**38th WEDC International Conference, Loughborough University, UK, 2015**

WATER, SANITATION AND HYGIENE SERVICES BEYOND 2015:
IMPROVING ACCESS AND SUSTAINABILITY

# Rapid assessment of prepaid water systems in Africa

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**REFEREED PAPER 2145**

*Prepaid water meter systems appear to overcome many of the challenges of supplying water to a range of consumers in Africa. However there are concerns as to the effect on the human right to water as well as on the viability of the approach to water service providers on scale. The paper presents findings from a World Bank study in eight African countries using on-site data collection, key informant interviews, 27 focus groups and 1,180 household surveys in three countries. The study found that customers appreciate the convenience and believe that prepaid systems have enabled them to manage household expenses better, reducing the risk of incurring debt or disconnection. However, although many utilities believe the benefits outweigh the costs, they report that the robustness of prepaid meters varies at present varies considerably, leaving utilities too reliant on technical support from suppliers, which is not always timeously available. Initial capital costs are also relatively high.*

## Prepaid meter water systems

Too many people in sub-Saharan urban Africa still lack access to affordable safe water, with only 34.4% being able to access 'piped on premises' drinking water (WHO/UNICEF, 2014). In low-income urban areas, many residents source their water from a mix of public water points and private water vendors. Buying treated water from shared standpipes often comes with conflict over shared payments, while yard taps and standpipes stand idle and unused where the service provider has disconnected the supply because of non-payment. The promise of 'access' or 'improved coverage' is eroded where service points are disconnected and where intermediaries inflate the price of treated water.

Service providers, meanwhile, face daunting challenges, starting with the difficulty of meeting the ongoing costs of delivering safe, affordable water to rapidly growing urban populations, where many users cannot afford services, and some do not want to pay. Senior utility managers often fear political fallout if they raise tariffs to levels required to cover the costs of operations and reasonable capital maintenance.

In response, a growing number of urban service providers in Africa have adopted prepaid water systems since the late 1990s. Prepayment holds the promise of a remedy for low collection rates and, healthier cash flows, more revenue to fund wider coverage, and the resources to reverse or pre-empt a downward spiral that makes tariff increases unlikely, and a reduced risk of arrears or debt, as customers pay in advance for a specified amount of water. This paper captures the findings of a study undertaken by the World Bank Water and Sanitation Program (WSP) in 2013-14 (Heymans, et. al. 2014), which explores the potential of prepaid meters in serving urban poor communities.

## Research methodology

The study involved technical data collection and key informant interviews across all locations with utility staff and regulators, and household surveys and focus group discussions in three case study cities: Kampala-388 adults using public standpipes; 8 focus groups with men, women, children, landlords and water vendors, most using prepaid standpipes; Lusaka -395 adults with individual prepaid connections; 11 focus group discussions with men, women, children, tenants and landlords, using standpipes and individual connections, respectively; Mogale City -397 adults with individual prepaid connections; 8 focus group discussions with

men and women from different income strata, including tenants and landlords Figure 1 illustrates the case study sites and the types of prepaid meter installations investigated.

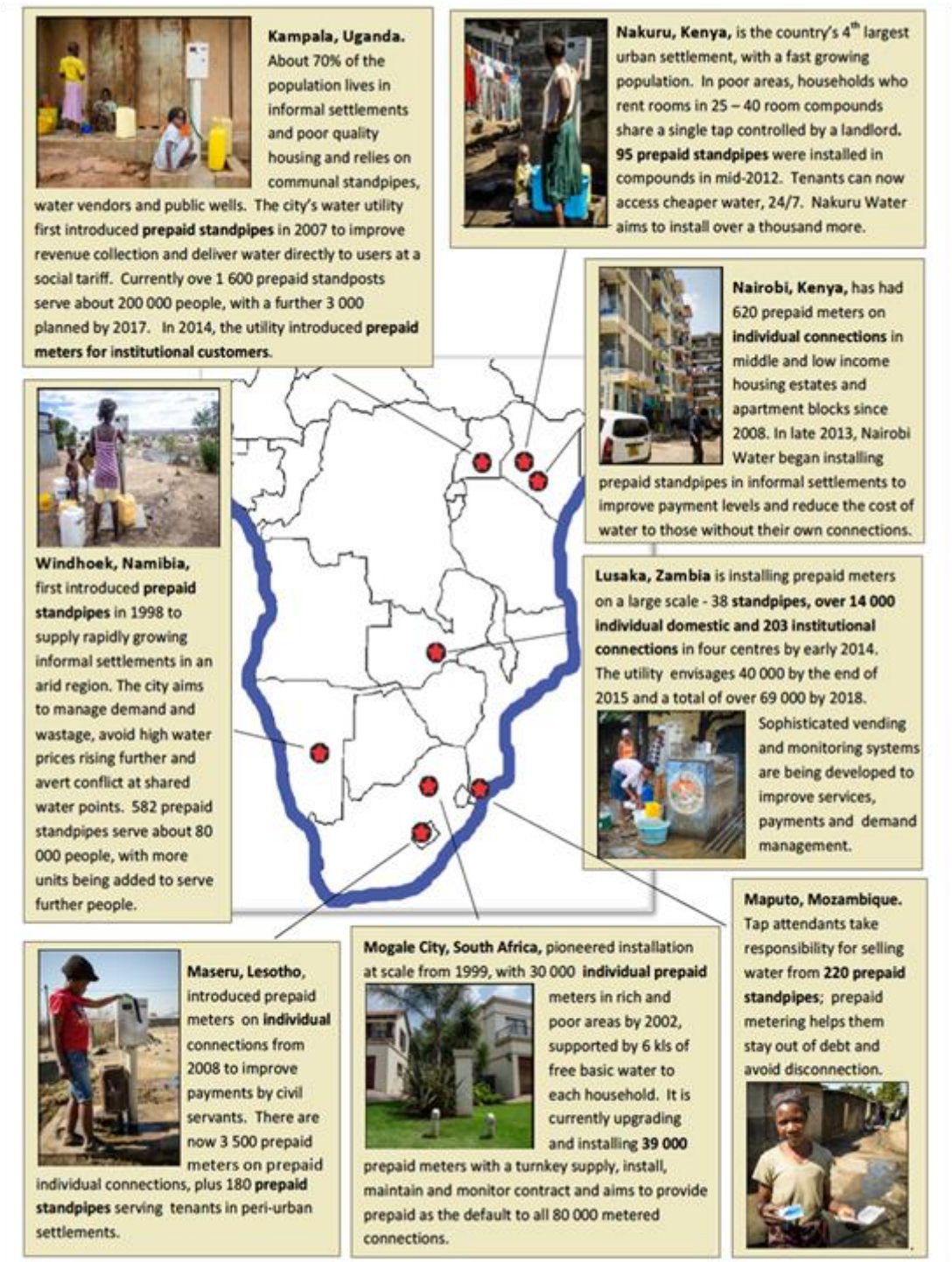


**Figure 1: Prepaid meter case studies**

## Key findings

Prepaid standpipes enable service providers to sell water directly to customers with their own prepayment tokens, without tap or kiosks attendants or other intermediaries adding a mark-up or capturing the benefit for themselves. This marks a significant difference from what happens in many low income settlements, where there are too few standpipes, and service providers pass on the costs of local distribution and payment collection to vendors, who recover these costs from their customers who pay several times the service provider's tariff for a poor service. With prepaid standpipes, service providers carry the cost of collecting payment, and recover it across their wider customer base (just as they recover the cost of bad debt across all customers).

Prepaid standpipes allow customers to get water whenever it suits them, outside the limits set by landlords and well beyond the hours when vendors and tap attendants work (assuming '24x7' supply in the distribution network). This is a major advance for people who leave home early or return late. It also distributes collection times more evenly throughout the day, which eases queuing times, especially for women and children who have primary responsibility for fetching water. The credit tokens are programmed to be usable at any prepaid standpipe, at any time of night or day. 'Wherever you go as long as you have your key, you can just put it inside' said one user. 'It does not have any specific time'.

**Table 1. Prepaid individual connections: Some customers' perspectives**

| Likes | Dislikes |
|---|---|
| 'It's easy to control your budget – you decide how much you want to pay and how long it must last you' | 'Water is a need, but money is not always available' |
| 'You can get water with even a small payment. It's better than trying to pay a big bill.' | 'The water can stop any time if you are not watching how much you have used' |
| 'You use only what you have paid for, so you only use what you can afford' | Inadequate consultation before the prepaid meter was installed |
| No debt, no disconnection | Inadequate explanation of tariffs and charges |
| No bills you don't trust and can't pay | Inadequate demonstration of how to use the meter |
| 'You spend less on water because you are more aware and you use less' | 'Postpaid gives you more time to find the money' |
| 'You are in charge. You can decide when the water stops, and you can put it on again. No penalty.' | Water is more expensive than with a fixed tariff |
| | Having to travel to purchase credit when you run out |
| | Some people don't share water anymore |
| | Slow responses when a fault is reported |

The study found that prepaid standpipes in Kampala, Nairobi and Nakuru have resulted in a sharp fall in what people without their own connections pay for water. Customers now get more water for less money, because they receive the benefit of a lifeline tariff directly. The cost of a jerrycan of water from a prepaid standpipe in City Carton, Nairobi, is half a Kenyan shilling (less than USD 0.01), compared to 2 to 5 shillings from a water vendor or kiosk. In Kampala, a 20 liter jerrycan costs just fewer than 25 Ugandan shillings (USD 0,01) from a prepaid standpipe. This works out at 55% of the cost from a house connection, and substantially less than the 200 to 500 Ugandan shillings and more that water vendors and resellers charge.

Customers are not primarily interested in the technology. They are looking for good services, reliably delivered at affordable prices, and where a prepaid water system offers them these benefits, most like it.. They like the fact that prepaid systems make it possible for them to manage their accounts more directly, with clear information on where they stand all the time, something which particularly benefits women who manage household budgets. This contrasts with conventional systems which carry the risk of inaccurate high bills and an unpleasant surprise long after consumption, leaving them in debt. Disconnection from postpaid systems left them reliant on water vendors and other intermediaries who mark up their prices and offer water only at particular times. Many say they want more convenient access to credit loading sites, and a quick response when faults impede the flow of water they have paid for in advance.

Among those surveyed, virtually all prepaid customers said they now spend less on water, and most of those using prepaid standpipes now used more water because it was much more affordable. From discussion in focus groups, it was evident that lower water costs have reduced stresses for women who depend on their husbands or partners to provide money for food and water, as they can now afford to buy more of the water they need without having to compromise on food.

Prepaid meters are no less prone to 'capture' than any other valuable resource. In Kampala, some landlords deny prepaid customers access to 'their' meter unless they pay a premium, despite the agreement

they sign with National Water that commits them to allow any customer access to the meter installed on or adjacent to their property. Some landlords insist on selling the water themselves, with a mark-up to 100 shillings (USD 0.04) per jerrycan. 'Some insist that you buy from them, even if you have your own token', said one tenant. Another said: 'Landlords take charge and chase away those they don't like. If you are on poor terms with your landlord, they won't let you get water from that prepaid meter.'

## Managing prepayment meters and billing

Prepaid water systems are not a technical magical wand -every service provider reviewed found that they had under-estimated what it takes to run an effective prepayment system sustainably, and just how much maintenance, support and monitoring it require. Managing prepayment is more demanding than conventional meters and billing, with electronic, mechanical and software components to manage, and more to go wrong. They are particularly prone to faults arising from debris or grit in the network, which is common where supply interruptions are rife.

Discussion of prepayment *metering* often deflects attention away from the complementary components of an *integrated prepayment system.* Beyond the daily challenges of maintaining a reliable supply of safe water, a prepayment system has inter-dependent components to manage and maintain at each connection site and vending point. It requires a network of credit vendors selling prepaid water that must be equipped, serviced and managed and, crucially for users, easily accessible. A credit transfer device is needed - either a physical token or smartcard, (which can get lost, stolen or broken), or a numerical credit key, printed on paper or sent by mobile phone, and entered via a keypad which must communicate reliably with the device. Most importantly, at the heart of prepayment, there are customers whose trust in the new system must be earned and sustained. A fault on a prepaid meter can shut down the supply of water that customers have already paid for, or provide free water. Regular monitoring and data collection is essential to track performance and consumption. *All of this demands the support of a multi-disciplinary team equipped to deal with these different aspects.*

The study found that the performance and reliability of prepaid meters vary markedly. Water managers in the eight case study cities have had experience of ten makes of prepaid meter between them. One manufacturer currently dominates the market for prepaid standpipes, but there is more competition among suppliers of individual meters. One recent entrant in particular shows promise of much improved reliability where the supply is 24/7 and the pressure relatively constant.

Some brands perform comparatively well, while others are notorious. Among the worst performers, one service provider said 20% of installed units failed in the first six months; another described this type as 'just an expensive tap', and removed them all within 18 months.

Pricing varies significantly, but all service providers who bought on the basis of the lowest price have been disappointed. Inexpensive devices can prove very costly where meters fail within a year or two and where reparability, access to spares and after-care is poor. The realistic working life of the device before replacement is a critical cost consideration, particularly with proprietary systems which do not allow service providers to mix and match components.

In Kampala, National Water reads every standpipe meter monthly and records basic performance data. On the day 1,223 prepaid standpipes were visited in February 2014, three-quarters (74.9%) were working well. Technical faults with the prepaid meter accounted for half the number not delivering water; more general service problems explained the lack of water at the remaining 12.4% sites. Performance was markedly worse at meters that were more than three years old, with almost half not working. Average consumption per meter from a sample of 455 for which data was available over a six-month period was 34.6$m^3$.

Windhoek City Council files records of all call-outs but does not collate or analyze the data. Call-outs are most commonly the result of customers reporting that they cannot get the water they have paid for. About 20% of calls report water running non-stop from the meter. Records from a 10-month period in 2012-13 show 1135 call-outs from 582 meters. Most prepaid standpipes are three years old or less. This represents just over two call-outs per meter per year, in a context of 24/7 water supply and adequate water pressure.

The most common problems were software errors, valve faults or low battery power. Two-thirds of call outs required replacement of parts; of those, 63% involved the valve – a seal, a diaphragm or the entire latch valve. Replacement of the parts shown in the table cost the city just less than USD 30 000 per year. Per meter, this averages nearly 10% of the USD 550 purchase price of each standpipe device. In addition, Windhoek replaces the batteries pro-actively every 18 months, and more frequently where individual

batteries fail before this. Each battery costs about USD 42. In areas of dense settlement and intensive use, batteries may fail after as little as three months.

## Financial analysis

The financial costs of prepaid metering are substantial, and for many service providers it may prove prohibitive. The financial analysis, based on data from systems that have been established for some time, found that an 'average' service provider in sub-Saharan Africa makes a net revenue loss on all prepaid metering approaches at present tariffs, except for large institutional /commercial consumers.

Using the same assumptions, conventional postpaid metered households and vendor-run stand posts make a small but positive margin, even allowing for reduced bill collection efficiency for stand posts compared to domestic connections. This is primarily because of higher sales income. Customers with their own postpaid connections typically use more water than those with prepaid meters, and tap attendants and vendors do not buy water at a lifeline tariff.

The findings indicate that prepaid meters on individual connections are not a cost-effective remedy for billing and collection inefficiencies, except at high average household consumption levels. Prepayment for large institutional customers, conversely, is very cost effective because of the high consumption volumes. The investment and maintenance costs are high, and much higher than current tariffs are designed to accommodate. This does not mean that prepaid meters are necessarily a wrong choice, but that their cost and revenue implications have to be investigated and managed.

**Table 2. Indicative assessment of costs and revenue income**

| **Shared standpipe serving 35 households** | | | | |
|---|---|---|---|---|
| | **Standpipe pay on use / individual private vendor / operators / suppliers** | **Prepaid meter on shared standpipe** | | |
| | | **Optimistic assumptions** | **Best evidence assumptions** | **Challenging assumptions** |
| Annual water consumption ($m^3$) | 41,1<br>113 l/hh/d | 49,3<br>135 l/hh/d | 54,3<br>150 l /hh/d | 49,3<br>135 l/hh/d |
| **Results with lifeline tariff = USD 0,27 m3** | | | | |
| Total annual costs to consumer per household | USD 111,9 | USD 19,1 | USD 20,6 | USD 19,1 |
| Net annual revenue to utility per household | USD 3,3 | - USD 6,1 | - USD 9,2 | - USD 11,9 |
| **Results with lifeline tariff = USD 0,41 $m^3$** | | | | |
| Total annual costs to consumer per household | USD 156,6 | USD 25,8 | USD 28 | USD 25,8 |
| Net annual revenue to utility per household | USD 11,4 | - USD 0,6 | - USD 3,1 | - USD 6,4 |

Optimistic assumptions relate to the lowest cost systems found; challenging assumptions are based on limited consumption, high (though not untypical) meter/standpost costs and software costs unable to be shared with household prepaid meter use.

## Conclusions

Prepaid standpipes offer more equitable access for people without their own connection. Customers with their own account and credit token can buy water at the utility tariff, without an intermediary's mark-up and without access being dependent on an intermediary's hours of business. Most said they preferred prepayment, but there were concerns about faulty meters, delayed repairs, too few convenient vending points, and difficulties replacing credit keys.

Prepaid individual domestic connections help manage the risk to the customer of consuming more water than they can afford, disconnection and debt – which most users value, emphatically - and the risk to the service provider of bad debt. Customers used to a continuous household connection are more sensitive to the inconvenience of supply stoppages when credit is exhausted than those used to fetching and carrying water from shared taps.

Prepaid meters on institutional customers consuming large volumes help manage demand and debt risk. The combination of high volume consumption, low transaction costs relative to purchases, and cost-reflective tariffs facilitate improved revenue flows, which can be used to support cross-subsidization to poor customers.

The tenuous financial basis of prepaid systems, especially their high cost of outlay, requires that their deployment has to be planned for. Where their primary purpose is to make water available more affordably and equitably to low income residents, cross-subsidies or external subsidies may be needed to ensure that prepayment does not divert funds from other needs. Service providers would be well advised to assess the cost and revenue effects of introducing prepaid meters carefully at the beginning, and to compare their impact to the alternatives in consultation with economic regulators and higher level decision-makers.

Prepaid water is not a miracle cure. It is not obviously cost-effective for the provider, has not been consistently reliable, and comes with substantial demands on management. However, many utilities believe that the benefits outweigh the costs. Its growing profile requires that prepaid systems should no longer be treated as essentially experimental. Prepaid water needs to be taken far more seriously in water sector policies and regulatory frameworks and in scaled up technical support to optimize the opportunities they offer and the risks they pose. Above all, this study has found that low-income consumers appreciate them.

## Acknowledgements

The authors wish to thank the national policy makers and especially the management, staff and customers of service providers who have given us so much time for interviews, briefings and information sharing. The market research firm Infotrack added much depth through their work in Kampala, Lusaka and Mogale City.

Special thanks to our World Bank Group colleagues working in Water (GWADR), who as peer reviewers provided valuable comments and feedback throughout the report's development.

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