METERING AND DATA MANAGEMENT PROCEDURE

(Annexure A4 of the System Operator Guidelines)

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1. Glossary of Terms

1.1 Definitions

The following definitions apply in this procedure. A list of defined terms in the **Governing Documents** referenced in the definitions below is provided in the System Operator Guidelines.

Advanced Metering Infrastructure (AMI)	means an integrated fixed network system of smart **Meters**, communications networks, and data management systems that enables two-way communication.
Business Day	has the meaning assigned to the words in the **Market Guideline**;
Day	has the meaning assigned to the words in the **Zambian Grid Code**;
Contestable Consumer	has the meaning assigned to the words in the **Market Guideline**;
Distribution Code	has the meaning assigned to the words in the **Market Guideline**;
Distribution Network Service Provider (DNSP)	has the meaning assigned to the words in the **Electricity Act**;
Electricity Act	means the Electricity Act, 2019, Act No. 11 of 2019
Electricity Regulation Act	means the Electricity Regulation Act, Act No. 12 of 2019
Eligible Seller	has the meaning assigned to the words in the **Market Guideline**;
Energy Regulation Board (ERB)	means the Energy Regulation Board established under the **Energy Regulation Act.**
Engineering Institute of Zambia	has the meaning assigned to the words in the Engineering Institution of Zambia Act, Act No. 17 of 2010.
Generator	has the meaning assigned to the words in the **Zambian Grid Code**;
Governing Documents	means the **Electricity Act**, the **Energy Regulation Act**, the **Open Access Regulations**, the **Net Metering Regulations**, the **Zambian Grid Code**, the **Zambian Metering Standards**, and the **IEC Metering Standard**.
IEC Metering Standard	means the IEC 62053 (Electricity Metering) Standard published by the International Electrotechnical Commission.

Information	has the meaning assigned to the words in the **Zambian Grid Code**;
Interconnected Power System	has the meaning assigned to the words in the **Electricity Act**;
Licensed Installers	For the purpose of this document, shall mean a person licensed by the Engineering Institute of Zambia to carryout work on or in electrical installations.
Market Guideline	means the Open Access Market Guideline for the Electricity Sub-Sector (latest draft)
Meter	has the meaning assigned to the words in the **Zambian Grid Code**;
Metering Installation	has the meaning assigned to the words in the **Zambian Grid Code**;
Metering Installation Owner	means a Party that owns a **Metering Installation** on the Zambian **Interconnected Power System**.
Net Metering Regulations	means the Electricity (Net Metering) Regulations, Statutory Instrument No. 38 of 2024
Open Access Regulations	means the Electricity (Open Access) Regulations, Statutory Instrument No. 40 of 2024
Participant	has the meaning assigned to the words in the **Zambian Grid Code**;
Party	has the meaning assigned to the words in the **Zambian Grid Code**;
Producer	has the meaning assigned to the words in the **Electricity Act**;
Prosumer	has the meaning assigned to the words in the **Net Metering Regulations**;
Regional Operator	has the meaning assigned to the words in the **Zambian Grid Code**;
Statistical Metering Installation	For the purpose of this document, means a **Metering Installation** for the purpose of providing statistical metering **Information**.
System Operator (SO)	has the meaning assigned to the words in the **Electricity Act**;
System Operator Guidelines	means the System Operator Guidelines for Open Access to Transmission and Distribution Systems (latest draft) of which this document is an annexure.
Tariff Metering Installation	For the purpose of this document, means a **Metering Installation** for the purpose of providing metering **Information** for billing and settlement.

Transmission Network Service Provider (TNSP)	has the meaning assigned to the words in the **Electricity Act**;
Zambian Grid Code	means the Electricity (Grid Code) Regulations, Statutory Instrument No. 79 of 2013
Zambian Metering Standards	means Zambian standards series ZS387 and ZS640 published by the Zambian Bureau of Standards.

1.2 Abbreviations

AMI	**Advanced Metering Infrastructure**
COSEM	Companion Specification for Energy Metering
DGC	Zambian **Distribution Code**
DLMS	Device Language Message Specification
DNSP	**Distribution Network Service Provider**
EIZ	**Engineering Institute of Zambia**
ERB	**Energy Regulation Board**
IEC	International Electrotechnical Commission
kVA	KiloVolt-Ampere
kVAR	KiloVolt-Ampere Reactive
kVARh	KiloVolt-Ampere Reactive Hour
kW	Kilowatt
kWh	Kilowatt-hour
OAREG	**Open Access Regulations**
SAPP	Southern African Power Pool
SO	**System Operator**
TNSP	**Transmission Network Service Provider**
ZGC	**Zambian Grid Code**
ZGC Ch3	**Zambian Grid Code**, Chapter 3, Metering

2. Introduction

The **System Operator Guidelines** provides an overview of Zambia's open access regime, with annexures providing a set of detailed procedures such as this Metering and Data Management Procedure.

2.1 Purpose

To establish a standardized approach for metering and managing metering data in Zambia's Open Access energy market, ensuring transparency, accuracy, and compliance with the Governing Documents.

2.2 Scope

This procedure applies to all **Participants**, **Prosumers**, and the **ERB**.

This is for the purpose of:

- grid connection and compliance
- ensuring accurate measurement of electricity usage for time-of-use tariffs.
- half-hourly polling used for industrial consumers to track peak and off-peak consumption.
- determining flows and losses
- confirmation of compliance with scheduling and dispatch instructions; and
- calculation of financial settlements.

This procedure shall also apply to the metering points at boundaries between participants in line with the ZGC Metering chapter.

2.3 Referenced Documents

This procedure makes reference to the following documents:

- The **Electricity Act**;
- The **Open Access Regulations**;
- The **Zambian Grid Code**;
- The **Net Metering Regulations**;
- The **System Operator Guidelines**;
- The **Market Guideline**; and
- **The Zambian Metering Standards**.

3. Metering Installations Requirements

3.1 Statistical Metering Installations Specifications

All **Statistical Metering Installations** shall:

- have full four quadrant metering installed where active and reactive energy flow is in both directions;
- comply with minimum Class 2 accuracy (active energy) in line with the **Zambian Metering Standard** ZS647;
- have annual calibration intervals for meters or as mandated by the **ERB**; and
- be capable of measuring active power (kW), active energy (kWh), apparent power (kVA), reactive power (kVar), reactive energy (kVARh), power factor (Pf) and power quality parameters (e.g., voltage, frequency, harmonics).

3.2 Quality of Supply Metering Installations

All **Metering Installations** measuring quality of supply shall:

- comply with minimum Class A accuracy in line with the Zambian Standard ZS387 series.
- have annual calibration intervals for meters or as mandated by **ERB**; and
- be capable of measuring voltage regulation, unbalance, total harmonic distortion, sags, swells, transients, interruptions and flicker.

3.3 Tariff Metering Installations Specifications

All **Tariff Metering Installations** shall have full four quadrant metering installed where active and reactive energy flow is in both directions;

3.3.1 Main and Check Metering Installations:

Main **Meters** (primary measurement devices) and check **Meters** (backup/verification devices) shall be installed at all grid interconnection points.

Both **Meters** must be of the same class and comply with minimum Class 0.5 accuracy (active energy) and Zambian Grid Code specifications.

Both **Meters** shall be of a similar type to avoid systemic errors.

Calibration intervals for check **Meters** shall align with main **Meters** (annually or as mandated by the **ERB**).

Meters must be capable of measuring active power (kW), active energy (kWh), apparent power (kVA), reactive power (kVar), reactive energy (kVARh), power factor (Pf) and power quality parameters (e.g., voltage, frequency, harmonics).

3.3.2 Prosumer Metering installations:

Prosumer Metering Installations shall use bi-directional **Meters** to record energy generation and consumption

3.4 System Operator Access

The **SO** shall have unrestricted real-time access to metering data via **Advanced Metering Infrastructure** at the injection or withdraw point.

For physical access to **Metering Installations**, the **SO** shall provide 24-hour notice to the site owner, except in emergencies affecting grid stability.

Metering Installations shall support remote access protocols (e.g., Device Language Message Specification (DLMS); Companion Specification for Energy Metering (COSEM)), for secure **SO** monitoring.

4. Metering Procedure

4.1 Metering Installation and Maintenance

4.1.1 Compliance with Open Access Regulations:

All **Meters** must meet technical specifications outlined in **Zambian Grid Code**, **Zambian Distribution Grid Code**, **Zambian Metering Standards** and the **System Operator Guidelines**.

4.1.2 Requirements:

Participants should use smart **Meters** for real-time monitoring and data communication.

For **Prosumers**, install bi-directional **Meters** capable of recording both energy generation and consumption.

4.1.3 Installation Process:

Participants shall conduct site assessments to identify appropriate metering points.

Participants shall install meters at connection points, ensuring compatibility with infrastructure and energy flow requirements.

Only **Licensed Installers** certified by **Participants** are authorized by the ERB to carryout installations. Installation documentation, such as calibration certificates and sealing records, must be maintained for at least five (5) years for audit purposes in line with the **Zambian Grid Code** (ZGC Ch. 3 §8).

4.1.4 Maintenance:

Metering Installation owners shall:

- conduct regular inspections to identify faults, tampering, or damage.
- calibrate meters annually or as specified by the **ERB** and replace faulty meters exceeding permissible error limits.
- implement firmware and software updates for smart meters to enhance performance and security.

4.1.5 Tamper Detection and Prevention:

Participants shall install tamper-proof meters equipped with anti-tampering alarms.

Participants and the **SO** should utilize automated systems to monitor irregular consumption patterns indicative of tampering.

4.2 Metering Data Collection

4.2.1 Automated Systems:

Automated collection of metering **Information** should:

- Deploy **AMI** for real-time data collection and to minimize human errors.

- integrate backup systems to prevent data loss during communication failures.

4.2.2 *Manual Data Collection:*

Tariff Metering Installations readings shall be taken by a representative of the **TNSP** or **DNSP**.

The **Eligible Seller** or **Contestable Customer** connected to the **TNSP** or **DNSP** shall be given no less than three (3) **Days'** notice, when the meter shall be read and have the option to be present.

Parties shall sign a meter reading log to validate accuracy.

The metering **Information** shall be collected on or before the third (3^{rd}) **Business Day** of each month.

Manual readings shall be submitted to the **SO** within 24 hours and cross-verified against historical data.

Each **Participant** shall store **Information** securely and also input it into the central database managed by the **SO**, to maintain data integrity for at least five (5) years.

4.2.3 *Data Validation:*

Metering **Information** should be validated through:

- use of cross-verification protocols to identify and correct anomalies in collected data.
- data correction taking place prior to settlements.
- validation a against grid-level flow readings to ensure consistency.

4.3 Data Management

4.3.1 *System Operator Protocols:*

The **SO** shall conduct annual audits of metering points to ensure accessibility and data integrity.

Tamper-evident seals and access logs shall be inspected during audits.

4.3.2 *Centralized Data Storage:*

The **SO** shall:

- establish a common nomenclature for metered nodes on the grid.
- establish a centralized and secure database for storing all metering data. The database must include an audit trail of all data amendments made, when made and by whom.
- ensure all data is encrypted to safeguard against unauthorized access.

4.3.3 Access and Transparency

The **SO** shall:

- allow stakeholders to access metering **Information** through a secure online portal, based on predefined roles and permissions.
- retain metering **Information** for at least ten (10) years to facilitate audits and analyses.

4.4 Data Sharing and Reporting

4.4.1 Provide Equitable Access:

The **SO** shall share metering Information with all authorized stakeholders, aligning with open access transparency requirements.

4.4.2 Reporting

The **SO** shall

- publish monthly and annual reports summarizing energy consumption, generation, and transmission losses; and
- allow stakeholders to request customized reports as needed. Any costs associated with creating customised reports shall be to the requesting stakeholder's account.

4.4.3 Dispute Resolution:

The participants responsible for collecting the meter data shall establish a well-defined protocol for resolving disputes over metering data, including independent verification. However, if that fails, metering data dispute must be resolved through the Dispute Resolution Procedures outlined in the **Zambian Grid Code** [*ZGC Ch1 §8*].

The **SO** may conduct independent tests or audits to resolve the disputes.

4.5 Compliance, Penalties and Auditing

4.5.1 Alignment with Open Access Guidelines:

The **ERB** shall:

- Ensure all procedures align with Governing Documents
- Conduct regular compliance workshops to keep stakeholders updated on metering standards.

4.5.2 Audits:

Biannual internal audits shall be conducted by generators, **TNSPs** and **DNSPs** to verify adherence to metering protocols.

The **ERB** will conduct independent audits to assess compliance and recommend improvements.

4.5.3 Compliance and Penalties

Non-compliance with metering standards may result in financial penalties or disconnection as per the Zambian Grid Code.

Contestable Consumers and/or **Generators** have the right to request meter verification tests at their own cost if disputes arise.

If main and check meter advance readings diverge by >1%, the parties shall seek an amicable way to resolving the discrepancy. If that fails within seven (7) Days, metering data dispute must be resolved through the dispute resolution procedures outlined in the **Zambian Grid Code**.

Dispute resolution logs, including witness signatures for manual readings, shall be retained for at least five (5) years.

5. Roles and Responsibilities

5.1 Energy Regulation Board

The **ERB** shall:

- oversee implementation, enforcement, and compliance with the Governing Documents and metering procedures; and
- ensure certification of **Meters** and accreditation of meter installers.

5.2 Transmission and Distribution Network Service Providers

TNSPs and **DNSPs** shall:

- facilitate meter installation, maintenance, and data collection at transmission and distribution levels;
- ensure consistent and timely submission of validated data to the centralized database;
- resolve disputes or escalate them in line with the ZGC dispute resolution procedure; and
- certify meter installers.

5.3 System Operator:

The **SO** shall:

- monitor grid operations to ensure a balance between generation and consumption using metering **Information**;
- aggregate data from **TNSPs** and **DNSPs**, verify its accuracy, and report system performance to the **ERB**;
- analyse and optimize system losses based on metering **Information**;
- manage the centralized metering **Information** repository;
- ensure physical and digital accessibility to all **Metering Installations** for monitoring and auditing purposes;
- maintain access logs for metering infrastructure and investigate unauthorized access; and
- audit **Metering Installations**: Annual inspections to verify accessibility, tamper-proof seals, and data consistency.

5.4 Energy Producers and Consumers:

Producers must ensure generation meters comply with **Zambian Metering Standard** ZS 647 as outlined in the ZGC and provide **Information** to network service providers.

Contestable Consumers and **Prosumers** must ensure their metering equipment is functional and promptly report any faults or discrepancies.

Metering Installation Owners shall:

- Facilitate **SO** access to metering points during inspections or emergencies; and
- appoint a representative to witness manual meter readings if **AMI** is unavailable.

6. Key Meter Certification Workflow

The following steps shall be followed to certify **Metering Installations**:

1. Meter Approval:

   The **ERB** certifies **Meter** models meeting ZGC, DGC and **Zambian Metering Standards**.

2. Meter Installer Licensing:

   The **ERB** accredits the **Licensed Installer** to perform installations.

   The **Licensed Installer** accredited must be a fully paid-up member of the **Engineering Institute of Zambia** and certified by the **Metering Installation Owner** they are representing.

3. Installation Supervision:

   Metering Installation Owners execute installations under **ERB** guidelines.

4. Post-Installation Validation:

   The **ERB** reviews calibration/sealing records.

   The **SO** audits data integrity and accessibility.