a world class African city

TITLE	**STANDARD FOR REVENUE MAXIMAZATION, ENHANCEMENT, COLLECTION AND MANAGEMENT OF VENDING AND PREPAID ENVIRONMENT**	REFERENCE **CP_TSSTAN_199** DATE: PAGE:	REV **1** **NOV 2025** **1** OF **34**

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FOREWORD

This specification was prepared by the following Work Group members:

Shumani Sadiki: Engineering Standards

The work group appointed by the Interim Study Committee, which, at the time of approval, comprised of the following members:

Study Committee	Name	Department and Section
Emergency Documents	Nolubabalo Makana	Revenue Protection
	Beauty Mbangula	Metering Customer Services
	Edward Malatsi	Metering Lab
	Mildred Raphunga	Metering Engineering
	Sam Sithole	Metering Engineering
	Abram Chewe	Vending

Recommendations for corrections, additions or deletions should be addressed to the:

Group Head

Strategic Infrastructure Development

City Power Johannesburg (SOC) Ltd

P O Box 38766

Booysens

2016

1 INTRODUCTION

City Power has been vending electricity over the years through Third Party Super Vendors that interface with our online vending Servers. There are more than 250,500 active prepaid customers within the City Power areas of supply as at 31st of Dec 2021 with prepaid meters that are maintained by both internal and external technicians. The types of customers range from lower class, middle class up to upper class. The prepaid environment in City Power is fairly well established but has multiple leakages which are caused by control deficiencies, socio-economic challenges, illegal installation of non-City Power meters, to mention a few. City Powers objectives include but are not limited to improving aspects of its revenue operations that are important to the municipal economic viability and financial sustainability, ensuring compatibility of meter data, identification and replacement of tampered meters and elimination of ghost vendors, reduction of municipal debt, as well as successful implementation of the credit control and debt management.

2 SCOPE

City Power is seeking to appoint a suitable service provider to manage the Prepaid Vending environment, ensure revenue enhancement and resolve electricity leakage due to non-technical faults. The service provider shall provide the prepaid vending footprint, have the financial capacity to pay the current revenue for vending customers upfront and employ their strategy and technology to improve prepaid vending revenue as detailed in the document. The Vending footprint shall be accessible to all City Power's customers, available for 24 hours and/or extended hours and compliant with NERSA's NRS 047 standard.

The service provider shall employ a build, transfer and operate model using its own finances. At the end of the period i.e. at transfer phase training and skills transfer shall be provided to City Power.

Key objectives include:

- Replacing existing metering infrastructure with advanced metering infrastructure (AMI) that supports reliable bi-directional communication and the STS protocol.
- Deploying a robust electricity distribution software platform that enhances utility revenue collection and enables data-driven network management.
- Minimising non-technical and commercial losses (particularly illegal connections) and enhancing service delivery for residents.

- Facilitating demand response, such as load-limiting, to mitigate municipal load shedding.
- Achieving higher levels of customer satisfaction achieved by offering accurate billing, transparent consumption data, and convenient payment solutions.
- Complying with national grid codes and NERSA licensee conditions, while aligning with international standards and best practices.

The service provider shall provide all hardware and services required e.g. meters, modems, kiosk (meter enclosures), network, installations, maintenance, etc. at own risk and in consultation with City Power.

The service provider should minimise costs by using the City's environment as much as possible. Only in cases where the City Power does not have applicable software or tools should the service provider introduce its own software. All field hardware installed by service providers will be transferred to City Power at no cost.

3 NORMATIVE REFERENCES

The following documents contain provisions that, through referenced in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this document shall applying the most recent editions of the documents listed below.

Document number	**Document title**
CP_TSSPEC_316	CP_TSSPEC_316 Specification for single and three phase meters.
OHSAS 18001	Health and safety Management Systems
ISO 9001	Quality management system
ISO 14001	Environmental Management Systems.
NRS047-1	Electricity supply – Quality of service – Part 1: Minimum standards
NRS055	REVENUE PROTECTION
IEC62055-41	Electricity Metering - Payment Systems: Standard Transfer Specification

	(STS) - Application Layer Protocol For One-Way Token Carrier Systems
STS600-4-2	STS key Management Centre version
XM, Vend	XML, end open interface standard, which facilitates the sale of prepaid electricity credit between electricity utilities and clients.

4 DEFINITIONS AND ABBREVIATIONS

Abbreviation	**Explanation**
ATM	Automatic Teller Machines
CP_TSSTA	City Power Technical Standard
CP_TSSPE	City Power Technical Specification
CIU	Customer Interface Unity
CSV	A comma-separated values file
EBSST	Electricity Basic Service Support Tariff (Free basic electricity)
GIS	Geospatial Information System
GPS	Global Positioning System
IBT	Incline Block Tariff
ICT	Information And Communications Technology
IEC	International Electro technical Commission
ISO	International Standards Organization
LAN	Local Area Network
MOE	Municipality Owned Entity
NERSA	National Energy Regulator of South Africa
NRS	National Regulatory Standard
OHSAS	Occupational Health And Assessment Series
SANS/	South African National Standards or South African Bureau of Standards
SHERQ	Safety Environment Risk And Quality.
SMS	Short Message System
SSL	Secure Socket Layer
STS	Standard Token Specification

STS_600 Edition 2	It's a general term used to refer to the latest suite of STS specifications and IEC Standards, which include security upgrades as specified in STS600-4-2
TCP/IP	Transport Controlled Protocol Layer/ Internet Protocol
TID	Token Identity Rollover
TPVS	Third Party Vending System
XMLVend	XMLVend is an industry-standard protocol developed by the NRS009 working group with participation from the Electricity Suppliers Liaison Committee.

The definitions and abbreviations in the above documents (Normative Reference) shall apply to this specification.

5 REQUIREMENTS

5.1 General

5.1.1 The system shall perform vending through the following platforms:

5.1.2 Point of sale terminals

5.1.3 Internet

5.1.4 Cellular phone

5.1.5 ATM machines

5.1.6 The required solution shall ensure and improve aspects of revenue operations that are important to the municipal economic viability and financial sustainability in line with NRS055.

5.1.7 The service provider shall validate and ensure compatibility of meter data, identification and report tempered meters and elimination of ghost vendors in line with NRS04712.

5.1.8 The service provider shall have the capacity to manage the prepaid revenue environment and make an upfront payment to City Power prepaid revenue

5.1.9 The solution shall ensure successful implementation of the credit control, debt management and subsequent reduction of municipal debt,

5.1.10 The service provider shall identify and report faults on the prepaid environment in line with outage and workforce management system as to CP_TSSPEC_259

5.1.11 The service provider shall have innovative and effective means to collect revenue and reduce losses.

5.1.12 The service provider shall ensure adequate vending footprint throughout city powers area of operation.

5.1.13 Issue Desktop and physical Monitoring of active meters

5.1.14 Issue disconnection notices

5.1.15 Provide list of both faulty and/or bridged meters

5.1.16 Seal meters found unsealed

5.1.17 Reconciliation of Sales, Deposits and Collections

5.1.18 The system should enable account physical location management, meter replacement workflow with a balance transfer, full asset management (kiosk, meter, CIU, configuration units, etc.), and full technical team support functions.

5.1.19 Physical field configuration units should integrate with the back end, providing commissioning workflows for all activities, planned work/activity schedules, and full maintenance diagnostics and reports.

5.2 Vending Management System Requirements

5.2.1 The system must enable the reconciliation of vending with consumption, including the ability to address large differences, zero vending with consumption, and vending with zero consumption. Additionally, it should facilitate the reconciliation of vending with vendor remittances

5.2.2 Credits can be loaded remotely, eliminating the need to input tokens manually. It should operate on a transaction-based rather than a token-based system, thereby ensuring that TID rollover has no impact. Furthermore, it should confirm successful vending transaction downloads.

5.2.3 Reconciliation functionality: The system should allow for check metering to facilitate consumption reconciliation of minimum subsidies, thus identifying non-technical issues such as illegal connections.

5.2.4 The system shall perform vending through the following platforms:

- Point of sale terminals
- Internet
- Cellular phone
- ATM machines

5.2.5 The system shall integrate with the municipality's financial management and other financial systems such as, Debt Management System that are currently integrate with the City Power’s system central database.

5.2.6 Integration and interoperability with City Power’s systems shall enable vending and production of management reports.

5.2.7 The prepaid token back-end software should have been in operation for more than (5) five years and must have completed the development phases to integrate their services into the Standard Transfer Systems and Proprietary vending systems.

5.2.8 The system shall support STS600 Edition 2 and provide a mechanism for a phased rollout of key-change tokens to support the base date change in line with STS600-4-2 and IEC 62055-41 Ed3

5.2.9 The system shall cater for multiple base date functionality in the security module.

5.2.10 The system shall support an import mechanism for loading of the new key-load file specification as contained in STS600-4-2.

5.2.11 The service provider shall provide the minimum number of vending terminals as required with the following functionality, but not limited to:

- Integrated Modem
- Integrated Printer
- Integrated LAN Port
- Integrated Display Screen
- Management Centre

5.2.12 The system shall support at least the following meter states:

- Scrapped
- Installed
- Removed
- In Stock

5.2.13 The system shall enable the updating and modification of meter states as required based on the results of field inspections, maintenance, repairs or credit control processes.

5.2.14 The vending system shall have the following additional characteristics:

- Ability to monitor transaction speeds
- Ability to provide auditable transactions
- Ability to track delivered and undelivered transactions
- Ability to perform pre-vend and/or key change vouchers ability to collect arrears from the consumer by leveraging the prepayment transaction.
- Ability to collect all municipal account payments at the vending points.
- Interface seamlessly with the municipal financial billing
- Real time online vending

5.2.15 The system must allow for debt collection module on municipal accounts.

types of payment:

- Cash
- Credit Card
- Debit Card
- Electronic Bank Transfer
- Crypto currency payments
- Free Basic Electricity (FBE) tokens

5.3 Functional Requirements

5.3.1 Account Payments

5.3.1.1 The consumer shall be able to make bill payments at any point of sale. This is in line with the municipality's goal of increasing accessibility to municipal services and debt reduction

5.3.1.2 The consumer does not have to be registered to a meter to make a payment

5.3.1.3 The system must offer comprehensive account management features, including:

- Credit control for non-electricity debt,
- Meter replacement workflow with balance transfer,
- Consumer change with a balance transfer, manual debits/credits,

USSD channel for consumer queries related to balance, last transaction, and consumption.

5.3.2 Tariff Management

5.3.2.1 System must support various individual meter tariffs, including basic, IBT, and fixed charges.

5.3.2.2 Tariffs must be loaded on the back end, allowing for immediate change application without requiring field intervention, such as engineering tokens. It should comply with the Eskom standard XMLVend specification and undergo functional and security certification per vendor.

5.3.2.3 Tariff Management shall include without being limited to the following

5.3.2.4 Tariff structure definition shall be in line with NERSA requirements

5.3.2.5 Tariff change administration shall be in line with Auditor General requirements

5.3.3 Debt Management

5.3.3.1 Transferring arrears information from the financial system into the Prepayment system

5.3.3.2 Blocking and unblock meters manually and/or electronically

5.3.3.3 Provision of various levels of blocking as prescribed by the Utility

5.3.3.4 Vending once arrears have been cleared

5.3.3.5 Account Payments

5.3.4 Revenue Protection

5.3.4.1 Irregular transactions indicator/s (nil, low, or abnormally high);

5.3.4.2 Free-format comments field (notes) (maximum 250 characters)

5.3.4.3 Inspection of points with no or irregular transactions and replacement of faulty meters

5.3.5 Transaction management

The system shall support the following types of transaction:

- Cash vend transaction.
- Retained credit transaction.
- Refund money transaction.
- Purchase blocking facility.
- Free basic electricity transaction - The system should accommodate the model per consumer and ensure automatic execution with confirmation of successful downloads to the meter.
- Arrears collection and debtor account payments.
- Engineering transactions
- Account Payment transaction

5.3.6 Message Management

The system shall allow:

- Entry of system messages;
- Entry of customer specific messages;
- Entry of predefined messages;
- Ability to send short message service (SMS) or email
- User Security Management

5.3.7 Security management shall include:

- Group rights definition.
- Entry of system users and allocation of group rights.
- System administrator rights
- Customer portal to view transaction history and messages

5.3.8 Monitoring

5.3.8.1 Control of all vending terminal operations.

5.3.8.2 Control and banking of cash collected through the prepayment system within 48hrs of collection.

5.3.8.3 Issue of free basic electricity to indigent consumers.

5.3.8.4 On-line viewing of all vending terminals

5.3.8.5 Installation and replacement of smart PLC meters.

5.3.8.6 Meter management processes shall automatically change the modes of operation associated with a meter.

5.3.9 Reports

5.3.9.1 All reports shall have the functionality to export into various formats, such as (but not limited to) excel, csv, txt, etc. The export shall be in a one-liner format.

5.3.9.2 It should support trending and trend analysis, with at least 12 months of online and unlimited offline data storage.

5.3.9.3 The system should provide high consumption reports and alerts for bypass, contactor, and meter status.

5.3.10 Vending footprint

5.3.10.1 The vending footprint shall be made available at no additional cost to City Power.

5.3.10.2 The vending footprint shall be;

- Accessible to all our customers
- Available for 24 hours and/or extended hours

5.3.10.3 Compliant with NERSA's NRS 047 standard Vending Footprint should cover the following:

- Major Banking Platform

- Online Payment Platform,
- Major Retails stores,
- Chain Filling station,
- Individually owned Tuckshops
- Standalone machine platforms in community centres, exhibition centres, shopping centres, etc.

6 SYSTEM AND SOFTWARE INFRASTRUCTURE

6.1 STS Vending System

The bulk of the municipality's revenue from electricity services is generated by domestic prepaid customers. As such, it is required that the bidder delivers an Online Vending System (OVS) that adheres to STS Edition 2 standards (IEC 62055-41/51/52). This system should consist of a primary server hosted in the cloud, equipped with a disaster backup, which can establish connections either directly or through third-party payment platforms with customers located in any region. The system must enable vending agents to instantly buy tokens from the central system, using the XMLVend protocol (SANS 1524-6-10) for communication and issuing encrypted tokens that conform to the latest STS suite of standards.

6.2 Security Modules and Key Management

The vending system shall leverage hardware security modules that run on latest STS firmware. These HSMs should be capable of supporting up to 10 million customers, with scalability for additional customers, and a continuous average transaction rate of at least 100 transactions per second. The vending system must allow uploading key management files (KMF) into the system database, enabling configuration and connection of encryption devices for STS encryption algorithms, and secure loading of new area key details into the encryption device, adhering to STS 600 key management specifications.

6.3 Token Management Overview

The vending system shall be equipped to enable the direct generation of both STS credit and engineering tokens directly from the management console, including the capability to issue vouchers without cost. It must facilitate the generation of both electricity unit (kWh) and currency (ZAR) transactions for meters using 11-digit and 13-digit STS formats and Misty 1 (ISO 18033-3). Consistent with national regulations, the system will support the provision of Free Basic Electricity (FBE), enabling the generation of tokens on a manual or automated basis, including the allocation of FBE tokens with the first vend of the month. The distribution of FBE must be restricted to the distribution of FBE tokens to eligible customers only.

6.4 System and Payment Infrastructure

The servers for the vending system shall be situated in an environment designed for high availability, featuring backup power supplies and network connections, and will be under the management of the bidder. The provision of comprehensive disaster recovery and ongoing business operations is mission-critical. Additionally, the system shall be required to securely archive all data to meet financial services regulatory standards, covering all aspects of sales and vending transactions. It shall facilitate various customer payment methods, including cash, credit and debit cards, bank transfers, and online gateways. To broaden the range of payment options available to the end user, the system must also accommodate API connections from third-party payment service providers via XMLVend 2.1. It shall also implement role-based access control for users and groups, with access permissions migrating along with data. Secure system interconnections will be enforced using SSL certificates with mutual authentication.

6.5 Credit Control

The vending system shall be designed to implement various strategies to enhance revenue collection and apply credit control, including arrears management, account blocking, and debt recovery as specified below:

6.5.1 **Arrears Management:** Deduct outstanding balances from prepaid electricity purchases. Define various arrears recovery categories and implement them across all electricity dispensing systems. Recovery options shall include:

- Fixed percentage deduction
- Daily or monthly availability charge recovery
- Full or partial arrear recovery with limited sales

6.5.2 **Blocking:** Block specific accounts based on arrears balances. Blocking shall be configured by account type, allowing either no sales or limited monthly sales for delinquent customers. Shared service accounts must be unblocked simultaneously when any blocked account within the group is paid in full.

6.5.3 **Debt Recovery**: The bidder must outline their approach for data exchange between the new system and existing debt recovery systems. This feature is outlined in greater detail in the subsequent section on the Electricity Sub-Billing System.

6.6 Messaging and Vending Registration

The vending system shall enable the Municipality to define personalised messages to be printed on credit vouchers. It will maintain a record of historical associations among meters, connection points, and customers. Purchases of prepaid tokens by consumers will be conditioned on the linking of a connection point, meter, and tariff. Additionally, the system will prevent the generation of tokens in cases of inconsistency between the database and meter/asset data. The vending system will feature an advanced search and filter function, facilitating the lookup of consumer information such as surname, first name, ID number, address, comments, account number, connection point (location), and meter serial number.

6.7 Tariff Management

The vending system shall facilitate the implementation of tariffs approved by NERSA, which can be predefined and scheduled to activate in alignment with the municipal seasonal billing cycle. The system must be designed to be compatible with the tariff structures existing within the current municipal tariff book, especially step or inclining block tariff (IBT) structures. Additionally, the system will maintain distinct meter Tariff Index and Customer Tariff Class to prevent widespread systemic adjustments during tariff modifications (e.g., changing from indigent to domestic). It will also calculate VAT with

every vending transaction processed. Payments shall still be possible for blocked accounts.

6.8 Report Generation and Customisation

The bidder must provide a comprehensive selection of report generation capabilities to facilitate the municipality's management and engineering functions. The system should come with a range of default reports, alongside the flexibility for customization and the development of new reports. The vendor commits to adjusting or introducing additional reports to meet the Municipality's specific requirements during the initial six (6) months, at no extra charge. The system must feature capabilities for report previews prior to printing, including the ability to choose printers and adjust report formats compatible with the current operating system. It should support exporting reports in both Excel and PDF formats. All reports identified by the Municipality should be available as standard options. This aspect is further elaborated in the section on the Provision of Analytics and Management Reports.

7 THE SYSTEM FUNCTIONALITY STEPS

1. On receipt of the vend request the system shall have a provision to ascertain the identity of the consumer.
2. The keys to identify the consumer shall be the meter serial number.
3. The vend terminal shall send the request to a central database server that shall authenticate the transaction request and generate an encrypted code.
4. On receipt of each request the vend terminal shall connect to the central database server in order to provision credit to the value of the purchase.
5. The credit shall be confirmed via SMS and sent directly to the meter.
6. Tokens shall be legible for at least one month from date of purchase.
7. The monetary value per credit can be limited per the municipality’s requirements e.g. minimum and maximum value, per consumer etc.
8. All payment types are recorded as returned by the vending terminal or third party aggregator.
9. The amount tendered shall first be allocated to clear the debtor's arrears balance if applicable, and then to allow for immediate purchasing of prepayment electricity.
10. The consumer can pay the municipal debtor account at any terminal which shall be transferred to the municipality's financial system, in a format as prescribed by the municipality.

11. The system functionality shall include tracing of credit if required.
12. The system is capable of performing vending functions simultaneously across all terminals and multiple types of vend can be combined one receipt at each terminal.
13. Cancellations shall not be allowed at the vending terminals;
14. Tariff plans shall be in line with City Power's tariff guidelines that are displayed and updated on City Power's website as endorsed by NERSA.
15. The municipality's image shall be positively reflected by the service provider's staff, collectors and aggregators as per a code of conduct.
16. Transfer of 3rd party payments should be made at least within two (2) days into the municipal main bank account.

8 TECHNICAL SPECIFICATION DETAILS

8.1 AMI System Functionality and Operations

The project requirements outline the need for a turnkey AMI revenue solution that is ready to use ("Commercial-off-the-Shelf") and capable of supporting metering from a variety of manufacturers and can satisfy both SPU and LPU customers in prepaid STS or post-paid billing modes in a smart and integrated manner. Bidders must ensure their offerings meet essential criteria, including:

- **Revenue Protection and Theft Detection Support:** The system should have the capability to receive and store tamper detection alerts from meters, as communicated by the HES to the MDMS. It must monitor for irregular consumption patterns and potential leakage, enabling real-time alert monitoring for devices and grid capabilities.
- **AMI Data Collection and Processing:** The system must have the capability to process interval and usage data from diverse AMI systems, back-office systems, and communication devices, including the management, storage, and versioning of interval and diagnostic data. It should serve as an operational data store, aggregator, and enabler for AMI systems, without restrictions on the type of interval metering data received (including kWh import/export, and reactive power across all quadrants for any metering point).
- **Device Lifecycle Management:** The system should be capable of synchronising information between physical devices (such as meters, data concentrators/network gateways, appliance control devices, and kiosk controllers) and customer

information (including premises, service points, and accounts). It should also facilitate the registration, commissioning, decommissioning, and meter asset management effectively.

- **STS Vending System Interoperability:** Ensuring complete compatibility of smart or AMI-based systems with STS prepayment vending systems, which includes facilitating the transmission of STS tokens using DLMS/COSEM suite pathways.
- **Manual Data Entry and Flagging:** The system must accept manually entered values, logging them in a traceable manner without overwriting automatically recorded data. Estimated or manipulated entries must be clearly flagged.
- **Calculations and Aggregations:** The system should be capable of performing calculations, aggregations, and summations necessary for billing and statistical metering. This includes generating billing determinants and calculating tariffs for peak, off-peak, and critical-peak periods across all customer accounts.
- **Two-way Communication:** The system should support integrated and automated disconnections/reconnections, power status checks, interactive reads, and pings, initiated by integrated systems.
- **On-Demand Request and Response:** The system must allow for the initiation of readings and controls for specific meters upon request, with the actual meter reading executed by the headend system. Additionally, it should offer a web portal for customers to make on-demand inquiries.
- **Demand Response Management:** The system must support preplanning for demand/response activities and facilitate post-event analysis, leveraging vendor experiences and best practices in this domain. It should provide support for load management using aggregated consumption information. The system is expected to support demand response and control functions, including load limiting, critical peak pricing, TOU pricing, and frequency control.

Therefore, the main outputs expected from the bidders include the vending system, meter data management system (MDMS), the headend system (HES), the network management system (NMS), and smart field devices such as modems, data concentrators, and smart meters. Consequently, the integration framework should encompass:

- STS Vending System
- HES along with its associated field devices

- MDMS integration with HES, billing, CIS, and other necessary legacy IT/OT systems as specified by the Municipality

8.2 Consumer Indexing

The Service Provider shall be responsible for establishing a comprehensive and accurate consumer indexing system to support smart meter implementation across the municipality.

8.2.1 Methodology for Updating and Maintaining Consumer Data

A comprehensive door-to-door survey will be conducted to capture data for each installed meter. This captured data will be verified against the Municipality's existing consumer records (physical, electrical, and commercial) and any relevant inventory management system.

To establish a clear link between each consumer and the corresponding meter within the electric network, the Municipality's asset codification system (including meter codes) will be followed. This may involve using the Municipality's existing GIS database (if available) for a single source of truth and enhanced data visualisation. In the absence of a GIS database, the successful tenderer will be responsible for creating a standalone consumer indexing database adhering to industry best practices and data security standards.

This database of electrical indexing shall have, inter alia, the following broad parameters: Energy Meter Nameplate Details, Meter Clustering (if any), Sealing Status, Installation Date, Start Reading (New Meter), Last Reading (Old Meter), Geolocation, Customer Name, Username, Postal Address, Telephone, Email, Sanctioned Load, Pole, Distribution Transformer, and Feeder Code.

8.2.2 Consumer Indexing (CI) guideline

8.2.2.1 Obtain existing consumer indexing information from the Municipality to use as an initial reference point.

8.2.2.2 Capture all mandatory attributes mentioned in the CI format.

8.2.2.3 Update consumer details within the geographical boundary covered by the Municipality, including data for new or relocated consumers as supplied by the Municipality.

8.2.2.4 Conduct consumer indexing for new or relocated consumers through ledger assessments or field surveys, including physical verification against the current database. In collaboration with the

Municipality, modify or correct consumer records, focusing on electrical connections and associated electrical assets.

8.2.2.5 Capture of complete attributes of consumers, such as the consumer code from the Municipality's legacy system, names, addresses, contact numbers, power supply asset IDs, service types (e.g., poles, feeders, pillar boxes, overhead/underground lines), meter OEM, meter locations, and meter serial numbers.

8.2.2.6 Capture GPS coordinates (latitude and longitude) of consumer premises by way of a digital application.

8.2.2.7 Perform quality assurance and control on the data collected about consumers.

8.2.2.8 Provide the Municipality with the compiled consumer data in a digital format that allows editing, updating, and creation. Additionally, two (2) hard copies shall also be provided for review and feedback by relevant officials.

8.2.2.9 Ensure that the CI data is verified and approved by the appropriate officers or authorities. The implementation agency must secure a formal acceptance or sign-off certificate from these officials.

8.2.2.10 Physically verify and map all consumers connected to each pole/service pillar, along with the distribution transformer supplying each individual customer. Field teams must trace power supply line(s) to confirm the specific distribution transformer serving each consumer.

8.2.2.11 Upon successful meter installation, automatically update the AMI system with critical details including the consumer ID, meter ID, hardware and software configurations, and meter specifications (e.g., make, model, phase, etc). This information must be made readily accessible to consumers via a dedicated consumer portal.

8.3 Field Service Management (FSM) Application

To ensure data integrity and enhanced field activity tracking, a centralised field service management application must be used by all technicians and associated field crews for consumer indexing (CI) and meter installation (MI) tasks.

The application shall facilitate field surveys of electrical devices, enabling site inspections and door-to-door data collection. The application will be equipped to capture various asset and consumer details, including:

- Asset condition (meter condition, location)
- Consumer connection status (active, inactive, etc.)
- Inspection details (denial of access, locked doors, etc.)
- Geospatial data (GPS coordinates)

The application shall support field technicians in handling different scenarios of smart meter installations without the use of paper, including:

- New service connections
- Old meter replacements
- Smart meter upgrades
- Net metering installations
- Load enhancement installations

All necessary information for each type of installation will be inputted directly into the application, eliminating the reliance on paper records. Furthermore, consumer and meter information must be automatically transferred to the AMI system and the Municipality's database, to reduce manual entry errors and ensure data consistency.

A real-time or offline inventory management system shall be integrated with the FSM application. This will enable inventory tracking of all meter devices and accessories as CI and MI activities are implemented, as well as quality and safety assurance during field work.

8.4 Field Service Consumer Engagement

To foster community acceptance and minimise potential disruption as consumers transition to smart meters, the bidder will be tasked with creating a consumer engagement strategy that should, at a minimum, outline the consumer engagement initiatives to be executed by the Municipality. The Municipality will contribute essential insights to aid in crafting an extensive consumer engagement plan. The implementation of the consumer engagement strategy will be carried out by the Municipality with assistance from the bidder. This includes conducting a media campaign to enhance awareness and address common misconceptions about smart metering before and during its installation. Additionally, the Municipality will constructively address any opposition to the project or specific aspects of it.

8.5 Replacement of All Electricity Meters

The bidder shall install, integrate, and commission smart meters of different types, the estimated number of which is given in the Pricing Schedule. These installations will occur at current meter locations, including

consumer residences, distribution transformers, feeders, and boundary points. All new connections will also receive smart meters.

Technical specifications for single-phase whole current (STS) smart meters, as well as for three-phase whole current, three-phase CT operated, and three-phase CT/VT operated smart meters, will adhere to the standards and legislation outlined in the table of Applicable Legislation and Standards provided with this document. In line with the specified consumer indexing and meter installation processes, the following approach will be adopted for meter replacement:

- The municipality will provide details of meters for the purpose of updating the inventory management system. This will cover essential information such as meter brand, serial number, and, if applicable, the supply group code (SGC), tariff index (TI), and base time (e.g., 2014-01-01) to facilitate the integration of the meter into the database and ensure its visibility on third-party payment platforms.
- Upon installation, meter details (consumer ID, meter ID, hardware/software configurations, nameplate details, make, and phase type) will be uploaded to the system against the customer profile. This information will also be readily accessible to consumers through a dedicated customer portal.
- The bidder will design, build, or procure a reliable and robust communication network that is capable of efficiently handling the transmission of smart meter data, considering the varied landscapes, topologies, and population densities within the municipality. Future expansion will be duly factored into the network design. They shall be responsible for all necessary infrastructure and associated civil works for installing and commissioning equipment like modems, data concentrators, gateways, repeaters, routers, and access points.
- The network solution will include a disaster recovery plan, highlighting the redundancy and backup mechanisms for the HES/MDMS and, most importantly, for the STS vending system to ensure continuous prepaid vending in the event of system faults. Comprehensive testing of the network and its components for reliability must be conducted before beginning operations and billing.
- All equipment and power supply wiring installations will adhere to the Municipality's standards, regulations, and prevailing practices. The reasonable supply of electricity needed for operation and maintenance of the entire AMI system shall be provided by the Municipality free of cost.

8.6 Enable Bi-Directional Meter Communication

The municipality aims to establish a communication backbone for its smart meters that incurs minimal to no operational costs for maintenance and data charges, seeking independence from network service providers to the greatest extent possible. In choosing communication solutions, the bidder is encouraged to align with these goals and select services that minimise dependency on external providers. Smart meters shall be capable of accommodating various communication methods and will require compatibility with plug-and-play communication modules. These modules will integrate into the meter and will seamlessly synchronise with the required gateways to ensure smooth field deployment. The communication network should utilise radio frequency or cellular technology to establish a reliable bidirectional communication medium between the smart meter, gateway, and HES. For RF-based solutions, employing both licensed and unlicensed frequency bands, as allowed, is advisable. In these configurations, meter data will be transmitted or collected by devices such as gateways and relayed to a HES.

8.7 Communication Network Specifications

The bidder is responsible for selecting the necessary components to design and implement the communication infrastructure. This network should have the capacity to scale both horizontally and vertically, ensuring it can support additional meter installations in the future. Components of the network must include:

9 GATEWAY-BASED COMMUNICATION NETWORK

The gateway shall act as the critical connection that collects data from numerous smart meters, either on demand or according to a set schedule, and forwards their measurement, event, or diagnostic information to the HES/MDMS. It shall enable the transmission of data from smart meters through over-the-air (OTA) communication methods.

9.1 Gateway Specifications

Configuration, Security, and Self-healing

9.1.1 **Configurable Communication:** The gateway must enable communication from field devices at configured intervals to the HES (push or pull), and support on-demand data retrieval and pinging of individual meters or groups of meters, prioritising the transmission of control commands. It must also support remote firmware upgrades.

9.1.2 **Self-healing Network:** The communication network should be dynamic and self-healing. If a communication element fails, nodes connected to it should automatically switch to the best available element for data transmission to the HES.

9.2 Connectivity, Events, and Restoration

9.2.1 **Backhaul Connectivity:** The gateway must ensure secure data transfer to the HES via either cellular or fibre optic communication. Cellular backhaul must support SIM cards or e-SIMs with dynamic/static IP configuration from any service provider. It should support IPv6 addressing for future scalability.

9.2.2 **Events and Auto Network Restoration:** Upon power restoration, the gateway shall automatically establish links with underlying devices and upstream applications. It shall also facilitate recording of the following events at the HES for seven (7) days:

- Number of packet failures
- Retry attempts
- Missed periodic readings
- Failure to connect events
- Tamper-events

9.3 Gateway-based Mesh Network Requirements

The Municipality strongly prefers a mesh network as the primary communication infrastructure for the smart utility system, particularly for its domestic customers, due to its inherent redundancy. This configuration offers significant benefits compared to traditional layouts like star, bus, or point-to-point that are important in delivering a resilient, smart utility service in a local government context. In the event of a malfunctioning gateway, router, repeater, or access point, the smart meters (endpoints) must be programmed to automatically reroute communication paths through the most suitable neighbouring node. This ensures continuous data transmission, even if individual devices fail, mitigating the impact of gateway restart latency during load shedding events and addressing the frequent occurrences of tampering and bypasses within the distribution network. Furthermore, the following key requirements must also be met:

- All communication network equipment must comply with South African guidelines for operation in licensed or licence-free frequency bands.

- The network must be scalable enough to accommodate at least 1 million devices.
- The network shall employ standard encryptions at both network and application levels.
- Robust and secure method for remote OTA firmware updates is required. This OTA system should support a multi-application, multi-vendor framework for flexibility.
- Open APIs shall be used to facilitate future integrations with other systems.
- Maintain synchronised time and date information with the HES server using Network Time Protocol (NTP) for sub-second accuracy. Additionally, access points should support time distribution to each mesh node.
- Self-healing: each node will actively search for and track the best available nearby nodes or access points.

9.4 Network Management System (NMS) Specifications

A comprehensive network management system (NMS) application or microservice shall be available to monitor the performance of the communication network at any given time, enabling viewing and configuration of all deployed network devices. It should provide a web or cloud-based platform to offer a visual overview of the network at locations where devices are installed. This interface should include functionalities for managing connectivity and subscriptions. Additionally, it should facilitate field installations, record field activities, and manage field operations and maintenance for the duration of the contract. It should also support the following key functions:

- User-friendly browser interface for accessing system information without affecting AMI application performance.
- Monitoring of node availability within the network for data exchange, with automatic notification and reset capabilities for nodes not sending 'alive' or watchdog messages.
- Configuration and management of networking devices and nodes
- Adjustable data collection periods, with user-resettable statistics and on-demand access to data.
- Fault management to detect, isolate, and log network issues, ensuring fault identification in devices and nodes.
- Network diagnostics, including ping and trace-route capabilities for individual nodes or groups.

10 RESPONSIBILITIES

9.1 City Power's Responsibilities.

9.1.1 City Power shall provide personnel that shall be a part of the vending system process. These personnel shall assist and manage the administrative data, including settings of system accounts, tariffs, meter and consumer data.

9.1.2 City Power shall be responsible for various tasks that are not limited to the following:

9.1.3 Consumer Data Maintenance related to the debtor's profile

9.1.4 Meter Database Management

9.1.5 Uploading of meter database

9.1.6 Meter Management

9.1.7 Disconnection and reconnection of reported meters with abnormalities. Processing and commissioning customer applications

9.1.8 Meter maintenance and replacement

9.1.9 Disconnection and reconnection

9.1.10 Provide customer and sales database (as is)

9.1.11 Attend customer fault callouts

9.1.12 Customer service on customer and community interaction

9.1.13 Electricity Network Maintenance

9.1.14 Provision and Maintenance of vending system

9.1.15 Provision and maintenance of IT and communication infrastructure for the vending system

9.1.16 Monitoring and action of callouts

9.1.17 Verification of Sales, Deposits and Collections

9.1.18 Provision of vending system

9.1.19 Provision of meters and installation

9.1.20 City Power shall perform full data clean up and mapping of all meters and customers in the field to the pre-payment and financial database of City Power.

9.1.21 List of Mandatory data to be captured from the field shall be issued to the Service Provider at the time of audits, which shall include the GPS co-ordinates.

9.2 Service Providers Responsibilities

The following services shall be required from the successful service provider:

9.2.1 Pay City Power upfront for budgeted prepaid revenue (Annually or half-yearly)

9.2.2 Provide City Power with full Third-Party Vending Coverage

9.2.3 Maintain current vending performance and improve vending performance

9.2.4 Employ Strategies to improve prepaid revenue and reduce losses related to prepaid

9.2.5 Manage City Power prepaid environment

9.2.6 Improve data accuracy in the prepaid environment

9.2.7 The service provider shall have experience and financial capacity to manage the municipal prepaid revenue environment.

9.2.8 The service provider shall make an upfront payment to City Power prepaid revenue.

9.2.9 The service provider shall provide a vending service in all City Power areas especially those that currently have insufficient vending coverage.

9.2.10 The Service provider shall manage prepaid meter movement and reduce prepaid losses in all City Power areas.

9.2.11 Identify non-vending customers

9.2.12 The service provider shall collect revenue and reduce losses in a manner that is innovative and applicable to City Power.

9.2.13 The Service Provider shall provide the required support to City Power's customers and its affected stakeholders.

9.2.14 The Service Provider shall respond and provide a prompt service on faulty and bypassed meters.

9.2.15 The service Provider shall be equipped with required technology and dashboards to improve the management of City Power's prepaid environment. Gather location/meter point required information for data cleansing purposes

9.2.16 The service provider shall link a consumer with a location / meter/Point of Connection

9.2.17 The service provider shall enable integration of vendor and meters with City Powers vending System

9.2.18 The Service Provider shall be responsible for meter data verification and corrections as well as training of support staff and sub-vendors

9.2.19 The service provider shall monitor and make provision of Third-Party vending

10 REDUCTION OF ELECTRICITY LOSSES

10.1 Upfront Prepayments

10.1.1 A Pre-payment program shall be setup by the Service Provider to enable upfront payments to City Power, by the Service provider.

10.1.2 The upfront payment shall be 100% of the previous financial year revenue collection and it will be reviewed annually.

10.1.3 The program shall result in the immediate injection of cash flow into City Power's account and alleviate the risks and danger caused by lack of cash flow.

10.2 Data Management and Revenue Protection

10.2.1 The Service Provider shall assist with Customer Data Management and provide a Revenue Protection service to eliminate the loss of revenue resulting abnormalities such as tampering and or bypassing of meters.

10.2.2 The service provide shall implement strategies to acquire and provide accurate customer data to City Power such as:

- Extraction of a list from the vending system, analysing and comparing area average purchases with customer
- Analysing transaction averages and looking at deviations and trends in this regard
- On-site inspections and technical audits on prepayments meters at houses
- Data and revenue protection audits
- Data analysis and interrogation
- Provision of detailed reference database
- GIS Field management console for all consumers
- Spatial analysis and Geographical presentations of all audits through GIS techniques

10.2.3 The Service Provider shall implement a tamper proof work-flow management process to manage fines/infringements and undertake debt enforcement steps in relation to tampering and/or bridging of meters, in accordance with City Power's guidelines.

10.2.4 Service providers must make use of the latest techniques and technologies when performing of field audits and capturing of data, to eliminate human errors as far as possible. Handheld Devices (HHU) are a requirement in line with City Power's Meter Audit Processes.

10.2.5 Detailed visual audit of pre-payment meters, to identify all irregularities. (broken seals, tampers, faulty meters, vandalism, partial bypasses, etc.). Photos must be taken of all irregularities. Refer to section 5 for more detail.

10.2.6 Report all tamper irregularities to City power's metering department for remedial action in line with meter Audit specification.

10.3 Inspection of pre-paid meters

10.3.1 City Power shall provide a list of the meters to be inspected.

10.3.2 The inspection of pre-paid meter shall include collection of customer information and downloading of meter data via handheld to devices.

10.3.3 The customer's information to be collected shall include.

10.3.4 Meter number, as indicated on meter.

10.3.5 The total units on meter to be captured; a photo of the meter as proof; If the meter was tampered with or any fault found on the meter.

10.3.6 A description of what was found at each meter, e.g. no problem, meter very old, meter to be replaced etc. must also be electronically reported via the handheld terminal or cell phone.

10.3.7 GPS coordinates of each meter, Test the functionality of the meter. Sealing of unsealed meters using seal in line with the sealing spec.

10.3.8 Ensure compliance relating to token identifiers (TID) on STS vending systems.

10.3.9 The service provider shall perform a complete inspection as required per month and supply a detailed report of each meter that was inspected, to City Power.

10.3.10 The service provider shall present a monthly a detailed report of all faulty meters, damaged meters found as well as proof of testing, monthly to City Power.

10.3.11 The service provider undertakes to report without rectifying faulty and tampered meters and provide City Power with a detailed report as well as evidence in the case of tampered meters unless instructed otherwise in writing by City Powers Management.

10.3.12 Should meters not be audited due to lack of access, the service provider shall leave a notice to arrange access after working hours or weekends.

10.3.13 A detailed report of all meters not found, meters removed including where entry could not be gained and where access were denied shall be provided to City Power on monthly bases.

10.4 Tamper Management

10.4.1 The service provider shall provide City Power with a detailed report indicating all findings in the field, Meter types, and customers not at homes and other additional key information shall be required.

10.4.2 These reports shall be presented together with monthly feedback/monitoring reports on a weekly/monthly basis as per SLA.

10.4.3 The Service Provider shall attend City Power's monthly performance meetings with the metering and revenue protection team.

10.4.4 City Power shall provide guidelines and instructions once tampering has been reported.

10.4.5 City Power shall be responsible for the implementation of fines or penalties in relation to tampers and abnormalities.

10.4.6 City Power shall be responsible for collecting debt on tamper, bridged meters.

10.4.7 Hardware: The Service Provider shall provide enclosures to ensure that meters are protected from vandalism. Such a setup must have been proven to function.

10.5 Management of Prepaid vending

- The management services shall be based on a percentage (%) of revenue collected
- Monitoring of Prepaid Vending customer
- Customer Master data Monitoring and Correction

10.6 Revenue Enhancement

- The service shall be based on a revenue sharing model between service provider and City Power for period not more than 12 months.

- Where the Service Provider use their own Capex Budget to install new hardware, the revenue sharing will range as follow (75%-90% City Power and 10%-25% Service Provider) if they did not use their own Capex budget to install the hardware's then the revenue sharing will range as follow (85%-95% City Power and 5%-15 % Service Provider)
- Identify Prepaid Customers who are vending below average.
- Field Auditing and Data Collection
- Issuing of bylaw transgression fines/penalties.

11 REPLACEMENT OF OLD METERS

11.1 City Power is currently in the process of upgrading pre-paid meters to smart meters in line with CP_TSSPEC_316

11.2 City Power shall determine prepaid meters that need to be upgraded from the list provided by the service provider,

11.3 The Service Provider shall procure, issue new meters, update customer details and replace meters as and when required.

11.4 Both City Power and the service provider shall agree on site where meters need to be replaced, upon completion of the installation, the service provider shall report and update City Power using the reporting template provided.

12 COMPLIANCE TO STS TID ROLLOVER

The service provider shall provide an environment that is TID proof meaning that there should be not need for City Power to do a TID rollover exercise.

13 VENDOR MANAGEMENT

13.1 City Power to assist with setting up guidelines for appointing and signing contracts with existing or prospective vendors and compiling of agreement/contracts.

13.2 Collection of all revenue from vendors as per agreement.

13.3 Insurance against revenue loss.

13.4 Service provider shall provide the necessary security measures for collecting the revenue if required.

13.5 To reconcile the revenue received from the vendors daily and provide the necessary credit to the vendor to continue vending

14 PERFORMANCE MANAGEMENT

Performance shall be measured as per SLA on the following aspects:

- Vending and/or collection performance per area/township
- Number of active meters' vs number of vending/paying customers
- Tracking of new connections
- Resolution of queries
- Additional revenue
- Data accuracy and updates
- Daily/ Weekly/Monthly reconciliation of new customers and revenue sharing
- Income and receive in advance report

15 QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

16 HEALTH AND SAFETY

A health and safety plan shall be set up in order to ensure proper management and compliance during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste. Guidance on the requirements of a health and safety plan shall be found in ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

17 ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance is adhered to during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste. Guidance on the requirements for an environmental management system shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy.

Annex A – Bibliography

None

Annex B - Revision information

DATE	REV. NO.	NOTES
November 2024	0	First issue
November 2025	1	General editing Updated Study Committee