# TRANSNET PROPERTY

# TECHNICAL SPECIFICATION FOR THE NATIONAL SMART METERING SYSTEM

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## TABLE OF ABBREVIATIONS

| AC | Alternating Current |
|---|---|
| DC | Direct Current |
| DAQ | Data Acquisition |
| SPC | Spare Parts Catalogue |
| TP | Transnet Property |
| RFP | Request for Proposal |
| IEC | International Electro-Technical Commission |
| I | Current |
| V | Voltage |
| f | Frequency |
| P | True Power (W) |
| Q | Reactive Power (VAR) |
| S | Apparent Power (VA) |
| PF | Power Factor |
| APN | Access Point Name |
| GSM | General System for Mobile Communications |
| GPRS | General Packet Radio Services |
| IoT | Internet of Things |
| IP | Internet Protocol |
| ISO | International Standard Organisation |
| SABS | South African Bureau of Standards |
| SANS | South African National Standards |
| NSM | National Smart Metering |
| NRS | National Regulatory Services |
| SIM | Subscriber Identification Module |
| SAP | System Analysis Program Development |
| MSISDN | Mobile Station International Subscriber Directory Number |
| OTA | Over The Air |
| ENS | Energy and Sustainability |
| EPC | Energy Performance Certificates |

# 1. BACKGROUND AND INTRODUCTION

Transnet Property (TP) manages a large portfolio of commercial and residential properties across South Africa. The majority of these properties occupied by tenants are not metered for electricity and water consumption. TP owns a portion of the properties in the portfolio and manages the rest on behalf of Transnet Freight Rail (TFR) and is therefore responsible for settling the consumption bills with the Utilities Suppliers across the portfolio. The utility bills received from the Utility Suppliers are typically sourced from bulk meters for each account, owned by the Utility Suppliers, that feeds multiple buildings with various tenants in the precinct. Assumptions must then be made that the Utility Suppliers' meters are accurate, and no errors are made.

Disputes with Utilities Suppliers on invoices are difficult to substantiate without check meters. Water leaks can only be investigated upon receiving high consumption bills from Utility Suppliers with delayed responses to the occurrences of water leaks leading to prolonged water wastage and associated high billing costs. TP recovers the utility consumption cost from the tenants through lease agreements. In the absence of metering infrastructure, the tenants are charged at a flat rate for utilities leading to substantial discrepancies between the actual consumption and billed invoices. Most of the remaining properties that are metered have outdated meters with basic accumulated energy consumption displayed.

Conventional meters only reflect active energy (kWh) consumption and do not reflect power demand (kVA) or reactive energy (kVARh) utilisation per tenant, leading to challenges with the recovery of the demand/reactive energy charges from tenants. Existing meters are subject to manual readings and on-site connection of meters for historical data download. The metered properties require excessive travel to the various sites where manual readings are recorded and are subject to human error.

Transnet and various operations within its organisation are undergoing energy constraints. To respond to these issues, Transnet Property has identified the need to develop strategies to optimise energy usage across various sectors of the business. Since operations take priority, these sectors have traditionally been unconstrained with regards to energy usage. The goal of Energy and Sustainability department within Transnet Property is therefore to introduce energy efficient strategies, across current assets, that will enable business operations to continue as usual while simultaneously achieving a lower energy footprint. Major turnaround strategies identified for TP involves proactively managing energy and water consumption and recovering Utilities costs paid to Utilities Suppliers by establishing a measurement, verification and performance programme which would allow the setting of reasonable targets and objectives.

To unlock this exercise, physical and performance measurements of facilities, buildings, systems, processes, components, and subcomponents forms an integral part of Utilities management and are vital for guiding the identification of saving opportunities. In addition, energy data collected over a minimum of 12 months is a basic requirement to acquire Energy Performance Certificates (EPC). On the 8th of December 2020 it became mandatory for accounting officers and building owners to display and submit an Energy Performance Certificate (EPC) for their building, with an effective end date of 07 December 2025. The advanced metering infrastructure therefore remains the pivotal step for achieving this goal.

As such, this specification document describes Transnet Property's requirements for the *supply*, *development*, *delivery*, *installation*, *testing* and *commissioning* of the **National Smart Metering (NSM) System** to provide, consolidate and analyse Utilities consumption data, both electricity and water, using Smart Meters on a national central online platform.

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## 2. SCOPE OF REQUIRED SERVICES

### 2.1. General

This Technical Specification is for the supply, development, delivery, installation, testing, and commissioning of the *National Smart Metering (NSM) System* to measure, consolidate and analyse Utilities consumption data, both electricity and water, using Smart Meters on a national central online platform. The required overall quantity of Smart Meters required for installation is given on the Scope of Works document.

The primary deliverables for this specification are the supply, development, delivery, installation, testing and commissioning of:

1. Electricity Smart Meters:
   a) Bulk Smart Metering infrastructure
   b) Smart Submetering infrastructure
   c) EPC Metering infrastructure

2. Water Smart Meters:
   a) Bulk Smart Metering infrastructure
   b) Smart Submetering infrastructure

3. A secure Online Data Platform that allows for remote data transfer from the installed Smart Meters to a central national platform where data is processed, analysed, and accessed according to the requirements of the business.

The Respondent(s) are at liberty to provide solutions either to one or more of the abovementioned sets of the requested items meaning, the potential suppliers are not obliged to provide information to Transnet Property (TP) for all these metering infrastructures. However, preference will be given to Respondents who would provide ALL the requested items to ensure the uniformity of the metering solution.

## 3. TRANSNET PROPERTY SMART METERING SYSTEM

### 3.1. Generic Portfolio Overview

Transnet Property has a portfolio worth R6bn that is spread across South Africa. It has a footprint of residential and commercial properties in its five regions. The regions include Northern, Inland, KwaZulu-Natal, Eastern Cape, and Western Cape, as depicted in Figure 1 below. As such, this programme of installing the requested smart metering infrastructure will be conducted across the Transnet Property regions. The list is given on the Works Information -Engineering and Construction Contract document.

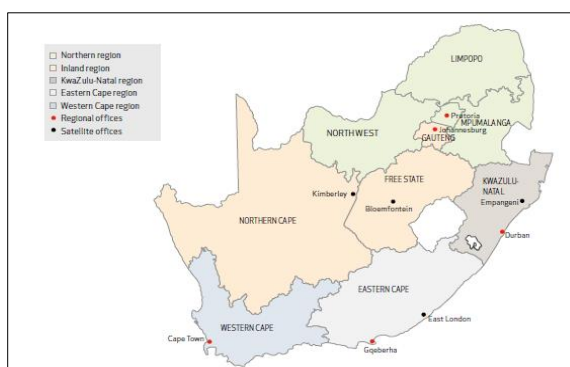

Figure 1: Transnet Property Regions

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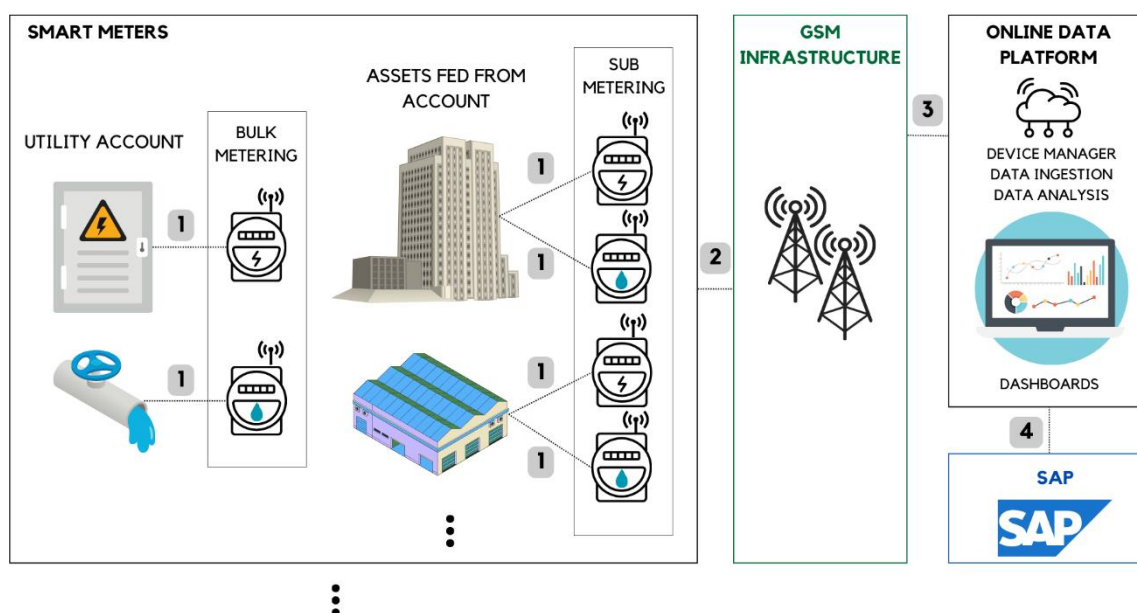### 3.2. National Smart Metering System Layout



Figure 2: National Smart Metering (NSM) System High Level Overview

The interfaces between the National Smart Metering System subsystems can be described as follows:

Table 1: National Smart Metering System Subsystem Interface

| Interface | Interface Description |
|---|---|
| 1 | Point of Supply/Delivery to Smart Meter |
| 2 | Smart Meter to GSM infrastructure |
| 3 | GSM infrastructure to Online Data Platform |
| 4 | Online Data Platform to SAP |

The National Smart Metering system can be divided into the hardware, end-to-end connectivity, and software subsystems.

Table 2: National Smart Metering Subsystems Response

| No. | National Smart Metering System Subsystems | | Response (Y/N) |
|---|---|---|---|
| S1. | The hardware to be installed to enable the system | | |
| | S1.1. | Electricity Smart Meters: | |
| | S1.1.1. | Bulk Meters – These meters shall be used to check electricity consumption read by Utilities Suppliers metering infrastructure to verify the Utilities Account Invoices received. Bulk Meters typically cater to medium voltage applications from 6.6 up to 33kV. | |
| | S1.1.2. | Submeters – These meters shall be used to quantify the electricity consumption of the tenants being supplied from the Bulk Metering point of supply thereby providing an accurate method of recovering the costs associated with paying the Utilities Account Invoices. Submeters typically cater to low voltage applications from 220 up to 400V. | |
| | S1.1.3. | EPC Meters – These meters shall be used to acquire energy data for buildings applicable to the Act (Act No. 34 of 2008) (Department of Mineral Resources and Energy, 2020: 3). | |

| | | | |
|---|---|---|---|
| | **S1.2.** | **Water Smart Meters:** | |
| | S1.2.1. | Bulk Meters – These meters shall be used to check water consumption read by Utilities Suppliers metering infrastructure to verify the Utilities Account Invoices received. The meter sizes are to be determined upon site assessment. | |
| | S1.2.2. | Submeters – These meters shall be used to quantify the water consumption of the tenants being supplied from the Bulk Metering point of supply thereby providing an accurate method of recovering the costs associated with paying the Utilities Account Invoice. The meter sizes are to be determined upon site assessment. | |
| **S2.** | | **The end-to-end connectivity that enables the NSM System** | **N/A** |
| | **S2.1.** | **Cellular SIM Cards** | |
| | | All installed Smart Meters, both Water and Electricity, shall be GSM communication enabled and SIM cards provided by Transnet's Network Provider shall be provisioned and onboarded to the Online Data Platform. The SIM cards shall be able to attach to Global System for Mobile Communication (GSM) (2G), Wideband Code Division Multiple Access (WCDMA) (3G) and Long-Term Evolution (4G) and have capability of 5G migration. | |
| | **S2.2.** | **Network Connectivity and APN** | |
| | | The SIM cards connected to the Smart Meters shall have connection to and be authenticated to the Data Center (DC) which hosts Transnet services. The network connectivity shall be based on GPRS as a minimum. | |
| | **S2.3.** | **Authentication and Security** | |
| | | The MSISDN's shall be assigned with a Static IP Address for authentication. Upon insertion into the Smart Meter and provision of the SIM card, the SIM card should not work on any other device unless an override is done by authorised personnel. The data sent over the SIM card and network must be encrypted and data privacy must be ensured at all times. | |
| **S3.** | | **The Online Data Platform software** | |
| | **S3.1.** | **Device Manager** | |
| | | The Device Manager shall provide access control, encryption, and authentication, to prevent data breaches and unauthorized access. The Device Manager shall offer a user-friendly and intuitive onboarding process that enables the addition, configuration of Smart Meter devices to the system and as such, provide OTA updates enable authorised personnel to push updates and patches to devices automatically. | |
| | **S3.2.** | **Databases and Relationship Management** | |
| | | Smart Meters, both Water and Electricity, connected to the system shall be identified using fixed IP addresses and unique identification, and loaded onto a database with their information, physical locations, and characteristics. Information databases required to process, analyse, and visualise Smart Metering data are: | |
| | S3.2.1. | Utilities – Utilities Accounts shall be loaded and linked to the Bulk Meters installed at the point of delivery from which Utilities Suppliers bill consumption via Invoices. A database of Utilities Suppliers details with Tariff Structures shall be loaded and linked to the applicable Utilities Account. Utilities Accounts and their linked Bulk Meters shall be linked to the Submeters corresponding with the Utilities Accounts. | |
| | S3.2.2. | Leasing – A database of lease agreement details shall be loaded and linked to the Submeters installed at the point of supply from which tenants can be billed for their consumption. | |
| | S3.2.3. | Finance – Cost Center numbers used for payments of Utilities Accounts shall be loaded and linked to the corresponding Utilities Accounts. | |
| | **S3.3.** | **Data Ingestion, Processing, Storage and Analysis** | |
| | | The physical architecture of the Online Data Platform shall encompass ingesting data transmitted from the Smart Meters authenticated by the Device Manager, processing, analysing, storing, and disseminating the data to the frontend Dashboards required by the end-users. | |

| S3.4. | **Frontend Dashboard Visualisation** |
|---|---|
| | National and Regional views of Smart Metering data and User Interfaces/Dashboards shall be customised for the following end-user groups: |
| S3.4.1. | Utilities Management |
| S3.4.2. | Finance Managers |
| S3.4.3. | Energy and Sustainability Managers |
| S3.4.4. | Data Analysts |
| S3.5. | **Integration with Transnet SAP System** |
| | The front-end dashboard for Finance Managers shall offer a means of sending information to the Transnet SAP System. |

The Concept of Operations document for the NSM system will be shared and discussed with the successful bidder upon Letter of Award to indicate the envisioned system operation in accordance with this document and the Scope of Works.

## 4. RESPONSE TO TECHNICAL SPECIFICATION

- The Respondent must adhere to all requirements outlined in this document. Failure to adhere to these requirements may result in the disqualification of the Respondent's submission, subject to the discretion of the adjudication panel.
- Transnet reserves the right to disqualify any Respondent should its submission not adhere to all the requirements specified in this document.

## 5. SMART METERING INFRASTRUCTURE TECHNICAL SPECIFICATION
### 5.1. Electrical Smart Meters

Various methods exist for the installation of the metering solution. The proposed system layout for smart metering infrastructure to be installed on Transnet Property's 3-phase networks or grids is depicted in Figure 3Table *3*, for consideration. This is an envisaged overview of what is expected as part of this specification but will be flexible to ensure an optimal solution is achieved.
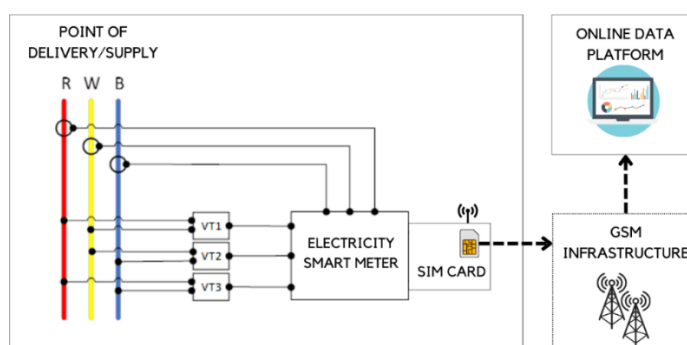


Figure 3: Proposed Electrical Smart Meter System Layout

This smart metering solution shall comprise of the actual **smart power/energy meter** and, where necessary, the instrument transformers, i.e., the **current transformers** (CTs) and **voltage transformers** (VTs).

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The smart metering hardware shall be equipped with wireless and direct communication modules and must be programmed with software that can allow for third party access. The acquired data measured through the current and voltage sensors shall be transmissible to the Online Data Platform via the end-to-end connectivity solution.

The smart meters shall be interconnected to the CTs and VTs installed on the respective phases to facilitate the measuring of AC and DC transients. Where direct measurements could be taken by the meter, the CTs and VTs may be omitted.

A similar solution architecture is required for the 1-phase systems but will be without the CTs and VTs. Every other functionality must be provided for these smart meters.

The proposed smart metering infrastructure shall be deployed to measure the substations, minisubs, facilities, buildings, and the key systems, processes, components, and subcomponents at voltage applications as given on the table below. It is of importance to note the maximum current and voltage limits of the points of delivery/supply and the corresponding smart meter specified for installation. Each site of installation requires assessment to evaluate and accurately specify the application category meter required.

Table 3: Electricity Smart Meter Application Categories

| Application | Description | Typical Maximum Current and Voltage Levels |
|---|---|---|
| 1 | 3-phase MV applications up to 33kV | • Vmax = 6,6 or 11 or 33 kV (RMS)<br>• Imax = 800 A (RMS) (most common cases) |
| 2 | 3-phase 400V system | • Vmax = 400 V (RMS)<br>• Imax > 100 A (RMS) |
| 3 | 1-phase system | • Vmax = 230 V (RMS)<br>• Imax = ± 63 A (RMS) (most common cases) |

## TECHNICAL REQUIREMENTS FOR THE ELECTRICAL SMART METERING HARDWARE

a) This technical specification is applicable for all the application categories of Electrical Smart Meters required as listed in Table 3. The site of installation for Bulk Metering, Submetering and EPC metering infrastructure must be categorised into the applications during the site assessments prior to hardware design for the metering installations. The respondent shall supply complete the right most column in response to the requirements of the equipment. All requirements apply to Bulk Metering, Submetering and EPC Smart Meters.

b) The respondent shall provide supporting documentation that can demonstrate their expertise to fulfil these functional requirements.

Table 4: Technical Requirements for Electrical Smart Meters

| # | Technical Requirements | Response (Y/N) | Remarks |
|---|---|---|---|
| R1. | General Requirements | | |
| R1.1. | The meter must have a clearly visible, indelibly, and distinctly marked name plate containing the following information:<br>- Manufacturer's name | | |

| | | | | |
|---|---|---|---|---|
| | - Meter type<br>- Number of phases and number of wires<br>- Meter serial number<br>- year of manufacture<br>- Rated voltage of the system<br>- Basic current and maximum current<br>- Reference frequency in hertz<br>- Meter constant in imp/kWh<br>- Meter Constant in imp/kVARh<br>- Class index of the meter<br>- Reference Standards | | |
| R1.2. | The meter must be backlit and powered with auxiliary control power | | |
| R1.3. | The meter must be protected by a password for the setup menu, alarms and reset menus | | |
| R1.4. | The meter must be equipped with internal anti-tamper security feature to ensure the integrity of the measurements with detection of tampering triggering an alert/alarm transmitted from the meter. | | |
| R1.5. | All setup parameters required by the meter shall be stored in non-volatile memory and retained in the event of a control power interruption | | |
| R1.6. | The meter must have a real-time clock with battery back-up with at least 1 year ride-through time without external power | | |
| R1.7. | The meter must be capable of being applied without modification at nominal frequencies of 50 or 60Hz | | |
| R1.8. | The meter must have a minimum usable lifespan of 15 years, or the Responder can stipulate such information | | |
| R2. | Measurement Requirements | | |
| R2.1. | The intervals for measurement, Logging and Transmission of data must be configurable. | | |
| R2.2. | Parameters to be measured or monitored and transmitted at **15 minutes** intervals with interval time stamp | | |
| R2.2.1. | Current – per phase and True RMS,<br>Voltage – per phase and True RMS,<br>Power Factor, Frequency, Phasor angles.<br>Four Quadrant (import/ export):<br>- Apparent Power (kVA)<br>- Active Power (kW)<br>- Reactive Power (kVAR)<br>- Apparent Energy (kVAh)<br>- Active Energy (kWh)<br>- Reactive Energy (kVARh) | | |
| R2.2.2. | Power Quality Indication:<br>- Total Harmonic Distortion (THD)<br>- Harmonics (up to the 31st)<br>- Unbalance | | |
| R3. | Display Requirements | | |
| R3.1.1. | The meter's Data Display Auto Scroll shall include:<br>- Date and Time<br>- Cumulative Active Energy kWh<br>- Cumulative Apparent Energy kVAh | | |

| | | | | |
|---|---|---|---|---|
| | - Instantaneous Phase Voltage<br>- Instantaneous Phase Current<br>- Instantaneous Load kW and kVA<br>- Instantaneous Power Factor, and<br>- Frequency<br>displayed for 5 seconds each. | | | |
| R3.1.2. | Data Display Scroll with Push Button:<br>All Parameters mentioned under Auto-Scroll mode should be displayed and additionally:<br>- Meter Serial Number<br>- Current Month Maximum Demand<br>- GSM Signal Strength | | | |
| R4. | Accuracy Requirements | | | |
| R4.1. | For meters with CT ratio x/5A:<br>- Active energy: Class 0.5S<br>- Reactive energy: Class 1<br>- Current: +/-0.3%<br>- Voltage: +/-0.3%<br>- Active/apparent power: +/-0.5%<br>- Reactive power: +/-2%<br>- Power factor: +/-0.005<br>- Frequency: +/-0.05% | | | |
| R4.2. | For meters with CT ratio x/1A:<br>Active energy: Class 1<br>Reactive energy: Class 2<br>Current: +/-0.5%<br>Active/apparent power: +/-1%<br>Power factor: +/-0.005 | | | |
| R4.3. | Annual calibration shall be required to maintain this accuracy | | | |
| R5. | Electrical and Mechanical Connections | | | |
| R5.1. | The meter must have removable connectors for voltage inputs, control, power, communications, input, and outputs | | | |
| R5.2. | Inputs for supply voltage: Screw-type terminals | | | |
| R5.3. | Measurement inputs for voltage: Screw-type terminals | | | |
| R5.4. | Measurement inputs for current: Screw-type terminals. | | | |
| R5.5. | Meter Mounting: Panel Mounted. | | | |
| R6. | Communication Requirements | | | |
| R6.1. | Local Communication:<br>RJ45, Optical Port, RS485, MBUS | | | |
| R6.2. | Remote Communication Modules:<br>Cellular GSM/GPRS as a minimum, Optional MQTT | | | |
| R6.3. | Communication Protocols:<br>MODBUS TCP/IP, 2G, as a minimum.<br>Wideband Code Division Multiple Access (WCDMA) (3G) and Long-Term Evolution (4G) with capability of 5G migration; NB-IoT | | | |
| R7. | Protection Requirements | | | |

| R7.1. | The IP rating of the supplied meter and accompanying equipment shall be no less than IP40 front panel, IP20 casing. | | |
|---|---|---|---|
| **R8.** | **Data Access Requirements** | | |
| R8.1. | The onboard logged data shall be downloadable in a .csv-format as a minimum at 15 minutes intervals. | | |
| R8.2. | The measured data shall be transmissible remotely to an Online Data Platform. | | |
| **R9.** | **Environmental and Operational Requirements** | | |
| R9.1. | Ambient Temperature | | |
| R9.1.1. | The maximum external air temperature the equipment will be exposed to due to environmental conditions is 50 degrees Celsius. | | |
| R9.1.2. | The minimum external air temperature the equipment will be exposed to due to environmental conditions is negative 10 degrees Celsius. | | |
| R9.1.3. | No de-rating of any equipment shall occur when the equipment operates within the above-mentioned temperature ranges. | | |
| R9.2. | Operating Temperature | | |
| R9.2.1. | The intended application shall be subjected to direct sunlight for prolonged periods of time. Accordingly, the design shall accommodate temperature rises within cubicles to ensure that the components do not exceed their specified temperature ratings, and thus do not compromise equipment design life. | | |
| R9.2.2. | The design shall ensure that during operation under any condition, the surface of the supplied equipment shall not exceed 90 degrees Celsius. | | |
| **R10.** | **Security Requirements** | | |
| R10.1. | The meter must be able provide alerts/alarms for:<br>-   Tamper detection<br>-   Fault detection | | |
| R10.2. | The meter box must be secured with a locking mechanism to protect the meter from unauthorised access. | | |
| **R11.** | **Compliance Requirements** | | |
| R11.1. | The equipment offered shall comply with SANS 474:2009 (NRS 057) and NRS 049:2008 | | |
| R11.2. | The services of a meter calibration laboratory that has been accredited by SANAS to SANS 17025 for AC energy, including on-site calibration must be used to perform calibration of meters. | | |
| **R12.** | **Obsolescence Management Requirements** | | |
| R12.1. | The meter model must be commercially available for the next 8 years as a minimum or the meter model must be selected such that replacement in the event of obsolescence must be easily integrated into the NSM system. | | |

## 5.2. Water Smart Meters

Various methods exist for the installation of the metering solution. The proposed system layout for smart water metering infrastructure to be installed on Transnet Property's water distribution system is shown in Figure 4. The meters' intended applications are to perform:

- The remote monitoring of cold potable water consumption/flow profiles,
- The remote monitoring of high and/or low consumption/flow profiles, and
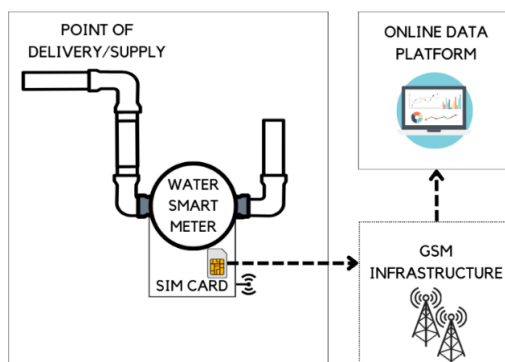- The remote monitoring of leakage within a zone.



Figure 4: Proposed Water Smart Meter system Layout

A site assessment by a qualified Plumber/Technical Manager and/or Engineer is required to determine meter sizes for installation at each site that should typically fall into the listed application categories:

Table 5: Water Smart Meter Application Categories

| Application | Nominal Bore | Flange Specification | Max. Working Pressure |
| --- | --- | --- | --- |
| Housing/ Commercial | 15mm – 32mm | SANS 1123 T16 / BS4504 T16 | 1600 kPa |
| Commercial | 40mm | SANS 1123 T16 / BS4504 T16 | 1600 kPa |
| Commercial | 80mm | SANS 1123 T16 / BS4504 T16 | 1600 kPa |
| High Activity Depots/ Industrial/ Commercial | 100mm | SANS 1123 T16 / BS4504 T16 | 1600 kPa |
| High Activity Depots/ Industrial | 150mm | SANS 1123 T16 / BS4504 T16 | 1600 kPa |

## TECHNICAL REQUIREMENTS FOR THE WATER SMART METERING HARDWARE

a) This technical specification is applicable for all the application categories of Water Smart Meters, both Bulk and Submeters required as listed in Table 5. Each site of installation must be assessed prior to the design of the installation and categorised into the application required per site.

b) The respondent shall supply complete the right most column in response to the requirements of the equipment.

c) The water meters can comprise of a holistic IoT integrated metering solution or can be provided as a Water Meter, data logger and water management device packaged together that meet the technical requirements listed below.

d) The respondent shall provide supporting documentation that can demonstrate their expertise to fulfil these functional requirements.

Table 6: Technical Requirements for Water Smart Meters

| # | Technical Requirements | Response (Y/N) | Remarks |
|---|---|---|---|
| R1. | General Requirements | | |
| R1.1. | The meter is intended to be permanently installed and be selected for long term unattended operation and minimal maintenance. | | |
| R1.2. | The long-term reliability of the meter whilst operating in harsh environments and the battery life will be considered as very significant factors in the product selection. | | |
| R1.3. | The meter/meter solution may comprise of an all-inclusive IoT Water Smart Meter with demand management OR a combination of a water meter, a data logger, and a water management device to meet the minimum capability of:<br>- measuring water flow, consumption, and pressure<br>- data logging and remote transmission of measured parameters<br>- controlling the quantity of water flowing through a water meter. | | |
| R1.4. | The meter must be able to be installed in an above ground and/or underground chamber, which is intermittently flooded or similar. | | |
| R1.5. | The meter must use electromagnetic induction for measurements. | | |
| R1.6. | The meter must be fitted internally with an integral non-return valve that prevents the meter operating in the reverse direction. | | |
| R1.7. | The meter must be battery powered, user replaceable and locally sourced | | |
| R1.8. | The meter should be suitable for flow in light loads and from pumped pipes | | |
| R1.9. | The meter should be suitable for use with water temperatures up to 50°C and maximum working pressure of 1600 kPa. | | |
| R1.10. | The meter must have pulse output. | | |
| R1.11. | The meter must be suitable for vertical, horizontal, or inclined installation and have unlimited fitting positions | | |
| R1.12. | The meter must have a minimum usable life of 10 years, or the Responder must stipulate usable life. | | |
| R1.13. | The meter must be immune to magnetic interference | | |
| R1.14. | The meter display must be a 6 digits LCD display | | |
| R1.15. | The meter must be PN16 rated with both ends flanged | | |
| R1.16. | The meter nameplate shall be clearly and indelibly marked with the following information:<br>- Name or trademark of the manufacturer<br>- Meter serial number where first two digits indicate year of manufacture.<br>- Direction of flow on both sides of the body<br>- Unit of measurement<br>- Meter type and size<br>- Maximum admissible pressure<br>- Pressure loss class<br>- Temperature class<br>- Straight pipe requirement<br>- Metrological approvals and flow values. | | |
| R2. | Measurement Requirements | | |
| R2.1. | Parameters to be measured, timestamped, and logged onboard at 15-minute intervals:<br>- Current water flow rate ($m^3$/h) | | |

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| | - Water consumption (kl)<br>- Water pressure (kPa) | | |
| R2.2. | Onboard memory shall be non-volatile and sufficient to store a minimum of the latest 3-month logged measurements. | | |
| R2.3. | Parameters to be timestamped and remotely transmitted at 30-minute intervals:<br>- Current water flow rate (m$^3$/h)<br>- Water consumption (kl)<br>- Water pressure (kPa) | | |
| R2.4. | Intervals for measurements, logging and transmission must be configurable. | | |
| R3. | Accuracy Requirements | | |
| R3.1. | The meter must conform to Class C Accuracy specification. | | |
| R4. | Water Management Requirements | | |
| R4.1. | The water management valve and body must be waterproof (IP68 submerged), robust, chemical and UV resistant or UV stabilized. | | |
| R4.2. | The valve body must be plastic grade glass filled nylon reinforced to a PN10 - PN16 pressure rated | | |
| R4.3. | Water delivered via the valve must be at full bore pressure and not on a trickle flow basis and there must be no change in pressure or flow | | |
| R4.4. | The volume of water delivered via the valve shall not vary with pressure fluctuations with a flow rate range per municipal ratings | | |
| R5. | Mechanical Requirements | | |
| R5.1. | The meter box shall be of metallic or non-metallic SANS approved, with a lockable but removable lid and be suitable for installation in the footway or lightly trafficked areas | | |
| R5.2. | The meter shall be protected against corrosion. | | |
| R5.3. | The meter box lids shall be provided with a slot to permit reading of the meter without removing the lid. | | |
| R5.4. | There must be sliding couplings for ease of installation and removal. | | |
| R6. | Communication Requirements | | |
| R6.1. | Local Communication:<br>Pulse, Status, MODBUS | | |
| R6.2. | Remote Communication Modules:<br>Cellular GSM/GPRS as a minimum, Optional MQTT | | |
| R6.3. | Communication Protocols:<br>MODBUS TCP/IP, 2G, as a minimum.<br>Wideband Code Division Multiple Access (WCDMA) (3G) and Long-Term Evolution (4G) with capability of 5G migration; NB-IoT | | |
| R7. | Security Requirements | | |
| R7.1. | The meter must be able provide alerts/alarms for:<br>- Leak detection<br>- Tamper detection<br>- Fault detection<br>- Low Battery | | |
| R7.2. | The water management valve shall be tamper-resistant, and the valve is to shut automatically upon removal of a sensor, tamper detection or if seal is removed. The valve should be able to shut off at least an hour after any of the tampering takes place. | | |

| R7.3. | The meter box must be secured with a locking mechanism to protect the meter from unauthorised access. | | |
|---|---|---|---|
| R8. | Protection Requirements | | |
| R8.1. | The IP rating of the supplied meter and accompanying equipment shall be no less than IP68. | | |
| R8.2. | The meter box must have:<br>-    fusion welded joints<br>-    a tamper proof locking mechanism (cover)<br>-    Keyed in fittings to prevent meter turning when removing or working with meter, and<br>-    SANS approved | | |
| R8.3. | The meter must have a wet dial. | | |
| R9. | Data Access Requirements | | |
| R9.1. | The logged data must be downloadable in a .csv-format as at 15 minutes intervals. | | |
| R9.2. | The measured data shall be transmissible remotely to an Online Data Platform. | | |
| R10. | Environmental and Operational Requirements | | |
| R10.1. | Ambient Temperature | | |
| R10.1.1. | The maximum external air temperature the equipment will be exposed to due to environmental conditions is 50 degrees Celsius. | | |
| R10.1.2. | The minimum external air temperature the equipment will be exposed to due to environmental conditions is negative 10 degrees Celsius. | | |
| R10.1.3. | No de-rating of any equipment shall occur when the equipment operates within the above-mentioned temperature ranges. | | |
| R10.2. | Operating Temperature | | |
| R10.2.1. | The intended application may be subjected to direct sunlight for prolonged periods of time.<br>Accordingly, the design shall accommodate temperature rises within cubicles to ensure that the components do not exceed their specified temperature ratings, and thus do not compromise equipment design life. | | |
| R10.2.2. | The design shall ensure that during operation under any condition, the surface of the supplied equipment shall not exceed 90 degrees Celsius. | | |
| R11. | Compliance Requirements | | |
| R11.1. | The meter must comply with the requirements of SANS 1529-1: 2019 and the Legal Metrology Act | | |
| R12. | Obsolescence Management Requirements | | |
| R12.1. | The meter model must be commercially available for the next 8 years as a minimum or the meter model must be selected such that replacement in the event of obsolescence must be easily integrated into the NSM system. | | |

## 6. SMART METERING SOFTWARE SPECIFICATION

The software development required for the National Smart Metering system shall form an online data management platform that remotely receives data measured by on-site smart metering infrastructure, performs data processing, analysis, and storage, and provides graphical user interfaces for end-users. The response to technical specification for this subsystem must be responded to as a whole in Table 2.

### 6.1. General

6.1.1. This specification is therefore not prescriptive of any one particular technology, architecture, or implementation paradigm. The successful bidder shall nevertheless demonstrate to the satisfaction of Transnet Property that the underlying software of their solution is fit for purpose: based on robust architecture model and framework using industry standard systems and applications.

6.1.2. There shall be no need for the installation of any software, hardware, or licensing required for front-end end-users.

6.1.3. Software deployment/ implementation shall be entirely cloud based with a Web based front-end.

6.1.4. The Web Application shall be guaranteed to work with standard versions of Internet browsers, including:
- Microsoft Edge
- Google Chrome
- Mozilla Firefox

6.1.5. There shall be no need for the installation of any browser extensions or "add-ons" such as Adobe Flash or similar.

6.1.6. The database shall have provision for automatically archiving raw data more than five years old, and this archived data shall be accessible if required.

6.1.7. The metering data acquired and stored by the successful bidder is the property of Transnet Property and the successful bidder shall accept full responsibility for the safekeeping, integrity of this data and the uninterrupted provision of these services.

6.1.8. The successful bidder shall provide a detailed procedure of how the disaster recovery and backups will be operated and maintained.

### 6.2. Authentication and Security

6.2.1. The Online Data Platform must make use of a Device Manager to perform onboarding of Smart Meters into the system.

6.2.2. The Device Manager shall provide access control, encryption, and authentication, to prevent data breaches and unauthorized access.

6.2.3. The Device Manager must only allow authenticated Smart Meters to connect to and communicate with the Online Data Platform.

6.2.4. The Device Manager must uniquely identify Smart Meters connecting to and communicating with the Online Data Platform.

6.2.5. The Device Manager must enable configuration beyond the initial provisioning phase including updates to firmware, networking, access permissions, or other properties.

6.2.6. The Device Manager must provide OTA updates enable authorised personnel to push updates and patches to Smart Meters automatically.
- The Device Manager must perform Smart Meter grouping according to function and location. The main Smart Meter function groups, viz. Water or Electricity and Bulk Meter or Submeter.

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### 6.3. Databases and Relationship Management

6.3.1. The Online Data Platform must maintain a database of installed Smart Meters with their unique SIM card ID, Serial code/number, and details e.g., property GPS coordinates and physical address, existing water pipe size, function, etc.

6.3.2. The Online Data Platform must maintain a database of Utilities Suppliers and their Tariff Structures.

6.3.3. The Online Data Platform must maintain a database of Utility Accounts that correspond to the Bulk Smart Meters at their Point of Delivery from which Utilities Suppliers bill the Employer for consumption. The Utility account details include, but are not limited to:
- Utilities Supplier,
- Utilities Account number,
- Applicable tariff structure and their billable line items,

6.3.4. The Online Data Platform must maintain a database of Lease Agreements that correspond to the Submeter at the Point of Supply from which tenants will be billed for their Utilities consumption.

6.3.5. The Online Data Platform must maintain a database of Finance Cost Centres and their details.

6.3.6. Submeters must be linked to corresponding Bulk Meters

6.3.7. Bulk Meters must be linked to corresponding Utilities Accounts

6.3.8. Utilities Accounts must be linked with corresponding Finance Cost Centres

### 6.4. Data Processing and Visualisation

6.4.1. The Online Data Platform must ingest data from authenticated Smart Meters as listed in Table 4 and Table 6.

6.4.2. The Online Data Platform must provide live views and historical views of data over a selected period for each utility, thus, day(s), week(s), month(s), year(s) with calendar plot via profile graphs, tables, etc.

6.4.3. The Online Data Platform must process, store, and visualise ingested data to provide consumption, expenditure and carbon emissions that is both visualised on the Online Data Platform and downloadable for reporting purposes.

6.4.4. The Online Data Platform must provide the end-users groups with the customised user interfaces:
- Utilities Management
- Finance Managers
- Energy and Sustainability Managers
- Data Analysts

6.4.5. The User Interfaces shall be intuitive and easy to use.

6.4.6. The Online Platform must provide the capability for end-users to perform remote downloading and exporting of raw data from the Smart Meters over a selected period for each utility, thus, day(s), week(s), month(s), year(s) with calendar plot.

6.4.7. The Online Data Platform must provide the capability to verify consumption billing of Utilities Account Invoices received from Utilities Suppliers for each Account.

6.4.8. The Online Data Platform Finance Managers User Interface must be integrated with the SAP system.

6.4.9. Utilities management personnel must have the capability of loading Utilities Account Invoices onto the Online Data Platform by:
- importing Microsoft excel files detailing itemised billing, and/or

- automated generation of tariff structure line items where cost associated can be inputted to the user interface.

6.4.10. Utilities management personnel must have the capability of manually adding irregular billed items not typically included in the tariff structure, e.g., interest, deposits.

6.4.11. Each billed item on the invoices must be verified via back-end calculations where discrepancies must be flagged for dispute with the Utilities Suppliers.

6.4.12. In the event of a dispute, average payment of the invoice must be calculated to be sent to Finance Managers.

6.4.13. Disputes with Utilities Suppliers must be logged and tracked on the Online Data Platform.

6.4.14. The Online Data Platform must allow verified bills to be sent to the Finance Managers' user interface.

6.4.15. The Online Data Platform must provide the capability to bill tenants with their consumption costs over a selected period for each utility, thus, day(s), week(s), month(s), year(s) using the consumption data recorded by the Submeters.

6.4.16. The Online Platform must allow tenant billing allocation cost to be sent to the Finance Managers' user interface.

6.4.17. The Online Data Platform must provide the capability to reconsolidate tenant billing upon receipt of the linked Utilities Account Invoice for the selected period in the event of discrepancies.

6.4.18. The Online Data Platform must provide Finance Managers with the capability to send verified Utility invoices to the SAP system where payments can be actioned.

6.4.19. Finance Managers must also be provided with the capability to record payments made for each Utilities Account on the Online Data Platform for reporting purposes.

6.4.20. The Online Data Platform must provide Finance Managers with the capability to send tenant billing allocations to the SAP system where invoices can be generated.

6.4.21. Finance Managers must also be provided with the capability to record payments received for each tenant/lease on the Online Data Platform for reporting purposes.

6.4.22. Bill Verification and payments made, and Tenant Allocations and payments received must be historically downloadable into reports using Excel and PDFs.

6.4.23. The Online Data Platform must indicate and send notifications via cell phone numbers and email addresses in the event of alerts/alarms received by Smart Meters:
- Tamper detection
- Fault detection
- Leakage detection (Water Smart Meters only)
- Low Battery (Water Smart Meters only)

6.4.24. The Online Data Platform shall have an integrated alert/alarm management system that is able to diagnose, store and report on communication and other metering problems.

6.4.25. The Online Data Platform must log events performed via the user interfaces including, but not limited to:
- Smart Meter Alert/Alarm notifications
- The Utilities Invoice Billing Verification process
- The Tenant Consumption Billing Allocation process

6.4.26. Any and all access to the Online Data Platform must be controlled using authenticated login credentials.

6.4.27. Customised access to the Online Data Platform User Interfaces shall be provided using the end-user's login credentials according to their user group and area jurisdiction (national or regional).

6.4.28. National and regional management users shall be provided with management control of the accounts linked to a manager user's profile.

## 7. ALTERNATIVES OFFERED

In addition to offers which comply with the requirements set forth in this Specification, Respondents may also offer alternative solutions that they consider might be advantageous and/or acceptable to Transnet Property.

The respondent may also offer additions to the scope, either being requested or of their own accord. The final decision to include these additions will rest with Transnet Property.

## 8. APPLICABLE STANDARDS

The respondent shall acknowledge and be aware that the following standards and best practices are to be adhered for goods to be delivered. The respondent must also provide a list of standards that they have adhered to, other than those mentioned in this specification document, to which their products are compliant.

### 8.1. SABS Standards

- SANS 10142-1 (Latest): The wiring of premises Part 1: Low-voltage installations
- NRS 048-2 (Latest): Electricity supply – Quality of Supply Part 2: Voltage characteristics, compatibility levels, limits, and assessment methods.
- NRS 049 - Advanced Metering Infrastructure Requirement for Smart Metering System
- NRS 071 – Automated Meter Reading for Large Power Users
- NRS 057 – Code of Practice for Electricity Metering

### 8.2. IEC Standards

- IEC 62053-22:2021: Electricity metering equipment. Particular requirements Static meters for AC active energy.
- IEC 62053-23:2020: Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy.
- IEC 62586-1:2017: Power quality measurement in power supply systems - Part 1: Power quality instruments (PQI)
- IEC 61000-4-7:2009: Testing and measurement techniques – General guide on harmonics and inter-harmonics measurements and instrumentation, for power supply systems and equipment connected thereto.
- IEC 61000-4-23:2016: Testing and measurement techniques - Test methods for protective devices for HEMP and other radiated disturbances.
- IEC 61000-4-30:2021: Testing and measurement techniques - Power quality measurement methods.
- EN50160: Voltage characteristics of electricity supplied by public distribution systems.
- EN61326-1: Electrical equipment for measurement, control, and laboratory use - EMC requirement - General requirements.
- EN60068 2-6: Environmental Testing - Part 2: Tests - Test Fc: Vibration (Sinusoidal).

## 9. PROPOSED PROJECT TIMELINES

### 9.1. Delivery

- The proposed timeline for a completed delivery and installation for the first phase of the required smart metering infrastructure to Transnet Property is described in the Technical Evaluation Criteria.
- The hardware and software aspects of the project are required to be done in parallel with each other.
- Delivery of all items quoted on shall be to various locations across all sites the five regions of Transnet Property. The priority list will be shared with the appointed supplier.
- Delivery of all items quoted on shall be to various locations across all sites the five regions of Transnet Property. The priority list will be shared with the appointed supplier.

### 9.2. Documentation

- The manufacturing and calibration certificates of all equipment shall be provided upon delivery of the equipment to Transnet Property.
- All technical datasheets shall be provided upon delivery of the equipment to Transnet Property.

### 9.3. Warranty

- All equipment shall be supplied with a 24-month warranty from the time of installation, testing and commissioning.

### 9.4. Clarification

- Should any void or uncertainty exist within any clause throughout this specification the supplier is at liberty to contact Transnet Property through the correct channels and request subsequent clarification.

### 9.5. Evaluation Criteria

- It is required that the supplier respond to the evaluation criteria accompanying this specification.

## 10. DOCUMENT AUTHORITIES

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