a range of other levers, such as providing connection subsidies; providing differentiated services; and incorporating alternative providers in the overall picture. The latter point includes devising an enabling framework for water provision; considering appropriate regulation of alternative providers; and considering the provision of subsidies to low-income households not relying on the public network.

5 Conclusion: Incorporating the Framework Into Water Sector Reforms in Africa

This paper has focused on presenting a framework to analyze water tariffs and subsidies as they exist today in developing countries. The main conclusion from the review of empirical evidence is that designing tariffs and subsidies for water has proven to be a challenge almost everywhere. Conflicting economic objectives (cost recovery versus affordable tariffs), social constraints (low incomes coupled with the fact that water is seen as a necessity), and incentives problems linked to the nature of the industry combine to create a range of conflicting issues, the importance of which varies across countries. The performance of water subsidies on different criteria varies greatly according to country, design, financing, etc. Nonetheless, a certain number of robust conclusions clearly emerge from the existing evidence.

First, affordability of public water services constitutes only one facet of the problem. Its relevance increases as access to piped water gets closer to universality. On the contrary, in many countries and in Africa in particular, access to improved water services continues to be the main constraint. Provision of access has the potential to improve welfare considerably through, e.g., allowing the poor to shift to improved quality public water from alternative supply sources, improving health outcomes and freeing time for education and income-generating activities.

Second, in most countries water tariffs are not a good redistribution tool. This poor performance relative to other subsidy mechanisms is due to many factors, including its indirect nature; the small proportion of poor households that are connected; and the relatively small share of water expenditures in household budgets. Thus, redistribution *per se* should not be the aim of water consumption subsidies.

Third, notwithstanding the argument above, there is scope for public intervention in both ensuring that poor households can eventually get access to improved water sources and that water tariffs are not too high for the poor. But individual household connections are only one of the ways by which this can be achieved; other forms of provision need to be considered as possible alternatives.

Fourth, from the available evidence, willingness to pay for improved services may be higher than supposed (or conveniently assumed) by politicians or regulators in poor countries. It is thus probable that the low tariffs for water observed across the world do not adequately reflect the capacity of households to pay for improved water provision, thus imposing unnecessary burdens on financially overstretched utilities. At any rate, tariffs levels and associated subsidies should be determined on a case-by-case basis based on empirical data, rather than assumed willingness to pay.

This set of findings may fall short of providing concrete recipes to policy makers. Water sector reforms do not begin with a *tabula rasa* but take place within the context of existing infrastructure and networks for water delivery, as well as preexisting tariffs and subsidies.[39] This section is devoted to the examination of the links between abstract principles and lessons, and the implementation of water reforms in developing countries. In short, how can the framework laid out above be successfully integrated into the design and implementation of water reforms?

As should be apparent from the analysis presented in the previous sections, political economy constraints are a major factor to take into account when trying to reform tariffs and subsidies in the water sector. This message is further reinforced by the examination of concrete project documents from multilateral donors such as the World Bank. This has a number of implications. First, reforms of tariffs and subsidies have to be gradual. Second, the idiosyncratic features of local markets, including income distribution, water tariffs, and the prevailing institutional arrangements for water delivery, determine in large part the limits within which transition paths from old conditions to new conditions have to be designed. The ambition of this section is not to cover any particular country circumstances in detail. Rather, focusing on Africa, we want to highlight issues that seem relevant for water reforms more or less across the board, although of course to varying degrees depending on the country examined. Having done that, we present some tentative recommendations.

5-1 Water Reforms in Africa: Some Political Economy Issues

Maybe the most urgent and general problem in the context of water provision in Africa is how to cope with the rapid urbanization which has been occurring across the continent. Urban areas in Africa are bearing the brunt of demographic pressure, facing increased demand for urban services as rural to urban migrations continue to feed the rapid growth of cities. As emphasized in recent work (Fay and Opal, 2002), in most of Africa in the 1990s urbanization was not accompanied by income growth, which has compounded the difficulties of providing adequate services to the major part of the population. As an example, in the case of Dakar, Senegal, it is estimated that 100,000 to 120,000 new migrants come to the city each year (Lauria, Hopkins, and Debomy, 2005). Relevant to water and infrastructure in general, most of this sustained urbanization has occurred in an extra-legal context, meaning that most African governments have not been able to offer incoming migrants adequate facilities in terms of water, sanitation, roads, as well as other basic amenities. Almost by definition, migrants coming to the periphery of cities face the most difficult conditions in terms of access to water. First, peri-urban neighborhoods are not likely to be connected to public networks, given the frequent backlogs and lags between the physical occupation of new areas and the effective provision of public water services. Second, most of the

[39] See e.g. Brook and Locussol, 2004, for a description of the reform of the subsidy system in Guinea.

urbanization is illegal in one way or another,[40] resulting in legal obstacles for utilities to provide services to residents. This is an acute problem in various countries.

Another clear constraint which manifests itself across the board in Africa is the precarious financial status of most utilities. Many utilities do not even recover operating and maintenance costs. In those cases, how to finance and speed up the financing of network extensions? Although *ad hoc* solutions have been devised, reliance on external grants remains the rule for most of the investments. This lack of financial sustainability results in so-called "low-equilibrium traps", whereby utilities cannot adequately maintain and extent the network; the quality of services deteriorates; households or industries have to secure consumption from other providers; the most well-off consumers opt out of the system, which further undermines the viability of the utility. Related to this financial sustainability equation are, on one hand, questions of capacity of consumers to pay for services, and on the other, efficiency and commercial performance of utilities. On the consumer side, it is worth mentioning once again that a key indicator of the extent of affordability is the proportion of households that do not connect to the network, even though the possibility exists. Further evidence on the reasons why households choose not to connect to the network is needed,[41] along with traditional data on income and expenditures, to improve our understanding of the extent of affordability constraints. On the utility side, what seems clear from the evidence accumulated in Africa is that substantial improvements in the financial health of utilities could in many cases be reached by working on improving the physical and commercial sides of water production and delivery.

5-2 Recommendations

It is outside the scope of this paper to provide a comprehensive list of possible actions by governments willing to reform water tariffs and subsidies. Such a task would indeed be formidable, given the broad range of actions that are at the disposal of governments in this domain. Those include in particular core normative decisions such as allocation of water between sectors or types of consumers; water pricing; the design of water subsidies; and refining the role of the State as a utility regulator and incentive provider. But they also include broader enabling actions such as devising adequate frameworks for cooperation between levels of governments in the delivery of services; giving support to alternative providers; and getting communities involved in the decisions regarding the delivery of basic services. Rather, this final section aims at providing a limited number of lessons and recommendations that emerge from the available empirical analyses and seem robust to a wide range of specific circumstances.

1) More data are needed

Micro-level data on household incomes, water consumption, and expenditure patterns, as well as assessment studies, are a prerequisite to sound policy formulation in the water sector. In particular, they should be used to determine the level and structure of the water tariffs that can be supported locally; the necessity of subsidies; and the type of subsidies needed and their probable incidence. In many contexts,

[40] This may occur for a number of reasons, the importance of which varies across countries. The land occupied by new settlements may have been invaded or illegally subdivided; or it may be classified as non-residential in urban planning or zoning documents; or the construction may lack a building permit or certificate of conformity. The result is the same: without a formal property title, households cannot access public services.

[41] Beyond affordability constraints, other reasons could include the existence of alternative ways of provision; technical or financial constraints stemming from the necessity to install end equipment (faucet, etc.) to be able to benefit from the service; political constraints, for example in neighborhoods controlled by landlords who also have a financial interest in alternative forms of water delivery services; and regulatory constraints (e.g. informal housing is not eligible for provision by public utilities).

such basic data and assessments are lacking. Data are also needed on a continuous time basis to monitor the subsidy program or to put in place administrative selection mechanisms.

The initial assessment should pay as much attention to the affordability of the connections as to the affordability of the service itself. Connections often entail upfront costs, both in the form of company charges and in the need for complementary household investments. These costs can be prohibitive for poor households with no or limited access to borrowing. As mentioned above, more data and studies are needed on the extent to which and on the reasons why households with potential access to the public water network choose not to connect. Lack of uptake by poor households is potentially a major factor in the regressivity of consumption subsidies.

2) Many of the current subsidy schemes would need to be better designed in order to improve targeting and increase coverage of poor populations

Water tariffs and subsidies are only a facet of development challenges in water and sanitation. In order to devise more equitable schemes, governments need to consider the big picture, including all the factors that potentially influence the provision of basic services to the poor: Those include in particular:

- low or very low overall access rates;
- disparities in rates of access between urban, peri-urban and rural areas;
- legal and administrative constraints (e.g. urban planning and zoning documents in peri-urban areas; legal limitations on the provision of basic services to dwellings not complying fully with the law) ;
- unclear and/or anti-poor regulation of the sector (e.g. by giving legal monopolies to utilities over areas which they currently do not serve).

3) In order to increase access to safe drinking water, governments need to consider a broader array of interventions than solely subsidizing utility companies,

In many contexts, and notwithstanding varying local situations, policies should be focused on increasing access to improved drinking water, rather than subsidizing utilities. Public interventions should aim at balancing a range of other levers, such as:

- considering how to speed up extensions of the network, especially in fast growing peri-urban areas ;
- providing connection subsidies to households who cannot afford connections to an already existing network;
- providing differentiated services, associated with tariffs reflecting the difference in service quality;
- incorporating alternative providers in the overall picture, including devising an enabling framework for water provision; considering appropriate regulation of alternative providers; and considering the case for providing subsidies to low-income households not relying on the public network.

4) Financing needs of utilities need to be separated from subsidy issues

As briefly explained in this paper, in many countries the "traditional" way to deal with utilities has consisted in mandating low tariffs, in exchange for compensating for the losses incurred through various means (see section 3-4 above). Such transfers to utilities mix two different financial issues, i.e. utility financing needs and social equity considerations. Due to political economy problems of various kinds, in practice this has often meant unfunded subsidies, lack of incentives for utility efficiency, or both,

resulting in declining quality of service which further undermines the viability of the utility. For the regulator or the government, it is difficult to sort out, in the financing requests of the utilities, how much relates to efficiency problems and how much relates to actual consumer subsidies.

As mentioned above, social concerns are legitimate, but the responsibility to assist poor customers should belong to the government, not to the utility. Utilities should be allowed to charge sustainable tariffs (although properly monitored), and subsidies to needy customers should be provided by the appropriate level of government. The advantages of such an unbundling are manifold:

- sustainable tariffs are the best guarantee to sustained services in the medium to long run;
- such a separation makes consumer subsidies more transparent,
- the framework provides better incentives for utilities and governments.

Better incentives and increased transparency may constitute the main reasons why multilateral donors have increasingly shifted their projects towards output-based finance and subsidies. In this framework, project financing and subsidies are delivered based on the completion of performance targets in terms of, e.g., households connected to the network, rather than provided as general support to the utility. It may also be noted that the recommendation to separate subsidies from finance constitutes a basic paradigm in other sectors, such as housing.[42]

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[42] For example, it is generally recommended, when the economic environment allows it, to substitute interest rate subsidies on mortgages, delivered through bank intermediaries, with direct (so-called "upfront") subsidies which either increase the household downpayment or come in the form of a deduction from payments of a mortgage taken at the market rate.

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