The Urban Water Supply Guide

Service delivery options for low-income communities

Produced by
Water & Sanitation for the Urban Poor

WSUP has been implementing water and sanitation programmes since 2006, during which time we've gained experience in eight countries. Improving water supply to low-income urban consumers is a core part of all our country programmes, and we know it's not easy. The unique characteristics of these communities present unique challenges and demand flexible solutions. In WSUP's experience, water utilities often have the will to serve these consumers, but they sometimes lack the necessary capacity and expertise. A fundamental part of WSUP's approach is to offer specialist support to the utilities so they become stronger and better able to provide sustainable services to all their citizens.

It was against this background that we commissioned an analysis of water supply options for low-income consumers in Kumasi, Ghana, to provide practical guidance to Ghana Water Company Limited. The results of the analysis were striking - fourteen different options were identified. All had different characteristics and different cost-benefit equations. The study, led by Richard Franceys, co-author of this publication, also showed that it is possible to implement service models that are both affordable for the low-income consumer and commercially viable for the utility.

It became clear that these findings needed to be shared with the wider sector, so that utilities throughout Africa and Asia could better appreciate the broad menu of options available for serving low-income urban consumers. This guide combines the Ghana study with practical experience from our programmes, in an effort to bridge the information gap that continues to prevent utilities from serving low-income consumers. The case studies we have included from our work on the ground show that it can be done. We hope you find the guide to be engaging and useful, and as always, let us know what you think!

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Contents

About this guide

What is this guide?

Providing improved water supply to low-income urban communities is a difficult challenge faced by water utilities throughout Africa and Asia. This guide provides an introduction to available options for serving these communities. The guide draws on sector experience in general, and more particularly on WSUP's extensive experience of implementing urban WASH programmes in sub-Saharan Africa and elsewhere. WSUP currently has programmes in 11 cities across six countries (Bangladesh, Ghana, Kenya, Madagascar, Mozambique and Zambia).

Who is this guide for?

This guide is aimed primarily at executive and technical staff in water utilities and related organisations, such as asset-holders and regulators. It will also be useful for WASH professionals working in governments, development agencies, funding agencies or civil society organisations.

So why is this guide needed? The challenges of serving low-income urban communities...

Access to a safe and affordable supply of clean water is widely accepted as a universal right, but it is far from a universal reality: 140 million people in urban areas still use an unimproved water source and that number is rising, not falling. In most cities in the developing world the utility is mandated to supply *all* urban consumers, but the expansion of water supply to low-income consumers can be neglected, despite accounting for as much as 40% of a city's population. Part of the problem is a lack of knowledge and a lack of support to utilities in taking the required steps: low-income communities have unique characteristics (see Box 1) and water supply to these areas can't be approached in the same way as for the rest of the city. This guide has been produced to give utilities some practical guidance on the variety of options available for expanding their services.

Box 1: What exactly is a low-income urban community?
Low-income urban communities are neighbourhoods in which a high proportion of households live in poverty. They are often characterised by poor-quality housing, insecure tenure and high population densities; by high unemployment and low-incomes; by low levels of access to basic services; by high levels of child disease and child mortality; and by low average life expectancy.

Remember: people in low-income communities are paying customers too!

We can agree that everyone has the right to a utility water supply, but we also need to accept that utilities are operating under real financial constraints. So before you read any further, it is important to clarify the starting assumption of this guide: people living in low-income communities are customers too, and in most cases they *can* afford to pay for a utility-managed water supply. A dangerous misconception is that it doesn't make commercial sense for a utility to serve low-income communities: wrong! Most of these consumers already pay high prices for their water, to an unregulated informal supplier; in many cases they pay *more* than the resident of a neighbouring high-income community with a piped utility supply. WSUP believes that this situation is both unfair and unnecessary. Through our programmes we have demonstrated that improved water supply to low-income communities is a 'win-win' situation: low-income consumers benefit from a cheaper, more reliable utility supply; the utility generates additional revenue from all these new customers; and this additional revenue can help to improve services to everyone in the city. So if you are a water utility looking to extend water services to low-income communities, we urge you to take some of the options in this guide and to put them into practice: it's good for you and it's good for your customers!

Box 2: So does this mean that WSUP recommends full cost recovery from low-income consumers?
No: low-income consumers can pay commercially viable rates, and serving low-income communities is good business for utilities. However some capital investment by governments and development partners is still generally going to be necessary to cover full lifecycle costs of water services provision; and providing services to the very poor will often require some form of cross-subsidy from other consumers, though the amount of subsidy needed may be less than is often assumed. (For more on how to achieve the right balance between affordability and commercial viability, see page 6.)

How to use this guide

Which water supply options are included?

This guide introduces a selection of water supply options identified as being effective through WSUP's work on the ground. We have only included water supply options in which a utility has potential involvement, and where some form of payment is required: private sources such as rainwater, wells and springs are not covered here. Individual household connections are the ideal, and we encourage utilities to aim for this where possible. But we also recognise that pragmatism is needed: utilities will have different starting positions, and transition options such as staffed standposts and kiosks may be a necessary medium-term strategy. By the same logic, we have included three options that are not considered improved by the WHO/UNICEF Joint Monitoring Programme (JMP): again, these must be viewed as temporary solutions in contexts where it is not currently possible to provide everyone with an improved water source. Finally, it is important to remember that although this guide looks at each water supply option in isolation, many of these options can be implemented simultaneously in the same community.

How is the guide structured?

The options are presented in four sections which are ordered by proximity to the household, beginning with individual household connections and moving further away in terms of the distance the householder needs to travel to collect water. The criteria for the three main sections of the guide are defined below:

In-House: It is possible for the consumer to access water without having to leave their house or private yard.

Compound: It is possible for the consumer to access water without having to leave their shared compound. Here 'compound' is defined as a cluster of households living in a shared space, typically around a central courtyard, often gated, and often paying rent to the same landlord. This is a common form of habitation in low-income urban communities.

Communal: The consumer is required to go outside their household or compound to collect water from a public location. These solutions include group connections in which a defined group of consumers share a water access point, and public facilities that can be used by everyone in the community.

Note that there are multiple scenarios for many of the options included in this guide, and these definitions are not absolute: for example, water resale (page 13) may take place in a public place outside a compound; or a householder may lay piping from a meter cluster (page 14) direct to their individual household.

Cross-cutting solutions: expanding the reach of services

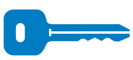
At the end of the guide we include three options that are particularly useful for expanding the reach of services in communities without a formal piped network supply. These options relate to the sourcing (Borehole: pages 24-25), delivery (Water tanker: page 23) and management (Delegated management: pages 26-27) of overall water supply and can be relevant to the house, compound and communal level. Each of the three options represents a short or medium-term solution for improving and expanding services: remember the long-term goal is for the utility to serve all customers directly with a piped network supply!

How are individual pages structured?

Each page begins with a basic description of the water supply option together with an illustration. We then summarise the practicalities involved with each option from a utility perspective. This summary is typically divided into four important areas:

- What are the capital investment requirements?
- Who is responsible for O&M?
- Recommendations for management
- Recommendations for payment model

Each page also includes a key point and a real-life case study of that option in implementation. Here you will need to look out for these helpful icons:



= the *key point* to remember about the option.

= a *real-life case study* from WSUP's experience.

Achieving the right balance between affordability and commercial viability

As noted, people living in low-income communities typically pay high prices for poor-quality water services provided by informal suppliers: so extending utility-managed services into these communities should be a 'win-win', good for low-income consumers, and good for the utility's business.

Of course the utility will need to manage this process effectively, and to think carefully about pricing (indeed, a well-functioning regulator will *oblige* the utility to think about pricing). As with any business, it will be vital to find the right balance: set the tariff too low and the utility creates an unsustainable cost burden; set the tariff too high and the utility fails to fulfil its legislated mandate as a provider of basic public services. In many contexts the process of tariff-setting is further complicated by the presence of cartels whose activities distort the market: the effects of these activities need to be recognised and planned for.

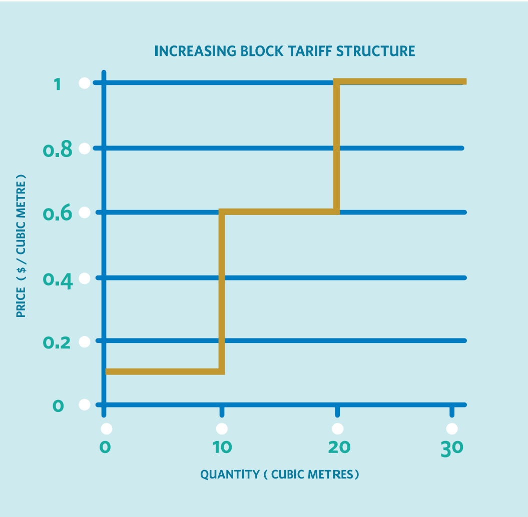
Pro-poor tariff systems

Pro-poor tariff systems aim to reduce the cost of water for low-income consumers, while at the same time maintaining sufficient revenues for commercial viability. Commonly used tariff systems are as follows:

Increasing Block Tariffs (also known as ***Rising Block Tariffs***): In these systems, customers who use less water pay less per cubic metre. An example is shown below: consumption of up to 10m^3 per month is charged at $0.1 per m^3. Above the lowest block (referred to as the **Lifeline Tariff**), the price per m^3 rises. The system aims to ensure that low-income consumers can access a minimum, affordable level of water, but there are some potential problems: firstly, the model assumes that low-income households use less water than high-income households when this may not be the case; low-income households may have lots of people using a single connection, so that total consumption is high. Secondly, the utility can find itself subsidising too many of its customers if middle-income consumers also restrict their usage to close to the Lifeline monthly allowance, leading to reduced revenue and usually poorer service for all. To guard against these risks, the regulator needs to assess whether an Increasing Block Tariff is an equitable system in the local context: this can be done through detailed surveys looking at ability-to-pay, and at relationships between poverty and household size. Certainly, adjustments should be made for group connections (see page 12 and pages 18-19).

Volume-Limited Free Water systems allow the poorest households to access a limited amount of water free of charge: the cost to the utility can be compensated by the removal of the Lifeline Tariff covering all urban consumers (this is no longer needed, as the poorest households have been directly targeted). **Flat Rate Tariffs** give low-income consumers access to unrestricted amounts of water, for which they pay a fixed amount (see page 9).

For more detailed information on tariff setting, see Banerjee S and others (2010) Cost recovery, equity, and efficiency in water tariffs: evidence from African utilities, World Bank; or Fonseca C and Franceys R (2010) Guidelines for User Fees and Cost Recovery for Urban Networked Water and Sanitation Delivery, African Development Bank.



Adjusting tariffs depending on service level

This guide offers various options by which utilities can improve water services in low-income communities: the 'gold standard' is individual household connection, but in the short term it may not be possible to provide individual household connections to everyone in the city. This means that the transitional solutions included in this guide are necessary, but they are still a compromise: most utilities are *mandated* to provide *all* consumers with an *individual* household water supply. This is important, because communal supply solutions are often cheaper for the utility than individual connections: for example, by supplying water through a kiosk or pre-paid meter, the utility avoids the cost of extending the piped network to each household. We therefore advocate that the utility should charge reduced consumer tariffs wherever it has not provided individual household connections (reflecting the reduced service costs of transition options); and charge reduced bulk water tariffs to intermediaries (reflecting the utility's reduced distribution costs).

This view is supported by a previous analysis carried out by WSUP in Ghana. As detailed in the box below, a utility-managed kiosk or standpost can provide consumers with a much better service than informal suppliers, at lower cost. But if the utility supplies water to the kiosk at the standard domestic-supply price, the kiosk consumer will be paying much more per m^3 than a customer with an individual connection, and the net benefit to the utility will be ridiculously high: up to 180 times more benefit in the examples shown! Obviously this cannot be considered reasonable. Similarly, delegated management options can provide improved services at reduced cost for low-income communities; but the intermediary needs to be paid, and so poor consumers will typically be paying more per m^3 than a customer served directly by the utility. In both cases the price charged by the utility needs to be adjusted so that the final consumer is paying a fair price.

In 2010, author Richard Franceys carried out a detailed financial analysis in Ghana, looking at the relative costs and benefits of a range of water supply options, for consumers and for the water utility. Some of the results of this analysis are summarised in the table below. We stress that these results are for urban Ghana in 2010: costs and benefits in other cities and countries might be different, and it would be important to carry out this analysis separately for your city. Full details of the Ghana analysis are available on request by emailing erl@wsup.com.

The options are listed in order of net benefit to the utility, from meter clusters ($0.4 net loss relative to every $1 net gain from a household connection: see page 14), to pre-paid metered standpost, where net benefit is calculated as $180 (!) relative to every $1 net gain from a household connection. Clearly no regulator could accept the utility obtaining 180 times more benefit from low-income consumers than from wealthier consumers with a household connection: the tariff system and associated regulation will therefore need to be adjusted to ensure the cost per m^3 paid by the consumer is no more than that paid by a consumer with a household connection.

Water supply option	Cost to consumer per m^3 (US$)	Cost to consumer per m^3 relative to HH connection	Net benefit* to utility per m^3 relative to HH connection
Meter cluster (see page 14)	$0.73	80% of cost	-0.4
Water tanker with communal standpost operator (see page 23)	$4.55	500% of cost	0.7
Individual household connection (see pages 8-10)	$0.9	100% of cost	1.0
Utility staffed kiosks (see pages 16-17)	$3.93	440% of cost	125 (!)
Pre-paid metered standpost (see pages 20-21)	$3.93	440% of cost	180 (!)

Franceys R & Nyarko K (2010) Financial Modelling of Alternative Delivery Mechanisms - Water for the Urban Poor. The analysis incorporates the cost of capital associated with each option, as well as operating costs (OPEX) and capital maintenance expenditure (CAPMANEX). All calculations assume that the utility charges the same rate per m^3, regardless of whether the immediate customer is a household or a reseller.

As noted, the results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections. In the Ghana analysis, the small margin being charged on household connections contributed to the very high relative net benefit to the utility of alternative water supply options.

*Relative to $1 net revenue from a household connection, the water tanker options generates $0.7, the utility staffed kiosk and pre-paid metered standpost options generate $125 and $180 respectively, and the meter cluster generates a *loss* of $0.4.

What about connection costs?

Finally, it is very important to note that the consumer costs of water services include not only the continued cost of consumption, but also the one-off cost of initial connection. Any detailed evaluation of costs to the consumer, and of investment costs and net benefit to the utility, must take account of these connection costs. It has previously been common for utilities to charge new customers a fee as a contribution to the existing fixed asset costs, in addition to the physical costs of pipes and ferrules; recent research has led to utilities now reducing or removing that fee, as well as subsidising physical connection costs for low-income consumers in order to remove that barrier to connection. Those costs are then recovered through a small addition on the tariff charged to all consumers. In the example of Mozambique, the connection cost is partially subsidised and the remaining cost is financed by the equivalent of a small loan from the utility, repaid over the following year through an addition to the monthly tariff.

Individual household connection

An individual household connection to a piped utility network supply is the target water supply option for urban consumers, providing the most convenient and least costly way for a household to purchase water. Delivering the physical connection requires flexible design of the distribution network in informal housing areas, support to households through reduced connection costs, and capacity to facilitate the paperwork. In some locations householders are required to display land title documents in order to establish a connection, making this a difficult option to implement in low-income areas built on contested land (though even in situations of this type solutions can be found). The ideal is for householders to benefit from a 24/7 pressurised supply, although a compromise may have to be accepted until the utility has excess supply over demand.

What are the capital investment requirements?

- Extension of the piped network supply to each household, usually between 5-10 metres per household served.
- Service pipes from the distribution main, with an isolating tap and delivery to either an in-house tap fixed above a sink, or a standpost-type tap fixed to an external wall (free-standing yard-taps are more expensive and vulnerable to damage).
- Supply and installation of meters, where used.
- Increased bulk water production to deliver the water volumes required.

Who is responsible for O&M?

- The utility is responsible for maintenance of the piped network and for regular replacement of meters (every ten to fifteen years where well-managed with good water quality). This will require access to the necessary spare parts and staff with the technical capacity to keep the infrastructure operational.
- Individual household connections produce significantly more wastewater, which either has to be managed by the utility (where also responsible for sewerage) or through municipality-managed drains.
- Where utilities are unable to deliver 24/7 water, households have to invest in fixed storage tanks (underground and/or above ground) or multiple storage containers, all of which need to be maintained.

Recommendations for management

- Computerised billing and accounting systems are required to manage the large number of customers and their data on water usage and payments.
- If introducing household meters for the first time in a new area, community engagement is required before implementation to ensure the new system of meters is understood and accepted.
- Ongoing customer support may be required in low-income areas to limit the tendency to move towards non-payment of bills, with particular attention paid to ensuring 'little but often' bill payments.
- Erratic meter-reading, a reliance on estimates and other errors in billing can lead to non-payment from unsatisfied customers: the utility should take the time to establish robust billing processes!

Recommendations for payment model

Option one: Flat-rate connection

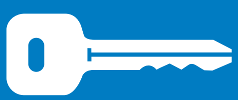
Under a flat-rate model the customer pays a fixed amount (based on their connection pipe size) for which they can use unrestricted amounts of water. Flat-rate charges require social cohesion and commitment not to waste water, but they can mean considerable savings to consumers. Other important points include:

- The utility saves very significantly on meter reading and administrative costs, particularly where linked to local municipal property taxes for ease of collection.
- Flat-rate tariffs can only be used where there is universal service such that households with a connection do not on-sell to neighbours, with a negative impact on the utility's revenue flows.
- The utility can be at risk of losing revenue through water wastage by households who have little incentive to restrict the volume of water they use.

Option two: Metered connection

With a metered connection the utility charges the household for the volume of water used, allowing for fairer billing and more accurate records of usage across the network when compared to flat-rate charges. Where the meters are accurate and well maintained (and have not been bypassed or duplicated) the customer pays for the amount of water they have used and the utility has a reliable means of securing payment for the water consumed. Other important points include:

- The tariff charged should be affordable to lower-income customers while contributing to the overall revenue required for utility sustainability.
- Lifeline Tariffs are often the default solution to 'help the poor' (this is the lowest level of an Increasing Block Tariff (see page 6), providing a basic level of water consumption at an affordable price). However in practice a Lifeline Tariff may confer more benefits on higher-income consumers, particularly where multiple household compound connections and/or large family sizes are common.
- The cost of connection is often a significant barrier to uptake: the utility needs to give customers the option to pay in a number of small instalments over time, and/or build the cost of the connection into the water tariff.
- Meters need to be read regularly so that credible bills are issued that encourage prompt payment, and the utility needs to consider how best to deliver the bill to the customer and facilitate payment. A billing system which alerts managers to unusual consumption patterns is required to protect customers against service pipe leakage and/or meter reader 'mistakes'.



Individual household connections are our goal. Charging households 'up-front' for the cost of connection can prevent them from connecting: utilities should absorb part of the cost of connection within water tariffs to ensure customers are not disadvantaged, in the same way that other fixed-asset costs of water supply are incorporated in the tariff.

Experience from Madagascar

In partnership with JIRAMA - the Madagascan water and electricity utility - WSUP initiated a pilot programme in late 2013 to promote individual household connections in five peri-urban communes of Antananarivo. Participating households were selected through pre-determined criteria including the ability to pay for the network connection and the administrative status of the land and house. Households pay approximately US$ 120 to connect to the utility network in addition to their regular water bill, for which they gain continuous access to a supply of safe drinking water. An important aspect of the pilot is the framing of the connection as a private asset, with the result that maintenance becomes the household's responsibility (suitability to maintain the connection is another aspect taken into account when selecting participating households). Affordability is promoted by giving households the option to pay the cost of the connection over a maximum of 12 instalments. The pilot has been a success so far, with 110 households already committed to a new connection: the next phase will target an additional 300 households, a figure that is likely to rise considerably as the programme continues to extend across the five communes.

Individual household connection

Financial analysis of the individual household connection option: costs to consumers and net benefit for utility.

Source: Analysis based on data for Accra (Ghana), 2012. The results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections.

Variation: Conventional household connection: piped supply with household meters and utility-managed distribution.

Cost to consumer per m^3 (US$)	$0.9
Net revenue to utility per m^3 (US$)	$0.01

Variation: Piped supply with household meters and conventional distribution, plus enhanced Information, Education and Communication (IEC), weekly bill collection and priority intermittent supply.

Cost to consumer per m^3 (US$)	$0.9
Cost to consumer per m^3, relative to conventional household connection	1.0
Net revenue to utility per m^3 (US$)	$0.11
Net benefit to utility per m^3, relative to conventional household connection	7.7 (i.e. 7.7 times more benefit)

Variation: Piped supply with household pre-paid meters.

Cost to consumer per m^3 (US$)	$0.81
Cost to consumer per m^3, relative to conventional household connection	90% of cost
Net revenue to utility per m^3 (US$)	-$0.45 (negative)
Net benefit to utility per m^3, relative to conventional household connection	-30.5 (i.e. net loss: see page 7)

Variation: Piped supply with a volume-limited flat-rate charge to designated low-income areas.

Cost to consumer per m^3 (US$)	$0.81
Cost to consumer per m^3, relative to conventional household connection	90% of cost
Net revenue to utility per m^3 (US$)	-$0.01 (negative)
Net benefit to utility per m^3, relative to conventional household connection	-0.5 (i.e. net loss: see page 7)

Variation: Piped supply with volume-limited free water to designated low-income households, with removal of >20m^3 Lifeline Tariff (the targeted provision of free water alleviates the need for a Lifeline Tariff benefitting all urban consumers).

Cost to consumer per m^3 (US$)	$0.28
Cost to consumer per m^3, relative to conventional household connection	30% of cost
Net revenue to utility per m^3 (US$)	$1.02
Net benefit to utility per m^3, relative to conventional household connection	69.7 (i.e. 69.7 times more benefit)

Experience from South Africa: water management devices

Access to water is enshrined in the Bill of Rights in South Africa, with each household entitled to a Free Basic Water (FBW) allowance of 6,000 litres clean water per month (in some municipalities the provision is as high as 12,000 litres). In an exciting innovation some municipal governments in South Africa have introduced a range of Water Management Devices (WMDs) targeted at low-income households as defined by the local authority. The WMDs are electronic control valves capable of controlling the flow of water (from full pressure to trickle flow) to a domestic consumer, enabling poor households to enjoy the convenience of an individual household connection while avoiding the risk of consuming more water than they can afford. The usage of water beyond the FBW allowance requires the householder to purchase credit for the meter, a safeguard which also helps the utility to limit its risk of bad debt. The introduction of WMDs has provided an efficient way for municipalities to fulfil their mandate of providing the most vulnerable with a minimum acceptable water supply, giving customers the control to buy more water if they choose and helping to recover costs for the utility by the same measure.

Household delivery

For households without access to a connection the time and energy involved in collecting water can be substantial. Many of these households are willing to pay more to have their water delivered, but most locations don't have a formal household delivery service. This enables private operators to fill the gap, often with low standards of service or water quality. These private operators avoid paying for bulk water access by using alternative sources or through illegal access to the utility supply, meaning that both the consumer and the utility miss out. So how can this situation be avoided? One solution is for the utility to form a service agreement with a private operator who buys water in bulk and delivers to the household: when combined with good regulation, this ensures the provision of water at a reduced cost to customers, and with little or no capital investment required from the utility. Household delivery typically takes one of three forms:

a) Drinking water only delivery – small amounts of additionally treated water are delivered directly to households from the local treatment kiosk.

b) Carter delivery – human-powered barrows and animal-powered carts deliver an agreed number of plastic jerrycans per day to households from a filling station.

c) Tanker delivery (see page 23).

What are the capital investment requirements?

- Extension of the piped network can be required in some cases, together with meters to charge operators.

Who is responsible for O&M?

- The utility maintains the connections and piped network through which water is supplied in the normal way.
- The private operator or deliverer has responsibility for O&M of any delivery mechanisms.

Recommendations for management

- Professional Services Agreements (PSAs) can be signed between the utility and the private operator, formalising the relationship.
- Active and engaged monitoring of private operators is essential to ensure service quality.

Recommendations for payment model

- Private operators should pay less than the normal commercial rate for water supplied from the utility source, reflecting the utility's costs savings in not delivering water the final distance.
- Private operators should charge a tariff that is affordable for customers while allowing the operator to retain a reasonable profit margin when the bulk tariff has been adjusted appropriately.

Many low-income households get water delivered to their door by an informal service provider for which they pay several times the utility tariff; these consumers would benefit from a cheaper, formal service. This option is not considered improved by JMP and should only be promoted where quality control is guaranteed.

Experience from Kenya: SmartLife

SmartLife is a business initiative led by WSUP Enterprises, with partners including Global Alliance for Improved Nutrition (GAIN), Unilever and IDEO.org. The business currently operates from two shops in Nairobi neighbourhoods, offering an efficient and affordable treated water and health goods home delivery service. After borehole extraction the water undergoes a process of on-site treatment through reverse osmosis. Customers subscribe to weekly deliveries and have the option of paying in-store or via mobile phone systems; the shop managers also undertake visits to customer homes to keep them up to date with available services and products. Customer loyalty is rewarded through free deliveries earned via a points-based system, with points awarded for each delivery and for any new customers recommended to the business. SmartLife currently buys water from a private borehole, but it is important to note that the model could be replicated from a utility supply.

Shared yard connection

A shared yard or communal area allows for the safe installation of a single connection to the utility network, which can then be shared between households who pay the bill collectively. This option enables the utility to increase the number of people served, with the additional benefits of a) a reduced level of infrastructure investment compared to individual household connections, and b) simplified billing procedures. As with individual household connections the bill-payer can either be charged at a flat rate for unrestricted water usage, or fitted with a meter and charged for the exact amount of water used (see page 9). Landlord-owned connections provide proof of property ownership (many utilities require this to set up the connection); however they can also cost the user more, because of the mark-up on water charged by landlords. Households benefit from having a standpost much closer to their home than a conventional street-located communal tap.

What are the capital investment requirements?

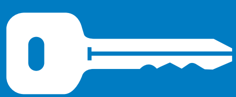
- Extension of the piped network to each compound or yard.
- Lockable standpost.
- Supply and installation of meters, where used. Pre-paid meters (see pages 20-21) can help landlords to manage multiple household payments.
- Landlord investment in above ground storage tanks (where 24/7 water supply is not available), to ensure continuous supply. Unfortunately most landlords do not make this investment – the utility should do everything possible to provide a 24/7 supply!

Who is responsible for O&M?

- Landlords are responsible for managing water use and wastewater disposal around the standpost.
- The utility must provide sufficient trained staff to ensure that meters are maintained and replaced over time.

Recommendations for payment model

- Landlord-owned connections should be considered to reduce the number of bills the utility has to manage. However a downside of this option is that landlords can be reluctant to commit their own funds, and may increase their housing rents disproportionally to recover costs.



This option may be problematic if there is a Lifeline Tariff system (see page 6): collectively a group of households are likely to exceed the limit for the tariff and will pay a higher rate than, for example, a wealthier person living alone. One option is for the utility to note the number of households served per connection, and to multiply the Lifeline allocation by the number of households on the stand when calculating the shared bill.

Experience from India

In experience presented by the Water and Sanitation Program (WSP: 2009), Bangalore Water and Sewerage Company (BWSC) introduced shared single-tap connections into its water supply options in the mid-2000s, with support from the Australian Government. A Social Development Unit was created within BWSC to promote the new policy, through which groups of 5-10 households were permitted to share a single connection. Another important component of the policy was the introduction of proof of tenancy of rented accommodation as the new minimum requirement, as opposed to land or household ownership.

Household resale

In low-income urban areas it is common for households with connections to the utility network (and/or with large volumes of storage capacity) to sell water to neighbours who don't have their own connection. This can be an effective way of improving access in densely populated communities, where 'resellers' provide a service to nearby households that is often more convenient, cheaper and of better quality than alternatives. This practice is not always condoned by utilities and regulators, and is in fact illegal in some countries; however in other contexts it is a reality that needs to be acknowledged, and consumers would benefit from utility management of the practice. The following guidance assumes that this option is legal and viable in the local context:

What are the capital investment requirements?

- Further investment is only required if the utility is increasing the total number of individual household connections in the area.
- Utilities should be aware of the risk of increased non-revenue water: network connections may be tampered with by resellers to increase water supply and reduce payment if a meter is installed.

Who is responsible for O&M?

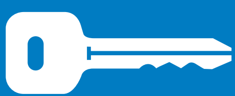
- Any extension of infrastructure beyond the network connection is the responsibility of the bill-payer, not the utility.

Recommendations for management

- The utility should formalise their relationship with the reseller and clarify the terms of the arrangement.

Recommendations for payment model

- High volume water usage from the connection should be charged at a reduced tariff to reflect the reduced costs for the utility and to deliver reasonable affordability for end users.
- The connection owner should be responsible for collecting user payments and for bill payment to the utility.

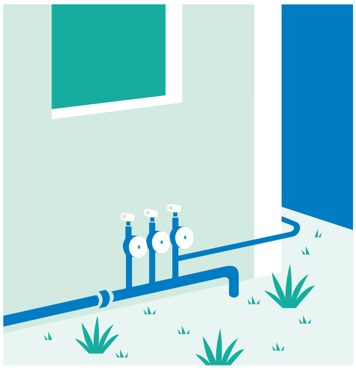


Household resale is not an ideal water supply option; however it is a reality in many low-income urban communities, and may need to be managed to improve service quality and affordability for households who depend on resellers.

Experience from Ghana

In Ghana it is relatively common for households living in urban areas to resell water from their individual network connection. These households are classified as having a commercial connection with the utility (Ghana Water Company Limited) and are charged at a reduced tariff for the water they supply. The price charged to other consumers by these resellers is currently unregulated and heavily influenced by the demand for water at any one time, with periods of shortage leading to short-term spikes. Nonetheless this remains a popular and convenient supply option, particularly as resellers often live in close proximity to the home or business of their customer.

Meter cluster



Meter clusters offer a cost-effective way for utilities to extend piped access to the utility network. The clusters can be located within communal or shared yards, and have also proven useful where it is illegal for the utility to serve informal housing areas: in these cases, the meter clusters are situated on adjoining recognised roads and households lay their own pipes to connect their homes to the more distant meters. The householder takes responsibility for the final few metres of pipe, which should result in the utility charging a reduced connection fee as it has avoided part of the network extension cost. Typically the model works like this: each household uses water from their own individual metered connection (though connections might also be shared by multiple-households); the household then pays for the amount of water used to a designated intermediary bill-payer (community, landlord or private individual), who pays the total amount to the utility. Alternatively the householder pays the utility direct.

What are the capital investment requirements?

- Extension of the piped network to the meter cluster (at a lower cost than extension to individual households).
- Meter clusters and protective mesh screens to limit tampering, especially when meters are not in direct view of householders.

Who is responsible for O&M?

- The utility is responsible for maintenance of the piped network.
- Householders are responsible for minimising leakage from their pipe connecting to the meter cluster.
- The utility must ensure that pipes are not ‘misconnected’ where distant from the householder; and that the meter clusters are protected against theft or vandalism, for example by siting the clusters within a secure compound, by promoting a sense of ownership among users, or by using plastic casings instead of brass casings. This is very important: in the financial analysis from Ghana (below), meter clusters were found to generate a small net loss for the utility because of the costs associated with repairing or replacing damaged clusters.

Recommendations for payment model

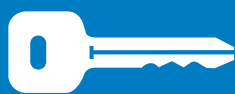
- The cluster can be billed as a) a series of individual customers, or b) one customer responsible for collecting payment from users of the individual meters that comprise the cluster.
- Under option b), the bill-payer should receive guidance on appropriate costs to pass on to individual households (i.e. the risk of abusive mark-up needs to be countered).
- In cases of communal non-payment, the utility should be aware that some individual households may have paid the bill-payer, who then failed to pay the utility: processes need to be established at the community level (e.g. receipt of payment to the bill-payer) to ensure these households are not unfairly penalised through disconnection.
- Where there is an intermediary, the utility should charge a reduced bulk water tariff, reflecting the reduction in their costs in terms of distribution and debt collection.

Comparative financial analysis of the meter cluster option: costs to consumers and net benefit for utility (relative to conventional household connection)

Source: Analysis based on data for Accra (Ghana), 2012. The results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections.

Option details: Meter cluster (piped delivery to meter clusters, with each household having its own meter and connection, and with enhanced bill collection).

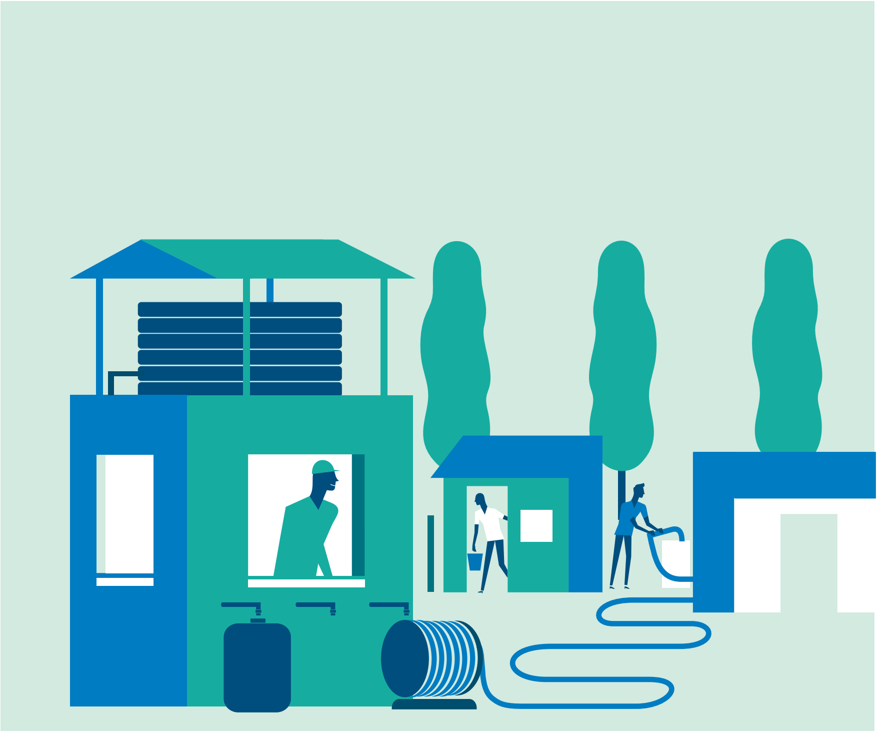
Cost to consumer per m^3 (US$)	0.73
Cost to consumer per m^3, relative to conventional household connection	80%
Net revenue to utility per m^3	-$0.01 (negative)
Net benefit to utility per m^3, relative to conventional household connection	-0.4 (i.e. net loss: see page 7)



The utility must ensure the clusters are protected against damage, theft and vandalism: this will help to keep O&M costs low and preserve the cost-effectiveness of this option.

Experience from Ghana

In 2012, Ghana Water Company Limited (GWCL) constructed a meter cluster water supply system in Obuasi, a large town in the southern Ashanti region. The network had two components operating under different models: a) 38 standpipes constructed within household compounds and where the users have direct accounts with GWCL, and b) a further nine meter clusters operated by private vendors under a delegated management system, with the vendors paying GWCL in bulk for total water used from the clusters. Under option a), the landlord of the compound is the registered bill-payer and pays the bill for the total amount of water used through the connection. The families living in the compound collect water through their own meter, part of a cluster fitted to the landlord’s standpipe: households are charged at a higher rate than landlords to allow for the costs of bill (and bad debt) management.



Flexible pipe from meter cluster

A flexible or fixed rubber hose can help to deliver water direct to the door of households for an additional payment, while also retaining the ability for consumers to collect directly from the metered connection. These 'flexible pipes' can be a) combined with meter clusters and operated in the manner described on page 14, or b) used as part of a kiosk-operated variation, in which the operator of a publicly located meter cluster delivers water to household storage tanks via a moveable flexible pipe. Under option b), customers refill their tank as and when they require it, paying the operator directly for the volume of water supplied. This option can be incorporated into pre-existing kiosks to extend services and increase revenue.

Experience: Water Choice kiosks

In March 2011 a series of new projects were initiated by Cranfield University and the Centre for Competitive Creative Design, to investigate the potential of a new and innovative design of water kiosk based on meter clusters and the use of flexible hoses (see Cranfield: 2013). The kiosk designs sought to address the lack of consumer choice that characterises water supply in many low-income urban areas by offering consumers a variety of options depending on their location and what they could afford. Trials were initiated in locations across Kisumu, Nakuru and Nairobi in Kenya, and more recently in Yaounde, Cameroon.

Trials in the Mukuru settlement of Nairobi - where the majority of water is accessed by households through collection in 20-litre jerrycans – were particularly successful, with households indicating that they purchased more water when the hose reel was brought to them. The model works like this:

- The private kiosk operator delivers water directly from the kiosk meter cluster to the customer's household using a hosepipe reel up to 40 metres in length.
- Customers fill any storage containers they have in their home, with some households filling large storage reservoirs that can last several days.
- In order to fill these large reservoirs, operators often roll out several hoses simultaneously.
- After the containers become full the customer phones the operator to turn off the supply; the customer is then charged the amount displayed on the meter at the kiosk.
- In some cases two operators manage the system, one moving the hosepipes and the other remaining at the kiosk to operate the connections and pass meter readings via mobile phone.

Although yet to achieve scale-up, the Water Choice kiosks are a very interesting innovation: the use of hose reels can allow a single kiosk to directly supply households within a 60-metre radius, dramatically decreasing the time spent by customers collecting water and offering household delivery at a lower cost than door-to-door water sellers.

Staffed standposts & kiosks

Public water standposts and kiosks are a popular form of water supply in densely populated areas with limited piped network infrastructure. Although there are various different management options for standpost operation (described below), all share a few basic characteristics: a purpose built staffed standpost supplies water through a single or multiple taps (in the case of a 'kiosk', there is also a small building to protect the standpost and the vendor); customers bring their own containers to the standpost and fill these with the amount of water they require; and the customer pays the attendant accordingly. Water is usually supplied to the standpost through a connection from the utility network; in areas which suffer from low pressure or intermittent supply, a ground reservoir tank or overhead tank can be used to supply water throughout the day. A spread of standposts is preferable to improve access and to guard against low water sales caused by consumers looking for an alternative source closer to home. In some cases third party investment may be available to help pay for capital costs.

Option one: Utility ownership and management

In this option the utility operates the standpost themselves and does not delegate any aspect of supply to a third party:

What are the capital investment requirements?

- The costs of constructing, maintaining and staffing the standpost are incorporated into tariffs.
- Standpost operators are usually paid through a salary (rather than by commission).

Recommendations for management

- In some low-income communities there can be a lack of trust between the utility and local residents; the utility should make a determined effort to develop or maintain strong customer relations, with good customer service at the standpost one way to achieve this.

Option two: delegated management

In this option the utility contracts a private operator and/or community association to operate the standposts. The utility may prefer one of these two arrangements depending on the local context: a common assumption is that community associations will be motivated to provide a better level of service to the wider community, whereas a private operator is likely to have stronger capacity and business processes. It is important that the utility retains ownership of assets and remains able to remove the contractor if the service quality falls below acceptable standards.

Who is responsible for O&M?

- The utility retains responsibility for the piped network supply, connection and meters: sufficient numbers of trained staff are needed to conduct ongoing maintenance.

Recommendations for management

- The utility must be sure of the managerial and operational capability of the contractor prior to signing any agreement, and is responsible for ensuring the service provided by the contractor meets the required standard.
- The utility is responsible for the supply (and typically the treatment) of water to the standpost.

Recommendations for payment model

- In the comparative financial analysis from Ghana (see page 17), this option was found to have the capacity to generate revenue for the utility, but often at the expense of the low-income consumer. The utility must remember that in using this option it has not fulfilled its responsibility to deliver water directly to all urban consumers; the reduction in the utility's distribution costs should therefore be reflected in reduced bulk water charges to the standpost. This rarely happens in practice with the vendor/intermediary costs typically paid by the consumer, leading to the poorest consumers paying much more per volume used than higher-income consumers with individual household connections. We note that where there is a replacement of vendors by pre-paid meters (see pages 20-21), these even higher costs are absorbed within the overall costs of the utility – the same principle should be applied with the staffed standpost option.
- The intermediary (private or communal) is responsible for paying the utility for total water usage from the network and for managing any losses and/or bad debts.

Through the flexibility to incorporate different treatment and storage adaptations, staffed standposts and kiosks are an effective option in areas with water quality and network supply issues. The common practice of passing on additional costs to the lowest-income consumers is unacceptable.

Comparative financial analysis of the staffed standpost and kiosk option: costs to consumers and net benefit for utility (relative to conventional household connection)

Source: Analysis based on data for Accra (Ghana), 2012. The results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections.

Variation: Standposts staffed by the utility.

Cost to consumer per m^3 (US$)	$3.93
Cost to consumer per m^3, relative to conventional household connection	440%
Net revenue to utility per m^3 (US$)	$1.8
Net benefit to utility per m^3, relative to conventional household connection	123.6 (i.e. 123.6 times more benefit: see page 7)

Variation: Utility delivery to standposts with volume limited free water and storage, and with removal of >20m3 Lifeline Tariff (designated low-income communities receive free water; this alleviates the need for a Lifeline Tariff benefitting all urban consumers).

Cost to consumer per m^3 (US$)	$0.55
Cost to consumer per m^3, relative to conventional household connection	60%
Net revenue to utility per m^3 (US$)	$1.58
Net benefit to utility per m^3, relative to conventional household connection	108.2 (i.e. 108.2 times more benefit: see page 7)

Variation: Utility delivery to local distribution network and standposts operated by Community Water Board.

Cost to consumer per m^3 (US$)	$1.59
Cost to consumer per m^3, relative to conventional household connection	180%
Net revenue to utility per m^3 (US$)	$0.01
Net benefit to utility per m^3, relative to conventional household connection	0.6 (i.e. 0.6 times more benefit)

Variation: Utility delivery to pay-on-use standposts operated by utility-nominated private sellers.

Cost to consumer per m^3 (US$)	$4.6
Cost to consumer per m^3, relative to conventional household connection	510%
Net revenue to utility per m^3 (US$)	$2.15
Net benefit to utility per m^3, relative to conventional household connection	147.5 (i.e. 147.5 times more benefit: see page 7)

Variation: Utility delivery to pay-on-use standposts with storage, operated by individual private operators/suppliers.

Cost to consumer per m^3 (US$)	$4.6
Cost to consumer per m^3, relative to conventional household connection	510%
Net revenue to utility per m^3 (US$)	$0.48
Net benefit to utility per m^3, relative to conventional household connection	33.1 (i.e. 33.1 times more benefit: see page 7)

Experience from Kenya

In partnership with Naivawass, the local utility, WSUP has supported the construction of a network of water kiosks across Mirera-Karagita fed by borehole-sourced water. Community-based Water User Associations (WUAs) have contributed to the construction and management of the kiosks with small private operators contracted to manage water distribution. Water supply in the Naivasha region (and elsewhere in central Kenya) is complicated by the high levels of fluoride in groundwater: tests of the boreholes in Naivasha found levels between 6 and 25 mg/litre, well in excess of the WHO recommended guideline (1.5mg/litre). In order to neutralise the water supply and negate the health impacts of high fluoride consumption, each kiosk incorporates a fluoride removal system where water is filtered through locally produced bone char (processed animal bones). Two types of water are now for sale at the kiosks: general purpose water which has not been treated (US$ 0.01 for 20 litres), and treated water for drinking and cooking (US$ 0.02 for 20 litres). Sales of treated water have been limited in practice and need to be strengthened, with a reduction in charges and community education ongoing about the harmful impacts of fluoride consumption. The delegated management model and kiosk-based fluoride treatment now being practiced in Naivasha demonstrate the flexibility of kiosks as a water supply option; the initiative has become widely recognised in the water sector in Kenya and attracted interest from a range of local and international stakeholders.

Group connection: metered standpost

In this option a group of households share a communally owned public standpost. The metered standpost is located in a public place and is typically shared by between 10-40 neighbouring households. The standpost is not staffed, so trust and co-operation between households is essential to ensure that everyone pays their share of the water bill. This option is most appropriate for densely populated, low-income communities where the cost of individual connections is too high for some households. Only a small infrastructure investment is required from the utility, while the creation of user committees or associations help to formalise the bill-paying process. The system can be operated through a utility or alternative service provider's infrastructure from a private or public source.

What are the capital investment requirements?

- Extension of the piped network.
- Provision of tapstand and meter connection.

Who is responsible for O&M?

- The utility or service provider should take responsibility for O&M of the network system, the cost of which is recouped through tariff charges. If this is left to the community there is the potential for poor workmanship which could lead to increased non-revenue water.

Recommendations for management

- To simplify the bill-paying process, grouped households should be encouraged to form a single user committee or association which will act as the formal customer.
- Discussions should be arranged with the community prior to installation to ensure they understand and accept the system and its operation.

Recommendations for payment model

- A group of 40 households sharing the same standpost can be expected to use a large volume of water: for this reason an Increasing Block Tariff (where the customer using more water pays more per cubic metre: see page 6) should be avoided, as this could result in low-income customers paying commercial rates. As with shared yard connections (see page 12), an alternative is to multiply a Lifeline Tariff allocation by the number of households using the standpost when calculating the shared bill. The use of a meter at the connection should help to ensure that the utility receives payment for the water consumed.
- A key issue around the use of communal standposts is 'free riding': some customers will pay their bill but others may not, and where there is a shortfall the connection gets disconnected and everyone is penalised. The utility will need to think carefully about how this can be avoided: one option is for participating households to form user associations with responsibility for bill payment.

Implementation of this option should always be accompanied by community sensitisation: this will help to ensure that user responsibilities (including bill-paying) are properly understood.

Group connection: storage tank

This option can be considered a variation of the group connection described on page 18. Instead of taking water directly from the network, a group of 10-20 families share an above ground or underground storage tank which is supplied from the network (in the case of an underground storage tank, users can withdraw water by handpump). This solution is particularly useful for network systems that suffer from low pressure and/or irregular supply which render tapped solutions unsustainable: the storage tank can fill slowly during periods of low demand or at night, which ensures that water is available during periods of high demand such as early morning and evening. Prior agreement of users is needed to operate this option as a group connection.

What are the capital investment requirements?

- Extension of the piped network.
- Provision of connections and meters.
- Storage tank (it will be important to clarify if the utility or user group owns the tank).

Who is responsible for O&M?

- As described on page 18, the utility should take responsibility for O&M of the network system.
- It will be important to clarify who is responsible for maintenance of the tank (this could include repairing leaks or ensuring the float valve is functioning correctly).

Recommendations for management

- Household groups should be encouraged to form a user committee or association to collect payments and simplify billing.

Recommendations for payment model

- Tariffs for these connections must ensure that grouped households are not punished for collectively exceeding the volume for a Lifeline Tariff.
- A meter could be installed to record water flow either into or out of the tank (again, this is subject to clarification of responsibilities between the user group and the utility, and to agreed ownership of the tank). Alternatively, a flat-rate, non-metered tariff can be applied.
- The utility must be confident that user associations will pay their bills.

In areas with low pressure and/or irregular supply, the addition of an above ground or underground storage tank to a grouped connection can ensure that water is available when it is most needed.

Experience from Bangladesh

In partnership with local government, NGOs and the water utility DWASA (Dhaka Water and Sanitation Authority), WSUP are currently implementing this option in Dhaka's low-income communities. The target is to install approximately 700 connections with underground storage tanks and handpumps, which in turn will improve water supply for 100,000 low-income residents (as of March 2014, 24 group connections have been implemented with 7,500 beneficiaries). Although the size of the user group for each connection depends on settlement patterns and the availability of land, the programme is promoting relatively small groups of families (10-20) per connection – a reflection of both community preferences and sustainability requirements. Implementation is financed through a combination of community contributions (5%) and NGO contributions (95%).

There is already some important learning emerging from the project. Participating households have formed user associations with responsibility to ensure water bills are paid. Although this aspect is working well, the decision to make the community responsible for O&M has been less successful and has given rise to a number of problems: meters, tanks and handpumps have not been adequately maintained in some cases, placing the sustainability of the infrastructure at risk. In a related initiative the Bangladesh government is addressing the prevalence of illegal connections, a major issue in Dhaka: this is an important step in decreasing non-revenue water.

Pre-paid metered standpost

Pre-paid meters dispense water to consumers from publicly located, pre-paid standpost systems. They work like this: each household or user has a card or token to put into the pre-paid meter; the meter reads the credit which has been pre-loaded onto the card and dispenses the corresponding volume of water; different methods can be used to top up the cards with credit, and the meters allow for multiple tariff options depending on the volume of water dispensed. Pre-paid meters have a number of advantages over other water supply options:

- The utility receives payment for water supplied *in advance*.
- Households have a straightforward way to monitor their expenditure.
- Third-party vendors are cut out, enabling the customer to access water at the utility's tariff (or better still, the utility's social tariff).
- Consumers have access to a 24/7 supply that is not dependent on the hours worked by a standpost attendant.
- Paying customers avoid the risk of becoming disconnected because others have not paid their share of a communal connection.

There is however an obvious downside to this option: the installation, operation and maintenance of pre-paid meters requires significant investment in technology and infrastructure. Continuity of supply is always important, but it becomes even more important in the case of pre-paid meters, which have a tendency to 'sell air' after a supply interruption (the resulting air column in the network can spin the counters and result in the customer losing credit). A utility considering this option must be confident they have the necessary resources to keep the system properly maintained and serviced by a reliable water supply.

What are the capital investment requirements?

- Extension of the piped utility network and connections may be required.
- The utility must decide where best to install the pre-paid meters: they can be installed at each connection or in a limited number of locations including existing water kiosks. It is common to provide both post-paid and pre-paid meters in the same location.
- Accessible and convenient paypoints must be provided for purchasing and loading credit. SMS mobile phone payment systems can be used to give customers more payment options: these systems tend to be well received by most customers but lead to more challenges, and greater initial expense, for the utility's billing and accounting processes.

Who is responsible for O&M?

- Maintenance of the pre-paid meters (including vending machines and accessible payment points) is more complicated than conventional metered standpoints and requires the utility to provide an adequate number of trained technicians.
- The utility must ensure 24/7 continuous water supply in order for pre-paid systems to function effectively.
- The utility must be able to fix faulty meters, which lead to some customers being denied water they have already paid for. Sufficient stores of spare parts should be available (especially batteries) to ensure stalled meters quickly become operational again.
- Close monitoring of the dispenser by trained utility staff is essential to minimise non-revenue water as a result of bypasses, leaks or faults which jam the valve open.

Recommendations for management

- The expense of installing and operating the required IT systems is often greater than expected; the utility should get accurate estimates.
- Water usage and credit expenditure need to be carefully monitored to ensure there are sufficient volumes sold to justify the investment.
- An extensive pre-consultation with the target population is needed to ensure the system is properly understood, accepted and used.

Recommendations for payment model

- Although the installation and O&M costs for pre-paid metered standposts are relatively expensive, it is important to remember that the utility has avoided the costs of extending the piped network to each household. In the comparative financial analysis from Ghana (below), this option returned an unacceptably high net benefit to the utility, relative to conventional household connections; this would need to be offset by reduced consumer tariffs (for example, the use of an Increasing Block Tariff structure with Lifeline Tariff for low-income, low-volume consumers: see page 6). The utility is responsible for ensuring that payment systems are understood by customers.
- The utility minimises non-revenue water by dispensing water only in accordance with the volume required and paid for by the user.

Comparative financial analysis of the pre-paid metered standpost option: costs to consumers and net benefit for utility (relative to conventional household connection)

Source: Analysis based on data for Accra (Ghana), 2012. The results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections.

Option details: Pre-paid metered standpost with shop/SMS mobile phone payment systems.

Cost to consumer per m^3 (US$)	$3.93
Cost to consumer per m^3, relative to conventional household connection	440%
Net revenue to utility per m^3 (US$)	$2.65
Net benefit to utility per m^3, relative to conventional household connection	181.4 (i.e. 181.4 times more benefit: see page 7)

Pre-paid meters depend on 24/7 water supply, complex IT systems and regular monitoring to ensure meters are functioning properly: utilities implementing this option must be committed to providing effective system maintenance!

Experience from Uganda

In 2008 Uganda's National Water and Sewerage Company (NWSC) initiated the installation of pre-paid water meters in the low-income Kisenyi district of the capital city Kampala. In the period prior to meter installation a community sensitisation and promotion campaign was conducted to encourage prospective customers to embrace the new technology. The customers buy credit from vendors who are paid commission by NWSC; all vendors are independent entrepreneurs running businesses that are open from early until late. Customers are charged the lowest tariff rating, meaning they now pay less than they did previously through vendors *and* receive a better quality service. Following on from the success of this trial, WSUP recently completed planning discussions for the implementation of pre-paid water meters in Nakuru, Kenya; 93 pre-paid meters have already been operational in the same location since 2013, funded by the Water Services Trust and SUWASA / USAID.

Standpost attached to communal sanitation facility

Communal sanitation facilities - toilet blocks serving a defined group of households - are common in densely populated, low-income districts. Although functioning primarily as a sanitation solution, some of these blocks have on-site water supply which can be used to provide water to members of the community. In addition to a water standpipe, the construction of a rooftop water storage reservoir allows for reliable service in areas that do not receive a 24-hour supply. Day-to-day management of the facilities can be performed by a public or private body, with a meter fitted to the connection ensuring that the utility has accurate information on water consumption.

What are the capital investment requirements?

- Extension of the piped network.
- Connections and meters.
- Reservoir storage tank if required.

Who is responsible for O&M?

- The utility is responsible for maintaining the piped network, connection and meters.
- The operating body is responsible for any infrastructure beyond the network connection.

Recommendations for management

- The sale of water can be managed by a single standpost attendant who records the volume of water used and collects payment from customers. This person can be a paid member of the utility staff, self-employed (retaining a small profit from water sales to make their livelihood), or an employee of the community association or private operator responsible for operating the facilities.

Recommendations for payment model

- The operating body typically determines the price of water tariffs; all options require direct payment from users to the standpost attendant.

Communal sanitation facilities provide a ready-made, high-traffic location for a public water standpost, enabling the utility to reach more low-income consumers at minimal cost.

Experience from Madagascar

In partnership with JIRAMA (the Madagascan water and electricity utility), WSUP and CARE have constructed communal sanitation facilities in five peri-urban areas of the capital Antananarivo. Referred to as 'Wash Blocks', the communal facilities were initially limited to a laundry block where residents could bring their clothes and pay to use water for their washing. It was soon realised that this infrastructure could be used to provide public toilets and dedicated water sales: the pre-existing network connection meant that only a small additional investment was needed to give consumers access to a reliable and affordable water source. Demand for these services is now high amongst residents of the five peri-urban areas. The infrastructure design is straightforward, and easily replicated in a location where suitable land is available. This model of water sales from a communal facility has enabled JIRAMA to increase water supply to thousands of people at a very limited investment.

Water tanker

Although expensive compared to other options, water tankers can provide an interim water supply solution in a number of specific contexts. Examples include as an emergency measure where other water sources have failed; for filling reservoirs prior to the extension of piped infrastructure into an area; to supply water to the perimeter of settlements; and to supply community storage reservoirs. These services can be provided by the utility, or by a private operator using water from a utility or private source.

What are the capital investment requirements?

- Purchasing of the tanker and fuel for tanker operation.
- Water filling points for tankers: this is usually done directly from the piped network.
- Water storage reservoirs for on-sale to individual consumers.

Who is responsible for the O&M?

- The tankers require regular maintenance by trained mechanics: if a private operator is providing the service, this is their responsibility.
- Contracts should reflect utility ownership of and responsibility for infrastructure such as storage reservoirs.

Recommendations for management

- The utility should formalise its relationship with the private operator through a contractual agreement; these operators will then need to be monitored to ensure that they deliver on their commitments.
- The utility should be aware of the risks involved with transient employment models (for example, using tanker drivers as a temporary fix). The short-term nature of these earnings opportunities can lead to social unrest unless carefully managed.

Recommendations for payment model

- Water supplied via tanker at a cost-reflective tariff is prohibitively expensive for low-income consumers:, onselling to the end consumer should be at the standard standpost tariff.

Comparative financial analysis of the water tanker option: costs to consumers and net benefit for utility (relative to conventional household connection)

Source: Analysis based on data for Accra (Ghana), 2012. The results may differ in other locations, particularly with regard to relative costs and benefits: these are sensitive to the initial balance between utility costs and revenues for conventional household connections.

Variation: Facilitated tankers to storage with communal standpost operators.

Cost to consumer per m³ (US$)	$4.55
Cost to consumer per m³, relative to conventional household connection	500%
Net revenue to utility per m³ (US$)	$0.01
Net benefit to utility per m³, relative to conventional household connection	0.7 (i.e. 0.7 times more benefit)

Option details: Private tankers to storage with private standpost operators.

Cost to consumer per m³ (US$)	$8.55
Cost to consumer per m³, relative to conventional household connection	950%
Net revenue to utility per m³ (US$)	$0.82
Net benefit to utility per m³, relative to conventional household connection	56.2 (i.e. 56.2 times more benefit: see page 7)

The use of tankers is not considered improved by JMP and does not represent a long-term solution for supplying water to low-income areas; however it can be an effective short-term measure while more sustainable supply options are put into place.

Borehole

In areas without formal piped supply but with available groundwater, the drilling of a borehole provides a quick way to improve services through a simple though relatively high-cost infrastructure investment (i.e. high cost per person served). Boreholes are often seen as a short or medium-term solution prior to the extension of a piped network supply, but they can also act as the primary water source *for* a local piped network – usually in the form of 'well-fields' to deliver required capacity – and can provide an effective long-term option in some major settlements. It should be noted that competing private boreholes can lead to rapidly reducing groundwater levels which is a challenge to public supplies: to promote sustainability of the resource, specialist hydrogeological advice is needed to ensure that the borehole is optimally sited, and care should be taken over likely groundwater pollution from on-site sanitation. Water can be delivered from the boreholes to the customer in a number of different ways including via piped network; through sale directly from the source; through pumping to a raised storage tank; or via tankers and other mobile delivery methods. The best choice of delivery method depends on the borehole yield and on the sustainability of the groundwater supply.

What are the capital investment requirements?

- Borehole drilling and adequate sealing to prevent water contamination; a fenced-off protection zone around the borehole should be considered for a well-field, but is unlikely to be achievable in a low-income settlement.
- The requirements for further infrastructure will vary according to the yield of the borehole and the desired rate of production. Mechanised boreholes bring extra capital and O&M costs and a higher risk of failure due to their greater complexity.

Who is responsible for O&M?

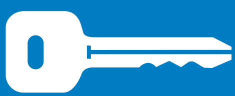
- The asset owner must regularly inspect the borehole to ensure there is no leaking into the casing.
- The operator must ensure the motor and pump for mechanised boreholes are regularly serviced and that stocks of spare equipment are readily available.

Recommendations for management

- The utility can manage borehole production themselves, or delegate management to a private operator or community association. A delegated management arrangement should be underpinned by a formal contract between the utility and the provider (see pages 26-27).

Recommendations for payment model

- Billing arrangements will be determined by the chosen delivery method (how water is transferred from the borehole to the consumer).
- Utilities tend to charge full costs of borehole-supplied water directly to the consumer, but it can be argued that the use of boreholes reflects the failure of the utility to extend its more cost-effective bulk water distribution network: the utility should therefore absorb the additional costs, charging only the standard Lifeline Tariff.



Utilities need to understand and optimally use the ground and surface water resources available. In addition to offering an effective long-term option for some major settlements, boreholes should be considered as a short or medium-term solution in areas where a) there is a low risk of groundwater contamination, and b) an extension of the piped network supply is planned for the future. In cases where there is some contamination of groundwater but no affordable alternative supply, treating contaminated water from the borehole may be preferable to providing expensive water or no water at all!

Experience from Zambia

Supported by funding from the Australian government and in partnership with Lusaka Water and Sewerage Company (LWSC), WSUP established a new borehole supply in the Mtendere East district of Lusaka. The borehole was commissioned in January 2012 to supply water directly to 30,000 inhabitants of the district, with 14,000 people in the neighbouring district Kalikiliki also benefitting through a resource-sharing agreement. The network is an extension of LWSC's main supply network, and is operated by Mtendere East Water Trust in a delegated management arrangement. Water from two mechanised boreholes is treated for chlorination before being fed to a network of water kiosks at high pressure; collections from the staffed kiosks are then transferred daily into the Water Trust's bank account and are sufficient to cover full operating costs. Plans are now in place through the Millennium Challenge Corporation to extend coverage to the whole of Mtendere East, ensuring all inhabitants will have access to a safe drinking water supply.

Experience in Mtendere has also illustrated the inter-dependence between mechanised borehole water supply and electricity, and the need for buffering reserves (i.e. storage reservoirs). Lusaka experiences frequent electricity outages, and with boreholes, outages mean no pumping is possible. In many parts of Lusaka this results in interrupted supplies, underlining that storage is essential to maintain water quality and continuity of supply.

Delegated management

What is delegated management?

Delegated management is the process of assigning or transferring authority, decision-making or a specific administrative function from one entity to another. In the context of urban water supply, this means the utility delegating one or all of its management functions to a local operator (private, NGO or CBO) who assumes responsibility for water supply to designated areas of the city.

Why consider delegated management?

The expansion of water supply services into low-income urban areas is a complex challenge requiring flexible approaches. The options set out in this guide provide some ways forward, but we acknowledge that utilities may not have the capacity to implement all of these options themselves! Faced with this reality, more and more urban utilities recognise the benefits of using formal agreements with a local operator to expand their services. In addition to lessening the burden on the utility, these local operators are well-positioned to address the specific challenges of servicing low-income communities: their knowledge of the local community fosters a close interaction with customers, which in turn helps the operator to keep on top of billings and revenue collection.

Here are some key aspects of delegated management:

Contract agreement

- Discussions between the local operator and the utility can ensure the terms of the agreement are acceptable to both parties.
- The use of Professional Service Agreements (PSAs) and Key Performance Indicators (KPIs) can help to formalise the relationship, promote accountability and drive the local operator's performance. Such mechanisms need to be accompanied by strong monitoring arrangements and regulatory sanctions.
- The arrangement through which the utility supplies water and recovers costs can take a number of forms. Examples include contracts based on bulk supply (the local operator buys water in bulk from the utility) and contracts based on percentage of revenue (the utility is paid a fixed percentage of the local operator's revenue).
- The utility must guard against the consumer paying more for their water (compared to a direct utility supply) because of the extra costs associated with using an intermediary: an appropriate solution is to charge the intermediary reduced bulk water tariffs to reflect the utility's reduced distribution costs (see pages 6-7).

O&M

- The utility continues to have ownership of the major infrastructure components (e.g. piped network).
- With more trained staff than the local operator, the utility is usually best positioned to perform O&M. The cost to the utility for retaining this function can be recouped through the water tariff charged to the local operator and a greater willingness-to-pay on behalf of customers resulting from the more reliable service.

Monitoring

- Proper monitoring is essential to ensure the quality of the service provided by the local operator. The capacity of any utility, government department or regulator to monitor services should be taken into account when considering which delegated management arrangement to put in place.

The delegated management of water supply to low-income areas can take a number of forms. Below we describe three variations on a delegated management approach, each of which has been successfully implemented in a WSUP programme (see the WSUP website for various Topic Briefs and other publications relating to delegated management).

Though both the utility and the local operator stand to benefit from delegated management, the ultimate beneficiary should be the low-income consumer, who ceases to depend on expensive and informal suppliers and gains access to a reliable and affordable service. However, this is only achieved if the extra costs associated with using an intermediary supplier – rather than the utility fulfilling its mandate to supply all urban consumers directly – are <u>not</u> transferred to the lowest-income consumers!

Experience from Ghana

In partnership with CARE, WaterAid and the utility Ghana Water Company Limited (GWCL), an influential community management model has been established in Kotei, a low-income area of Kumasi. GWCL constructed a network of eight gravity-fed tapstands to improve water supply in the area, fed by two mechanised boreholes from an elevated storage reservoir and able to serve 4000 people. The utility retains ownership of the assets and responsibility for O&M, but responsibility for the day-to-day management of the network is delegated to a Community Management Committee (CMC) based in Kotei. The CMC has a treasurer and maintains its own financial records; standpipe attendants are employed by the CMC to collect user fees, with a fixed percentage of revenue from water sales returned to GWCL. A recent sustainability survey of water supply in Kotei indicated that the CMC is covering its costs and has developed a trusted relationship with local consumers.

Experience from Mozambique

The utility Águas da Região de Maputo (AdeM) is mandated to provide water supply to the millions of low-income residents in Maputo, Mozambique's capital city. Recognising both the need to expand services into these areas and the flexibility offered by small-scale operators, AdeM decided to trial a delegated management arrangement with a local private operator, EMA. Under the agreement EMA buys water in bulk from the utility, and takes responsibility for distribution, meter-reading and billing in the low-income neighbourhood of Liberdade. WSUP provided financial, technical and business management support to EMA, helping them to validate their customer database and to improve their systems for billing and revenue monitoring; a set of KPIs were also agreed through which EMA's monthly performance was assessed. The success of the pilot, which has produced a 100% increase in revenue receipts within three years, has persuaded AdeM to replicate the arrangement with a separate private operator in the low-income neighbourhood of Boane.

Experience from Zambia

Lusaka Water & Sewerage Company (LWSC) is mandated to provide water and sanitation services in Zambia's Lusaka province. In order to better reach low-income communities, an innovative form of community-led delegated management was developed by the utility with initial support from CARE Zambia. The community-based organisations are known as 'Water Trusts', each of which has responsibility for day-to-day management of water services in a designated low-income informal settlement (known locally as 'peri-urban areas'). The responsibilities of the Water Trusts are underpinned by a Service Management Contract with LWSC, who retains responsibility for O&M. So far 11 Water Trusts have been established in 11 peri-urban areas; the model appears to be working well, with at least eight of the Water Trusts generating sufficient fees to cover their operating costs. With support from the Stone Family Foundation (SFF), WSUP is currently working with Kanyama and Chazanga Water Trusts to improve access to safe water for 90,000 people across these two peri-urban areas.

ADDITIONAL RESOURCES

WSUP Publications

One of WSUP's key objectives is to promote effective service delivery models to the WASH sector worldwide. To help share the lessons from our work on the ground, we produce a wide range of publications including Practice Notes, Topic Briefs and Discussion Papers. All of our publications are free to download from our 'resource database' – a fully searchable library of our publications and other print resources: http://www.wsup.com/programme/research-and-learning.

The following WSUP publications are of particular relevance to the issue of urban water supply to low-income communities:

WSUP (2011) Can NRW reduction programmes lead to improved services for the poor? Practice Note 5.

WSUP (2011) Location is everything: optimal placement of community water and sanitation services. Practice Note 6.

WSUP (2011) Helping people connect to water networks: good for business, good for the poor? Practice Note 7.

WSUP (2011) Business models for delegated management of local water services: experience from Naivasha (Kenya). Topic Brief 2.

WSUP (2012) Delegated management of water and sanitation services in urban areas: experiences from Kumasi, Ghana. Topic Brief 3.

WSUP (2013) Designing effective contracts for small-scale service providers in urban water and sanitation. Topic Brief 8.

WSUP (2013) Getting to scale in urban water supply. Topic Brief 12.

Key sources for this publication

Cranfield University (2013) Enhanced Demand Driven Water & Sanitation Products and Services for Urban Tenants.

Fonseca C and Franceys R (2010) Guidelines for User Fees and Cost Recovery for Urban, Networked Water and Sanitation Delivery. African Development Bank.

Franceys R, Nyarko K, Lamptey F, Boachie, F (2010) Financial Modelling of Alternative Delivery Mechanisms: Water for the Urban Poor. Report prepared for GWCL.

Sansom K, Franceys R, Njiru C, Kayaga S, Coates S, Chary S (2004) Serving All Urban Consumers, Volume 2: Guidance Notes. WEDC: Loughborough.

Water and Sanitation Program (2009) Global Experiences on Expanding Services to the Urban Poor. Accompanying Volume to the Guidance Notes on 'Improving Water Supply and Sanitation Services for the Urban Poor in India'.

Ying Y, Skilling H, Banerjee S, Wodon Q, Foster F (2010) Cost Recovery, Equity, and Efficiency in Water Tariffs: Evidence from African Utilities. World Bank.

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