ውሃና ኢነርጂ ሚኒስቴር
MINISTRY OF WATER AND ENERGY

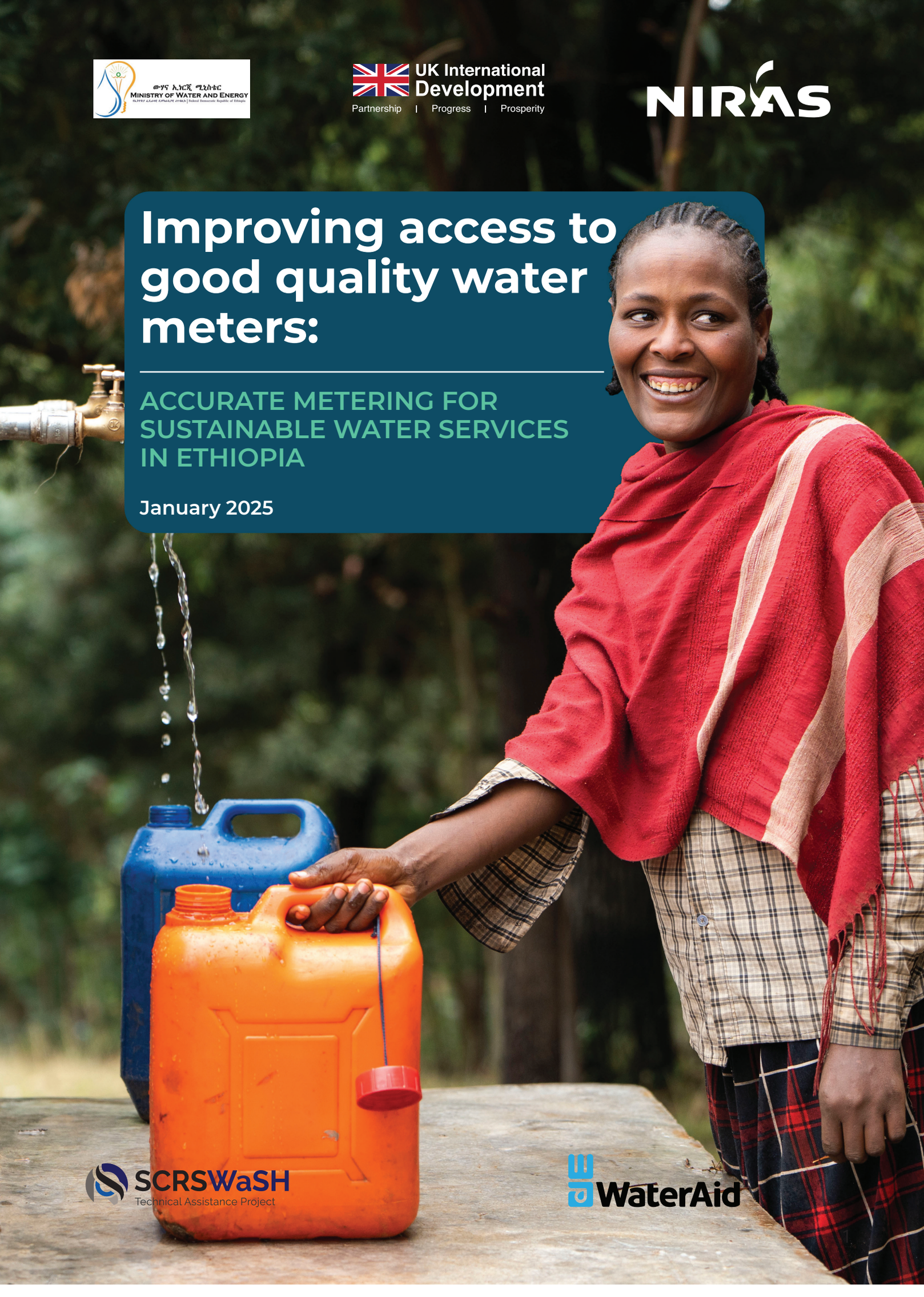
UK International Development
Partnership | Progress | Prosperity

NIRAS

Improving access to good quality water meters:

ACCURATE METERING FOR SUSTAINABLE WATER SERVICES IN ETHIOPIA

January 2025



SCRSWaSH
Technical Assistance Project

WaterAid

Strengthening Climate Resilient Systems for Sustainable Delivery of SCRS-WaSH: Technical Assistance Project

About TAP:

Strengthening Climate Resilient Systems for Sustainable Delivery of SCRS-WaSH: Technical Assistance Project, funded by the United Kingdom's Foreign and Commonwealth Development Office, supports the implementation of the climate resilient pillar of the Government of Ethiopia's One WaSH National Programme. The accompanying technical assistance project known as 'TAP' aims to strengthen the management of selected rural multi-village schemes (MVS) for water supply in the Climate Resilient WaSH (CR-WaSH) intervention areas of the programme. The project also supports the establishment of 30 women and youth-led micro and small enterprises (MSEs) to supply spare parts and maintenance services; the development of a WaSH Sector Finance Strategy; and an improved supply of menstrual hygiene products to 150 schools in programme areas.

Key Findings

- **Defective and Substandard Meters:** A significant challenge to water utilities in Ethiopia is the prevalence of faulty, inaccurate or low-quality water meters. These problems undermine these utilities' financial sustainability by causing underbilling or overbilling and increasing non-revenue water (NRW) losses.
- **Lack of Availability and Affordability:** Many utilities struggle with a lack of access to affordable, high-quality meters, often having to deal with supply chain disruptions or shortages. Some utilities have faced meter shortages for over two years, limiting their ability to service new connections or replace malfunctioning meters.
- **Limited Local Production:** Only a few local suppliers produce or assemble water meters, and their capacity is limited, leading to dependence on imports. Despite some imported meters undergoing quality checks, the majority are not tested thoroughly, leading to widespread use of poor-quality meters.
- **Absence of National Standards:** Ethiopia lacks comprehensive national standards for water meters. While some guidelines exist for the technical service provision in urban areas, there is no clear regulatory framework for the quality and specifications of water meters. This results in inconsistent meter quality and a reliance on international standards that may not be fully applicable to local conditions.
- **Improved Revenue from Meter Replacement:** Replacing defective meters can lead to a dramatic increase in utility revenue, as evidenced by the Heben-Negelle-Siraro (HNS) utility in Oromia, where replacing 1,500 old meters of sample customers led to a fivefold increase in water consumption readings and a corresponding revenue boost.

Introduction

As the team provided technical support to MVS water utilities under TAP, it became evident that problems with the availability, quality and affordability of customer water meters were widespread and hindered efforts to reduce levels of non-revenue water (NRW) losses. This note explores the nature and extent of Ethiopia's challenges regarding the policy and legal framework for the supply of meters; laboratory tests on a sample of meters; a supply chain assessment; and analysis of the impact of meter replacement at one utility, including the impact on utility revenue.

Background

Water meters are vital for the accurate measurement of water consumption, enabling proper billing and identification of issues such as leaks or unauthorised use. In Ethiopia, however, defective and substandard meters contribute to the loss of utility revenue and inefficient water management. Factors such as poor supply chains, inadequate quality control and the lack of a clear regulatory framework exacerbate the problem.

TAP's support to MVSs has highlighted significant barriers in the availability and quality of domestic water meters. Many utilities are unable to procure and replace meters, leaving them without accurate data on consumption. This leads to underbilling, overcharging and a loss of revenue, further destabilising water service delivery.

Several factors determine the appropriate type of water meter for a location, such as:

- **Climate and Environment:** In regions prone to extreme temperatures, water meters need to be robust and weather-resistant to cope with the harsh conditions.
- **Water Quality:** High levels of sediment in water (for example, when treatment is inadequate) can cause meters to silt up and fail, while the pH or mineral content of the water may cause corrosion.
- **Consumption Patterns:** Meters must be suited to the anticipated level of consumption, since commercial and industrial users will consume signficantly more water than a single household.
- **Continuity of Supply:** Some meters do not cope well with intermittent supplies and low flows, which are the norm for many rural water supply schemes. Air in the system can also lead to inaccurate measurements or meter failure.
- **Infrastructure Status:** The condition and age of a scheme's water infrastructure can impact the type of water meter needed. For example, in an aging water supply system characterised by deteriorating pipelines and meters, utilities may need to adopt a more vigilant approach in identifying leaks or signs of wear and tear.

This highlights the importance of using meters suited to local conditions and circumstances. TAP has found, however, that for most utilities in Ethiopia, suitable and affordable meters are simply unavailable. Some utilities supported by the project have been out of stock of water meters for over two years, leaving them unable to service new connections or replace old, non-functional meters. This leaves utilities with low customer satisfaction, reduced revenue, limited service access and the undermining of overall performance, sustainability and reliability of service provision.

Legal Framework and Standards

The Ethiopia Water Resource Management Policy outlines a general requirement to adopt national standards for the design, installation, operation and maintenance of technologies, including imported systems and equipment. However, no established technical standards exist for water meters. The Ministry of Water and Energy (MoWE) National Guideline for Technical Service Provision to Urban Water Supply Utilities (2013) outlines key considerations for selecting water meters such as pressure rating, accuracy, minimum flow, sealing conditions and casing materials. However, the lack of specific performance criteria limits its practical use.

As a result, utilities, MoWE and Regional Water and Energy Bureaus (RWEBs) often refer to international standards, particularly ISO-4064-1, which addresses metrological and technical requirements for cold potable water meters, and ISO 4064-2, which covers meter installation and use. While widely accepted, applying international standards in Ethiopia presents challenges, including appropriateness to local conditions, cost implications, regulatory hurdles, limited utility capacity financially and in terms of human resources and cultural factors. Developing a national standard tailored to Ethiopia's context, informed by international best practices, could address these challenges, improve water management, enhance service delivery and increase consumer acceptance.

Regarding regional frameworks, TAP's review found no regulatory measures for water meters in Afar, Benishangul Gumus, Somali, South Ethiopia or Tigray. Only Amhara and Oromia have regulations outlining the responsibilities of service providers to supply and use meters, but neither defines minimum technical standards for the meters themselves.

Supply Chain Challenges

There are only a few suppliers in Ethiopia that produce or assemble water meters, and their capacity is limited, meaning most meters are imported. While a small proportion of imported meters (mainly those acquired directly from manufacturers) undergo some level of quality control, the majority are brought in without proper inspection. Smaller utilities often lack the resources and expertise to conduct quality checks, leading to widespread use of low-quality meters.

In early 2024, TAP conducted a rapid assessment of water meter supply practices across 19 MVS utilities supported by the project, spanning nine regions. The assessment revealed that only six utilities could independently procure meters, and over the past three years, they met only half of the annual demand, which averaged 200 meters. Another three utilities purchased meters from the RWEB. Oromia RWEB had previously supplied meters at an affordable price but discontinued the practice in 2022 due to difficulties in sourcing high-quality meters, both locally and abroad, amidst restrictions on foreign currency access. Consequently, utilities took on the responsibility of procurement, often passing the right on to individual household customers. In fact, 10 of the 19 MVSs adopted this approach as they could not manage the procurement process themselves. Furthermore, only three utilities provided customers with specifications on meter quality, allowing users to purchase cheap, low-quality meters. Only three of these 10 utilities conducted physical checks on meters purchased by customers before installation. None of the 19 utilities had their own testing facilities, and 13 of them lacked a facility within a 100 km radius.

The assessment also explored the availability of water meter sales outlets within 100 km of the sampled utilities. This revealed that meters were often available only in major towns, far from many rural utilities, implying that only better-off customers could afford to purchase them. This highlights that for lower-income households, lack of access to water meters could be a significant barrier to obtaining a private connection.

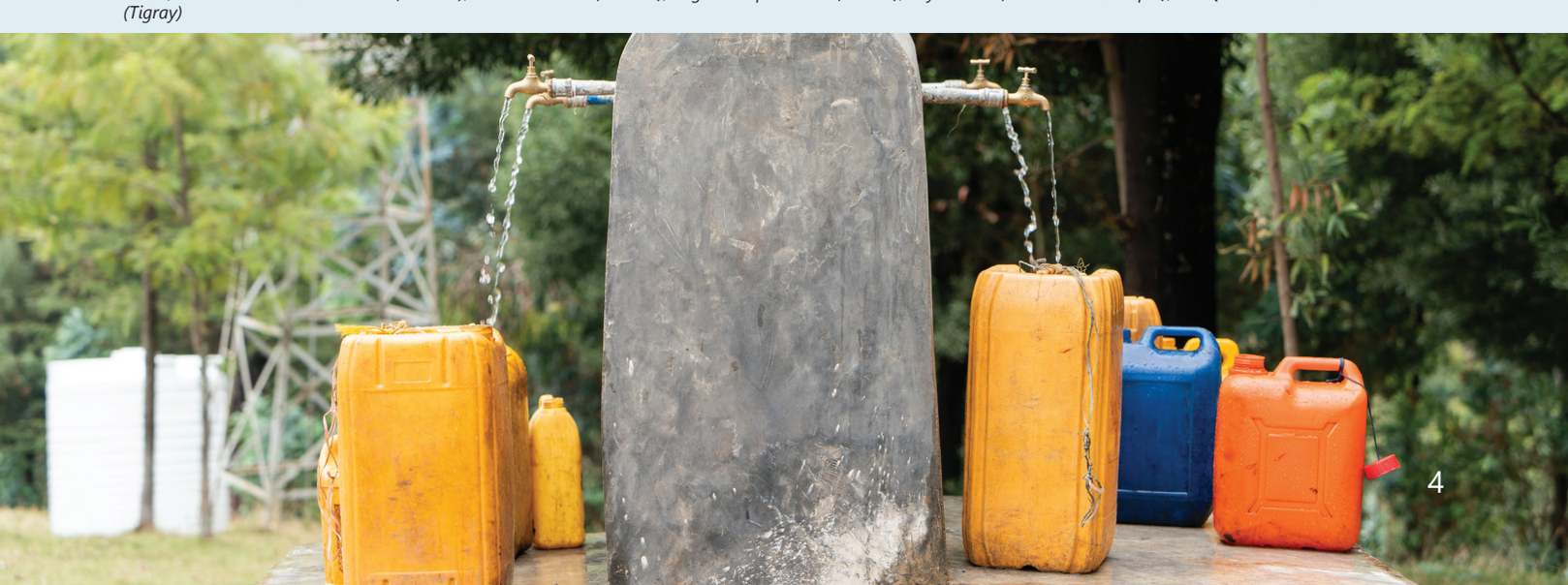
TAP support to improve access to quality water meters

TAP assisted twelve[1] utilities by supplying domestic water meters directly; providing training on meter quality checks, installation and calibration; and advising on actions to reduce NRW losses. Technical assistance on the design and installation of a locally made water meter testing bench was also provided to utilities. In the local market, there exists a diverse selection of water meters of varying quality with unit prices ranging from 800 to 6,500 ETB. The primary concern pertains to product quality. As part of the procurement process, TAP conducted product accuracy tests on meters from five different suppliers using a test bench at the Addis Ababa Water Supply and Sewerage Authority. The results indicated that meters from only one supplier met the defined accuracy standards for measuring maximum and nominal flows. The quality of the water meter's body is also significant and should be assessed due to its implications for health. For example, the presence of lead in water meters is a critical health concern, as lead is a hazardous metal that can lead to severe health issues, especially among vulnerable groups such as children and pregnant women. Consequently, it is essential to not only focus on using high quality accurate meters but also ensure that water meters contain minimal lead content to guarantee the safety of drinking water. By addressing both the accuracy of water meters and the materials used in their construction, we can improve the reliability and safety of water services for the community.

Impact of water meter replacement at one utility

The HNS MVS has been operating for over 30 years and has gradually expanded its services. With TAP technical support, the utility received NRW reduction training which led to the replacement of approximately 1,500 non- or poorly functioning meters in late 2023. This replacement project was completed by March 2024, with the utility purchasing the meters directly from a local manufacturer, and TAP supported the monitoring and quality oversight of the purchased meters.

1. Anko Golma and Chano Mile MVSs (South Ethiopia); Del-hode MVS (Benishangul Gumus); Lege-Oda Gudenfeta MVS (Dire Dawa); Samte MVS (Harari); Heben Negelle-Siraro; Huruta-Hitosa-Dhera MVSs (Oromia); Awada Boricha (Sidama); Miguen-Fiq-Hamaro (Somali); Siyali MVS (South-West Ethiopia); Adi Qelebes and Ebo MVSs (Tigray)



Following installation, TAP evaluated the impact of meter replacement on revenue using data on meter readings and financial records. Data was collected from a sample of 31 households selected from 360 meters replaced in December 2023. These households are part of a larger group of 1,500 customers, with the remaining meters being replaced in various months up until March 2024. This coincided with the launch of the utility's new meter reading and billing system. A comparison of monthly water meter readings between October 2023 and February 2024 was performed, revealing that total billed consumption in October 2023, which was 136.73 m^3, increased fivefold to 487 m^3 by February 2024 due to the intervention. Consequently, the revenue collected from these customers experienced a notable increase of 406 percent, as illustrated in Figure 1.

Old and non-functioning water meters collected from customers

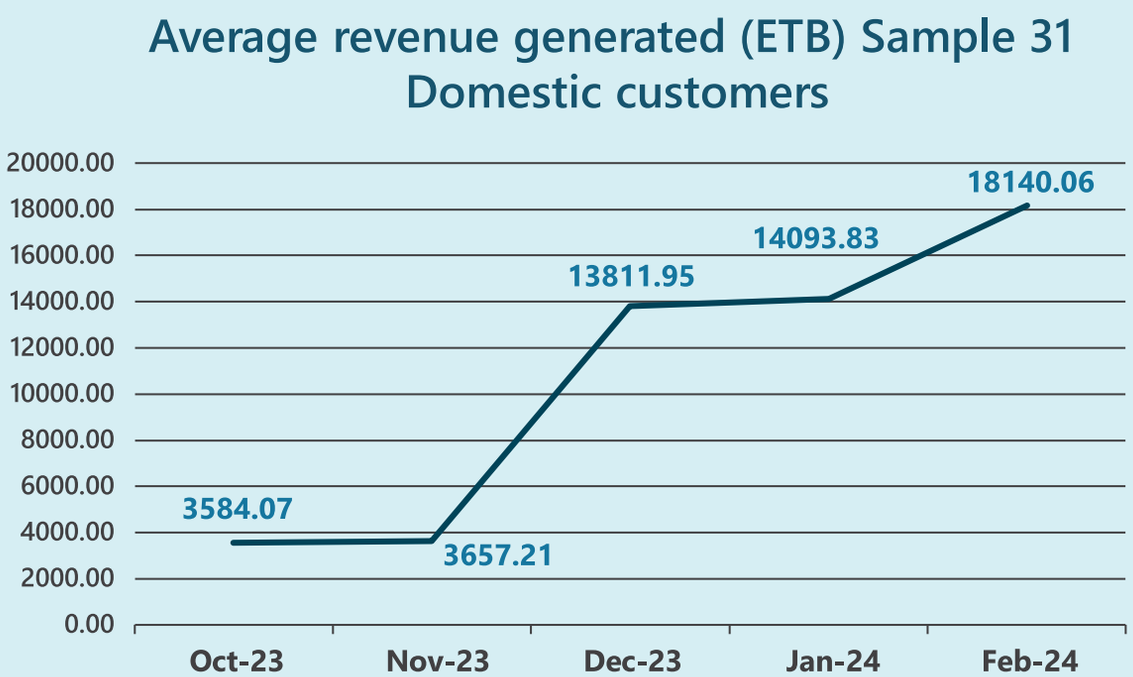


Figure 1: Revenue increase from a sample of households which received new meters

These findings prompted the utility to investigate unauthorised connections and meter accuracy further. TAP also encouraged the utility's branch offices to check billing records regularly for accuracy and provided guidance on doing so. Additionally, the project supported testing a sample of new meters using a newly installed test bench, whereby all meters passed the tests.

It is important to acknowledge that this was a simple 'before and after' assessment and that it will be necessary to continue monitoring meter accuracy since this will likely decline over time, especially if issues such as high sediment levels in the water or intermittent supply emerge. Further, to determine whether revenue increase is solely due to the installation of new water meters, the utility should investigate if customer usage has changed for any reason; if any changes in water supply production and distribution have occurred; and if the newly replaced water meters are more efficient compared to the old meters, for the purpose of informing future procurement decisions.

Conclusion

The experience from TAP underscores the importance of addressing challenges posed by defective or substandard water meters in Ethiopia. Limited market availability of good quality meters and a lack of supply chain quality control exacerbate the problem. Inevitably, many customers choose from cheaper options available which may not be fit for purpose and, as a result, undermine the performance, revenue and long-term viability of utilities, which are short of funds. Most utilities lack equipment and knowledge to check meter quality, but with modest technical support, it is possible to develop basic testing facilities locally.

Replacing defective water meters with accurate and effective meters can significantly improve utility revenue and help identify and repair leaks promptly, both of which contribute to reducing NRW. By implementing the recommended policy measures and enhancing utility capacities, the government can further improve water management, increase revenues and ensure sustainable access to water services for all citizens.

Recommendations

To address these challenges, the following actions are recommended:

Establish National Standards for Water Meters:
The Ethiopian government should develop and adopt national standards for water meters that consider local climatic, water quality and environmental conditions. These standards should be informed by international best practices but tailored to Ethiopia's specific needs.

Strengthen Supply Chains:
The government should strengthen the supply chain to ensure that high-quality water meters are available nationwide. This could involve supporting local manufacturers or sourcing meters from international suppliers through government-supported bulk purchasing initiatives.

Improve Water Meter Testing Infrastructure:
RWEBs should be equipped with the necessary facilities to test the meters' quality. The government could establish partnerships with local or international testing organisations to certify meters before distribution.

They must test not only the accuracy but also the construction quality (bodies and caps) of imported or locally manufactured meters. An authorised government institution, such as the Ethiopia Conformity Assessment Enterprise, should conduct or oversee these tests and provide certification of products.

Enhance Utility Capacity for Meter Procurement and Quality Control:
Utilities should be made responsible for the procurement and installation of meters to ensure that quality is maintained. Capacity-building programmes should be implemented to train utility staff in meter quality assurance, installation and regular calibration. The International Water Association suggests that purchased meters should be tested prior to installation and the respective utilities should also monitor the testing process.

Ensure Periodic Replacement and Monitoring of Meters:
Utilities should implement policies for periodic replacement of defective or expired meters to maintain billing accuracy. A clear replacement schedule should be established based on local conditions with high-quality meters expected to last up to 15 years in typical Ethiopian settings.

Increase Public Awareness and Support for Utilities:
Public education campaigns must be specifically aimed at customer forums and representatives on the utility board to enhance understanding of the significance of high-quality meters which, despite their higher costs, can reduce inaccurate readings and mitigate NRW losses and customer complaints. Further, it is essential to emphasise the proper usage and protection of these meters as they are directly linked to revenue generated. Additionally, utilities could partner with government entities and the private sector to facilitate access to affordable water meters for low-income households that may struggle to afford premium products. Implementing extended payment plans and offering subsidised options can greatly benefit low-income households.

Acknowledgements

This material has been funded by UK International Development from the UK government; however, the views expressed do not necessarily reflect the UK government's official policies.

For further details and inquiries, please contact:

Zewdu Seifu
Team Leader/ Task 1 Lead and Lead Author
Email: zeas@niras.dk
Taylor Martin
NIRAS Programme Manager
Email: tama@niras.com