

TECHNICAL SPECIFICATIONS

Project: Deployment of 40 Solar-Powered Smart Prepaid Water Meters at 3-Tap Kiosk Public Stand Posts
Location: Zone 1, Bidi Bidi Refugee Settlement, Uganda
Target Operators: Northern Umbrella for Water and Sanitation (NUWS)

1. Executive Summary & Scope of Works

This document sets out the comprehensive technical specifications and itemized, priced Bill of Quantities (BoQ) for the procurement, engineering installation, and commissioning of forty (40) rugged, off-grid, solar-assisted smart prepaid water meter systems in Zone 1 of the Bidi Bidi Refugee Settlement. Each installation comprises a heavy-duty prefabricated Galvanized Iron (GI) steel kiosk enclosing a high-precision hydraulic manifold that branches into three (3) active individual water demand tap stations, totalling 120 managed water outlets across the settlement network. The equipment framework features heavy bias toward extreme climate durability and decentralized transaction architectures optimized for displacement and humanitarian operations (including native offline NFC token loops, resin-filled IP68 waterproof shielding, and bi-stable motorized low-draw internal valves). Financial systems are fully integrated with widespread automated clearing interfaces, incorporating mobile money (MTN MoMo, Airtel Money), commercial banks, and localized POS vendors. Institutional capacity building for twenty (20) selected engineering personnel from NUWS and NWSC, complete with peer field benchmarking in Kampala, specialized fast-moving spares buffers, and an all-inclusive 24-month manufacturer warranty configuration are embedded within this turnkey contract layout.

2. Tabulated Engineering Technical Specifications

System Module	Minimum Technical Engineering Compliance Standard & Performance Criteria
Metering Engine & Hydraulics	High-performance volumetric or multi-jet dry dial mechanical velocity configuration. Threaded connection sizing DN20/DN25. Must support nominal operating pressures up to 10 Bar, fluid temperatures up to 50°C, and feature factory-integrated dual internal sand/silt filtration meshes to process high-turbidity borehole water without clogging or registering false rotation vectors.
Actuation & Flow Control	Internal, integrated bi-stable motorized electronic latching valve mechanism. Draws power exclusively during brief opening/closing electrical pulses (millisecond duration) and retains its static state with zero continuous holding current. System must execute an automatic hardware-forced shutdown the instant user token credit records 0.00 UGX.

Hybrid Energy Architecture	Core flow measurement logic and valve actuation powered by an internal, hermetically sealed, non-rechargeable industrial Lithium Thionyl Chloride (Li-SOCl ₂) battery array (5–7-year maintenance-free field life). Supplemented by an external, vandal-shielded 10W monocrystalline solar PV module dedicated to powering continuous NFC card scanning, wireless telemetry bursts, and display backlighting under massive daily usage cycles.
Asynchronous Token Interface	Native contactless Near Field Communication (NFC) smart storage card or high-impact molded resin keyfob verification. Cryptographic transaction authentication must execute locally between the physical user media token and the meter hardware interface within 0.5 seconds, guaranteeing full, uninterrupted water dispense operations during total grid collapse or cellular network blackout periods.
Omnichannel Payment Suite	Centralized cloud management platform providing automated financial clearing via secure APIs. The software suite must natively support real-time and batch credit purchases via: (1) Mobile Money aggregators (MTN Mobile Money and Airtel Uganda USSD codes, STK push, and application suites), (2) Commercial Banking networks (agent banking terminals and national banking switches like Pegasus or Interswitch), and (3) Localized point-of-sale (POS) vendor merchant terminals for manual web-cash handovers.
Demographic Token Matrix	To mitigate queue pressures in densely populated settlement zones, the allocation framework establishes a strict dual-tier structural distribution network: (1) 20 Master Vendor Allocation Tokens (heavy-duty smart cards distributed to authorized water vendors and localized water committee distribution managers for emergency overriding, bulk water distribution, and physical cash processing), and (2) 4,000 High-Capacity Consumer Media Tokens (ruggedized ABS plastic contactless NFC keyfobs allocated at a density matrix of 100 households per PSP to minimize spatial conflict).
Anti-Vandalism Protection Armor	Physical fortification framework against high-wear and unauthorized interference: Enclosure constructed from heavy-gauge (minimum 3mm thick) hot-dip Galvanized Iron (GI) steel structural kiosk skin with high-tensile dual internal padlocking mechanisms, reinforced concrete anchoring brackets embedded into foundation plinths, hidden internal non-exposed plumbing joints, custom-formed wire-mesh cages protecting the monocrystalline solar PV array, and shatterproof polycarbonate shielding covering electronic LED readout displays.
Wireless Telemetry & Sync	Dual-mode wireless transmission configuration embedding a quad-band GSM/GPRS/LTE cellular modem alongside a long-range sub-GHz radio module (LoRaWAN). Programmed for automatic background batched sync uploads of hourly log structures detailing absolute consumption vectors, net revenue cashflow, operating battery voltages, solar charge profiles, and active physical chassis tamper alert flags.
Ingress Protection (IP)	True certified IP68 Submersible qualification. The entire internal electronic microcontroller, sensory logic relays, battery array, and actuation solenoids must be fully encapsulated in premium electrical-grade insulating resin to resist all continuous

	condensation, dust ingress, and full water immersion under flash flooding or high relative ambient humidity cycles.
3-Tap Kiosk Assembly	Heavy-gauge ~~pre-fabricated~~ prefabricated Hot-Dip Galvanized Iron (GI) steel protective enclosure kiosk with built-in internal thermal insulation and secure dual-padlock mechanical door locks. Features an internal hydraulic manifold splitting the single main metered line into three (3) active independent distribution lines. Each line must pass through the kiosk wall and terminate with a heavy-duty brass spring-loaded self-closing water conservation tap to prevent intentional or accidental waste.
Auxiliary Hydraulic Valving	Full high-grade brass mechanical plumbing assembly upstream and downstream of the meter unit. Line must feature heavy-duty brass isolating ball valves for manual line maintenance, an inline physical brass Y-strainer (50-mesh size minimum) for secondary particle capturing, and an inline spring-loaded non-return check valve to eliminate any reverse siphoning dynamics or erroneous backwards register tracking.
Institutional O&M; Training	Mandatory formal capacity-building curriculum covering hands-on operations, preventative maintenance diagnostics, local telemetry range adjustments, card encoding, and backend cloud accounting reconciliation. Training tracks must be custom-tailored for exactly twenty (20) specialized technical personnel drawn from the Northern Umbrella for Water and Sanitation (NUWS) and the National Water and Sewerage Corporation (NWSC). The curriculum must incorporate localized peer field benchmarking visits to established water networks in Kampala where identical prepaid technology arrays have operated successfully, incorporating fully paid per diem, lodging, and travel allowances for all 20 participants.
Comprehensive Warranty Policy	Minimum binding hardware and performance warranty period of twenty-four (24) months from the date of final operational site commissioning. Covers all prepaid computing controllers, solar PV collectors, bi-stable flow valves, internal battery systems, and electronic sensors against factory material defects, software errors, or rapid environmental degradation under field operational parameters.