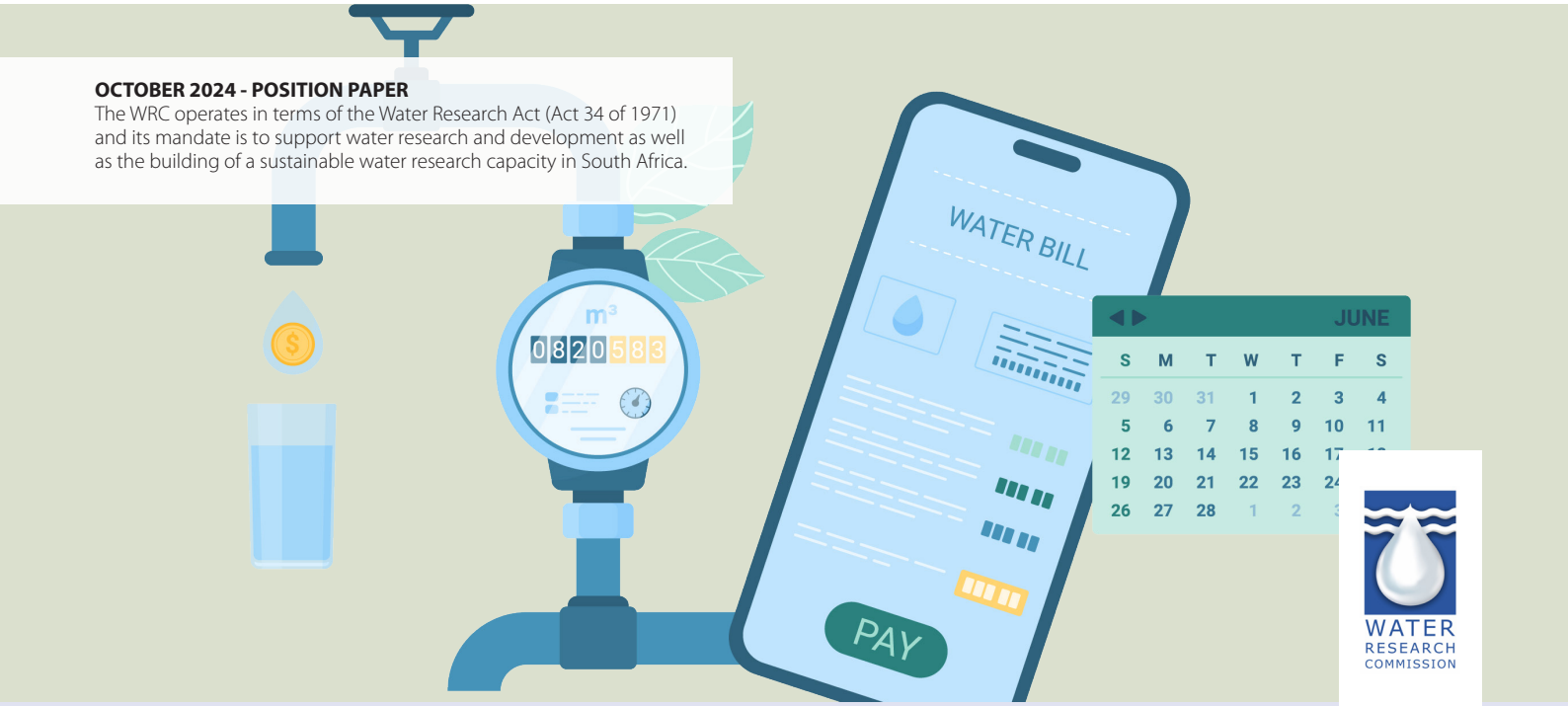
OCTOBER 2024 - POSITION PAPER
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.



TRENDS AND OPPORTUNITIES IN ADDRESSING NON-REVENUE WATER THROUGH SMART WATER METERING

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South Africa is a water-stressed country, with a growing population and limited access to water resources. Non-revenue water (NRW) is a significant problem, with an estimated 47.5% of water lost due to leaks, theft, and inaccurate metering (DWS, 2021). Globally, NRW is a significant issue, with an estimated 32 billion m³ of water lost every day (World Bank Group, 2019). NRW has an impact on greenhouse gases (GHG) as the energy used to treat, pump, and distribute water lost as NRW generates GHG emissions. Globally, NRW translates to carbon dioxide emissions of approximately 1.5% of the world's total emissions (UNICEF, 2020).

Internationally, water utilities have demonstrated that smart meters can be used in conjunction with other smart water technologies to significantly reduce NRW. As a result, significant deployments are underway in some of the leading developed countries such as Australia, the United States of America, the United Kingdom and others across Europe. Advanced metering efforts in South Africa have previously been focused on water consumption control and payment, however, recent technological developments, combined with lessons learnt from the international community could help South Africa benefit from using smart metering as a solution for driving down systemic water loss, increase and manage revenues, and protect the security of this precious natural resource.

Overview of smart water metering drivers

The value proposition for smart water meters in South Africa is clear. The drivers cut across operational and financial efficiencies, ability to increase revenue collection in currently constrained municipalities, address water leaks, and create enhanced consumer and household engagement to manage awareness and behaviour.

Figure 1: Value proposition for smart water meters in South Africa.

Overview of smart water metering barriers

The greatest barriers to smart water meter adoption lies in the reliability of technologies, capital and operating costs, compatibility with existing technologies, security due to vandalism and theft, and customer engagement and demand. By mitigating these challenges through smarter and innovative business models, utilities have the opportunity to create a number of benefits as part of the value chain.

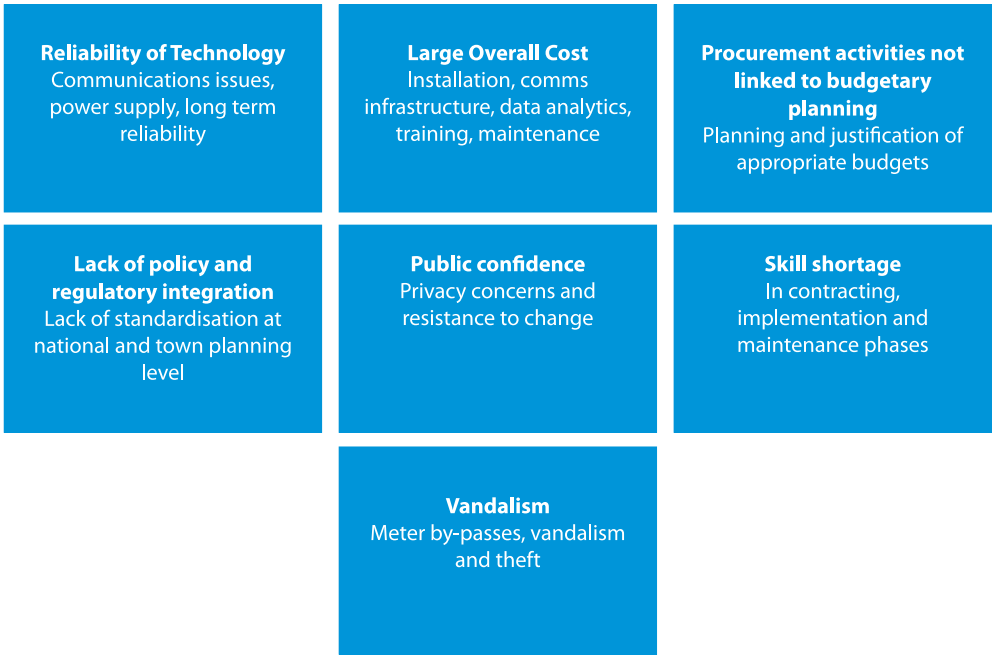


Figure 2: Overview of the key barriers to smart water meter roll-out in South Africa.

Global and local market for smart meters

The Global Smart Water Metering Market analysis was valued at R39.49-billion in 2022 and it is expected to reach R129-billion by 2032. This growth is largely due to increasing awareness of the efficient utilisation of water resources and growing concern around the reduction of NRW (Allied Market Research, 2021). Accurate and more efficient billing is another key driver which is pushing utilities to seriously consider smart water meter deployment.

The smart water metering market in South Africa has seen an increase in use and rise in the promotion and marketing of smart meters by the manufacturers (Bluefields, 2017; Maize, 2017). This is in line with the increased focus on, access to and availability of the internet of things (IoT) as well as the constant need for better, more actual and accurate measuring and data. The table below highlights the most widely used smart water metering companies in South Africa.

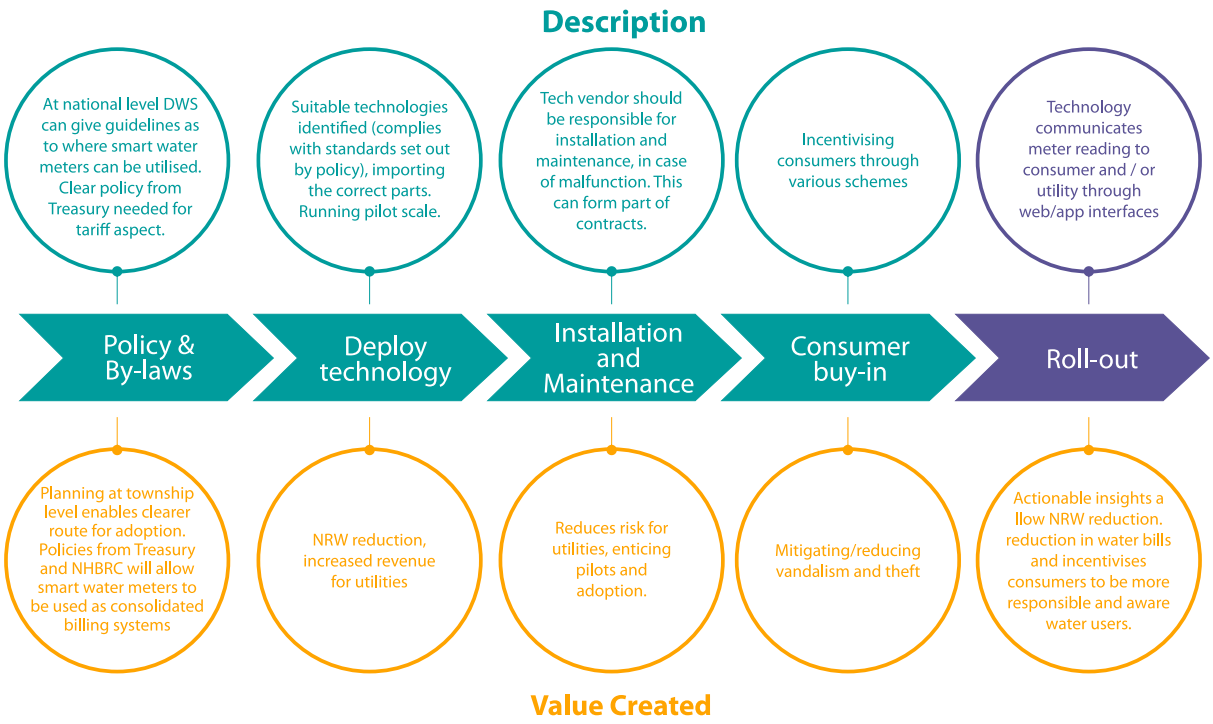
Table 1. Key market players in the South African smart metering market

Company Name	Country of Origin
Itron	USA
LAISON	China
Lesira	South Africa
Kamstrup	Denmark
Sensus	USA

The GreenCape Market Intelligence Report, 2022, stated that the growth in demand by the municipal sector is expected to be the greatest of all sectors in South Africa. Due to this, it is expected that the greatest opportunity to reduce water loss through smart water meter implementation is in the municipal sector. The figure on the bottom this page shows the financial value of water sales by sector with municipal water services sitting at 58% value. This highlights the true monetary value of water services and provision, enhancing the case for smart water meter implementation.

Market opportunities

Following a literature review, analysis and speaking to key stakeholders in the water sector, opportunities that can be leveraged for rolling out smart water metering in South Africa were uncovered. Roll-out of smart water metering is a multi-faceted approach, requiring buy-in from not only the technology side but also consumers, municipal staff and policymakers to name a few. They have been summarised in value chain on page 4.



Overview of smart water metering status in South Africa

Many South African utilities are at early stages of their smart water metering journey. Currently, examples of two municipalities actively engaging in smart water metering are George Municipality and Saldanha Bay. The plans are to install ultrasonic water meters throughout George over a period of three to four years, with the first 2000 meters that was planned to be installed in April 2023. Saldanha Bay are understood to have an active pilot of residential smart water meters in the town of Vredenburg.

National Treasury has recently awarded a transversal contract (RT29) in support of municipal procurement of smart electricity and water meters including other services. They have specified durability, networks, communication and security features, battery lifespan etc. This bodes well for municipal rollout. Two additional municipalities are currently exploring smart water meter pilots – eThekwini Water and Sanitation (EWS) and the City of Cape Town who highlighted the following:

- EWS are looking at different options to pilot, however there is still uncertainty surrounding smart meters vs automated meters and the definitions are still not clearly defined and distinguished. At the time of writing they were undertaking a study funded by SALGA ,through EWS, to pilot an AMR device for real-time monitoring of bulk water transfer between uThukela and Umgeni. The contracting is to be finalised.
- The City of Cape Town (CoCT) is planning to roll out a citywide meter replacement with an AMI system over the next 13 years. The plan, exceeding R5 billion, anticipates widespread implementation that initially focuses on business and industrial customers, with a goal to include the majority of residential customers by 2037. The City is currently in an "Intention to Procure" phase.

Other utilities, such as Johannesburg Water, have trialled prepaid water meters (not smart), for example in Soweto.

A five-year strategic roadmap

A five-year strategic roadmap was developed for the rollout of smart water meters. It assumes that the utility has engaged in the considerations that should be accounted for before proceeding with smart water meter systems. (Municipal Brief). The roadmap encompasses all insights gained from both global and South African stakeholders and addresses previous challenges from a utility perspective.

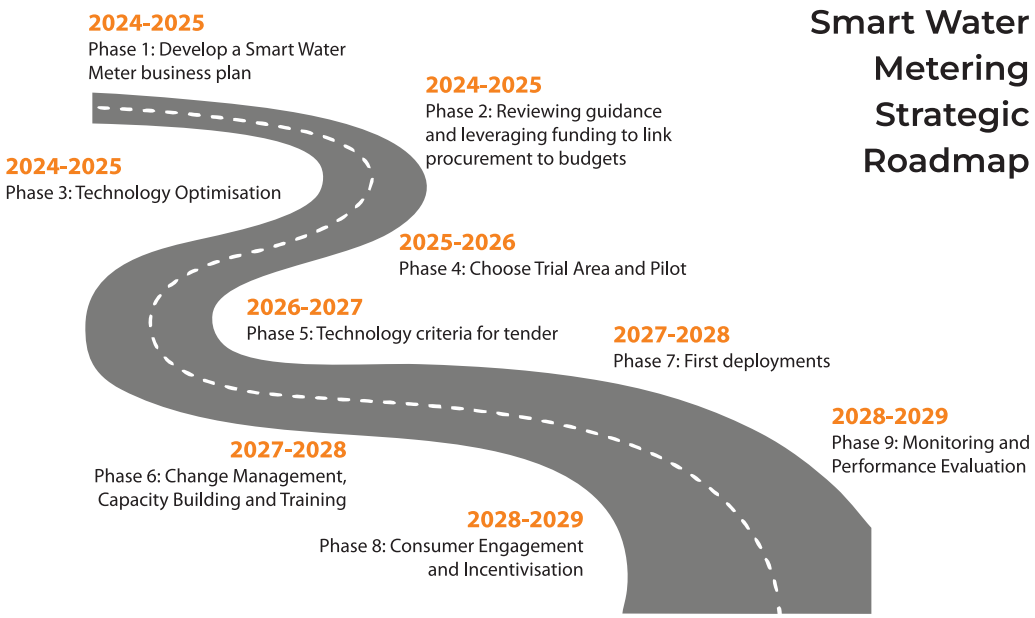


Figure 3: A 5-year Strategic Roadmap for smart water metering in South Africa (Isle,2024).

Phase 1: Develop a smart water meter business plan

In order to successfully link procurement to budgetary planning and leverage appropriate funding sources, it is vital to develop a strong business case for smart water metering. The business plan should cover outcome indicators, output indicators, key activities and inputs (resources) (Division of Revenue Bill). It is important to engage with stakeholders, including government agencies, utilities, technology providers, community groups, and consumers, to understand their needs, priorities, and concerns regarding water metering.

Have a clear definition of smart water metering. Ensure right from the inception of a study or business plan, that

the definition of a smart water meter aligns across all stakeholder groups and is not confused with various other water management tools.

Carry out long-term cost forecasting. Analysis for meter replacement to strengthen the business case should be carried out. If a utility's current meters are coming to the end of their life and will need investment for replacement, then this is the best time to install a smart water meter rather than a conventional one. Laboratories should be used to analysing meters and determining the optimum meter replacement age and/or volumetric reading. Meter age can be determined through comparison with historical data and identify accuracy of the meters.

If old meters are not replaced then inaccuracies can lead to more water being lost than is being measured. Due to energy and chemical price increases, the cost of treating and distributing water has also increased significantly in the last few years. Reducing water losses through more accurate metering can help to alleviate this.

Aside from revenue saved in terms of water losses, long-term cost forecasting should also factor in manual labour, replacement and security costs, such as meter reading, associated with conventional metering along with bill distribution costs. For example, at eThekwini Municipality, out of 540 550 water connections, 45 000 bills remain undelivered due to a lack of traditional addressing systems. This incurs significant mailing costs and requires substantial staff effort to ensure distribution.

Identify which customers to target in each year as part of trials in order to demonstrate the quickest ROI. (i.e. focusing on areas with higher economic profiles or high NRW rates).

Carry out customer surveys and awareness campaigns to strengthen the business case from a consumer standpoint. In order to gain the best results, these surveys should be assessed by an external company. The survey provides consumers with the opportunity to say what will benefit them, i.e. incentives, and how they would like to engage with data and information from their upgraded meter, i.e. mobile app. Awareness campaigns can be used to ensure customer transparency, and the utility can communicate benefits such as easier communication and usage awareness, but also inform consumers that meters do not contain high value parts. Through effective communication, this should help to mitigate vandalism issues that have been seen in the past (for example, in Soweto with prepaid meters), saving cost long term and strengthening the business case as a result.

Phase 2: Reviewing guidance and leveraging funding to link procurement to budgets

Phase 2 should involve **reviewing any relevant frameworks for tender**, such as the National Treasury Tender (RT29-2024: 'Delivery, installation, management and maintenance of smart metering solution for a period of 36 months'). This is a framework tender for all meter and technology original equipment manufacturers. Through review, alignment can be ensured with supply chain management requirements.

Leverage the Smart Meters Grant (Division of Revenue Bill, Smart Meters Grant 2024/25) whose purpose is to enable municipalities to implement bi-directional smart metering systems: The grant will prioritise municipalities in the debt relief programme (70 municipalities are on this programme), those with council-approved business plans (per customer category and ward), those with high potential for revenue generation/protection, and those with high potential reduced electricity/water loss. The grant will continue until 2027 subject to review.

Medium term expenditure framework (MTEF) allocations are 2024/25: R500 million; 2025/26: R650 million and 2026/27: R800 million. Responsibilities of the national department and of the municipality should be abided by.

The process involves submitting council-approved business plans to National Treasury (Division of Revenue Bill, Smart Meters Grant 2024/25)

Phase 3: Technology optimisation

Before technology selection and entering the tendering process, it is important to decide the variables that will optimise the benefits from smart water meters. Phase 3 should **include determining the frequency of readings** and balancing this with meter battery life.

Utilities will need to decide the frequency at which they would like data to be received. These specifics can be included in the tendering process. The frequency of smart water meter readings can vary depending on factors such as the specific needs of the utility, regulatory requirements, technical capabilities of the metering system, and the desired level of granularity in data collection.

Decisions will need to be made as to how often the utility will receive readings. Some smart water meters are capable of providing continuous or near-real-time monitoring of water usage. These meters transmit data at frequent intervals, such as every ten to fifteen minutes. The more frequently data is transmitted, the lower the battery lifetime of the meter.

Many utilities opt for hourly or daily readings from smart water meters. This frequency provides a good balance between granularity of data and operational efficiency regarding battery life. The most common frequency would be to send readings to the utility once per day with 24 hourly readings.

The two approaches can also be used together, and more

frequent readings (say four-five times per day) may be critical for larger uses of water, such as industrial customers but then hourly readings which get sent once a day may be suitable for residential applications.

Set up customer engagement portal for insights and nudges. The utility needs to decide whether they are looking for the hardware only or just software, as some providers may offer some of the customer engagement tools. If this is a requirement for the utility then this guidance should be included in the tender. There is an option to integrate the customer portal with the smart water metering system to enable seamless data transmission and retrieval.

Decide how the portal will be accessed, e.g. via web browsers and mobile devices. Ensure that the portal can handle large volumes of data and scale effectively as the number of users and meters grows over time. A meter data management system will need to be set up to clean and segment data. A team of data engineers and analytics engineers will need to be assembled.

Set up a SMOC (Smart Meter Operation Centre). The centre will identify when a meter has become faulty and needs maintenance. The meter will also act as a financial tool, so if battery runs out then as well as water being lost, a revenue stream is also being lost, Hence it is vital that smart meters are maintained correctly.

Phase 4: Choose Trial Area and Pilot

Once all of the previous phases have been successfully achieved, then a trial area can be chosen and a pilot can begin. Phase 4 should include **carrying out an analysis on the type of user to target first** (i.e. residential or industrial/ commercial).

Different utilities will have different customer groups that use up most of the water. Although not the only decision-making metric, it is good to focus on the biggest consumers of water – for example, 20% of users may be using up to 80% of the water. Carry out an analysis on what area to undertake the trial in. Other ways to determine trial areas is to analyse the economic profile of suburbs and target rollout to those areas that have higher incomes. This is to mitigate risk associated with vandalism and non-payment.

Focus on areas that suffer from high rates of NRW. Focus on areas where meters are old or coming to the end of their lifetime. This is probably the most economically justified rationale for choosing a trial area. Old meters can result in many inaccuracies which would then cause the price of water to be more expensive than the cost to replace the meters, which would be a value add to the business case. See Phase 1.

Revisit the established performance indicators and metrics in the business plan to assess the impact of smart water metering on key objectives, such as water conservation, revenue collection, customer satisfaction, and operational efficiency. Effectively capture lessons learnt for technology requirements, which will inform the tender process.

Phase 5: Technology criteria for tender

There are many factors that utilities need to consider when deciding which technology to procure. Phase 5 should include **choosing what mode of ownership is best**. A significant barrier to smart water meter rollout is the large overall cost. Utilities can have different forms of ownership from owning the metering assets themselves to just paying for metering as a service, whilst another entity has ownership over assets.

Metering-as-a-service is a concept where vendors are looking to capture more market share by offering the provision of data without the capital outlay of the devices by the utility or the hassle of maintenance. This concept has developed overseas where metering penetration is much lower. Markets, such as South Africa, where meters are being installed for the first time present a viable opportunity for metering-as-a-service. The approach will depend upon each utility's financial position and using this method may prove beneficial to smaller municipalities, avoiding large upfront installation costs.

A shared benefit model is another mode of ownership whereby the utility owns the metering assets but enters into a collaborative agreement with suppliers to receive ongoing revenue from the deployment. This type of strategic agreement could include terms wherein a supplier receives 10% of the revenue generated, eliminating upfront setup costs through a performance-based contract with municipalities. This will help address the barrier echoed by many South African utilities of technology unreliability. It should be made clear what the role of the supplier and what the role of the utility is in the contracts at the start of the study, shifting the responsibility of installing and maintaining the systems to technology suppliers. Confirmation is required as to whether the MFMA will allow such a mode of ownership.

Utility owned and -operated solutions are also a mode of ownership whereby the utility purchases outright all of the technology (from devices to data analytics software) and maintains the entire system. However, this is very unlikely in the South African context due to the lack of capacity and business readiness for smart water metering.

Use trial results to inform the tender specification. For example, in technical trials pre-tender, the utility may have had the devices sending data across every fifteen minutes, but post-trial found that this high of a frequency is not needed and that receiving readings once a day is sufficient and will also save years on battery life.

Decide to opt for one technology provider or multiple

providers. Decisions will need to be made as to whether one technology provider will be used or multiple. Having one technology provider means that there is no one to pin the blame on and communication may be easier, however, having multiple providers can de-risk implementation and add a sense of back-up and safety. Most South African utilities do not have the expertise in house to be able to tackle the complexities of integrated smart water metering systems, and a consortium type approach is most likely.

Decide the best communication pathway(s). Decisions will need to be made whether to use existing communication networks. In most smart metering applications, NB-IoT is the preferred approach as these leverages existing infrastructure and therefore helps to keep deployment costs lower.

Phase 6: Change management, capacity building and training

Implementing smart water meters involves significant changes in technology, processes, and organisational culture. Change management is crucial to ensure a smooth transition and maximise the benefits of smart metering. Phase 6 should include **developing a comprehensive communication plan** to keep stakeholders informed and engaged throughout the implementation process.

Provide training programmes and capacity-building initiatives for utility staff, technicians, and customer service representatives to familiarise them with the new technology, processes, and procedures. Offer hands-on training sessions, workshops, e-learning modules, and user manuals to ensure that employees have the necessary skills and knowledge to operate and support smart water metering systems. Identify change champions within the utility who can advocate for the adoption of smart water meters and help drive acceptance and adoption among their peers.

Identify community champions and NGOs in the community to lead change management processes. The public may be more receptive and trusting towards their fellow community members, who can advise and guide communities on the benefits of using a smart water meter. Establish feedback mechanisms to capture input, suggestions, and concerns from stakeholders throughout the process.

Phase 7: First deployments

Once trials have been completed and a good level of institutional capacity has been built from a change management perspective, then first deployments on a wider scale can start to take place. Phase 7 should involve **deploying smart meters at designated locations**, ensuring proper installation and calibration. This may involve coordinating with utility crews or third-party contractors for installation.

Rollout the smart water metering system across the target area, following a phased approach if necessary to manage resources and minimise disruptions to water service. Conduct thorough testing of the smart metering system to ensure accurate meter readings, reliable communication, and data integrity. Validate the system's performance under various conditions and scenarios.

Phase 8: Consumer engagement and incentivisation

The true benefits of smart water meters cannot be realised without engagement from customers. Phase 8 should include launching **comprehensive awareness campaigns** to educate consumers about the benefits of smart water meters.

It should be clearly communicated how these devices work, the advantages they bring, and how they contribute to water conservation and cost savings. User-friendly materials should be provided, such as brochures, videos, and infographics, explaining the functionality and advantages of smart water meters. Saving money on water bills will be the main driver for most customers so it is important to highlight potential cost savings for consumers as a result of accurate billing and early leak detection.

Provide physical customer incentives. One method involves providing households with 2 gigabytes (GB) of free data. The data will hopefully encourage consumers to engage with behavioural change nudges. If consumers are receiving free data, they will be a lot less inclined to cause meter damage and vandalism.

Often, the idea of an incentive is often enough to get consumers involved. Various utilities globally have trialled initiatives where consumers are promised a financial reward for acting on their insights and reducing water usage. This delivers promising results and is a method which can be trialled with South African residents.

Create virtual communities and gamify the experience. Water savings between 5% and 10% have been reported in global utilities such as PUB Singapore where a gamified mobile application was used to motivate and increase awareness on water usage.

Create easily accessible customer support channels for consumers to seek assistance or address concerns. Customers should be encouraged to provide feedback on their experiences with smart water meters and this feedback should be used to make improvements and address any challenges.

Phase 9: Monitoring and performance evaluation

Monitoring and performance evaluation methods will be key to determining if the rollout is a success and will provide rationale to expand further in the future. Hence, it is critical that robust methods are put in place. Phase 9 should include **revisiting the established performance indicators**

and metrics in the business plan to assess the impact of smart water metering on key objectives, such as water conservation, revenue collection, customer satisfaction, and operational efficiency.

Implement monitoring systems to track key performance metrics in real-time and generate regular reports for stakeholders to review progress, identify areas for improvement, and make data-driven decisions.

Conduct periodic evaluations and audits of the smart metering programme to ensure compliance with regulatory requirements, address any issues or concerns, and optimise the effectiveness of the system. Conducting regular customer feedback surveys to gather information on how smart water meters are helping them change behaviour and reduce water use.

Ensuring adherence to operations and maintenance plans and/or any other requirements agreed to as part of the funding agreement contained in the MoU and ensure the sustainability of the solution (if National Treasury grants are utilised).

Conclusion

Changes at policy and governance level will take many years to implement. Some points to consider for longer term impact is to have legislative policies in place both at national and municipal level. Nationally, there is some guidance such as the framework tender but more needs to be done, particularly at town planning level. Different countries have rules and regulations regarding meters, for example Spanish authorities state that meters need to last at least 12 years (battery life) which is a step in de-risking implementation for utilities. There is a need to develop guidelines, procedures, and protocols for the installation, operation, maintenance, and decommissioning of smart water meters in South Africa, as well as data collection, storage, and sharing. It would be beneficial if the National Treasury transversal contract can help achieve this or set the roll-out on the correct path.

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