



Final v.1

Metering and Data Management Procedure

(Annexure A4 of the **System Operator Guidelines**)

[Date]

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1. Glossary of Terms

1.1 Definitions

- 1.1.1. Unless the context otherwise requires, relevant definitions stated specifically in this Procedure are as set out in the Governing Documents. In the event that any definition in the Governing Documents is amended, such amended definition shall, from the effective date of the amendment, be deemed to apply to this Procedure, until this procedure is expressly amended to reflect such change.
- 1.1.2. References in this Procedure to any document (including these Guidelines) are references to that document as amended, consolidated, supplemented, novated or replaced from time to time, and to all annexes, schedules, attachments and supplements which form part of such document;
- 1.1.3. A term in this Procedure that uses the singular includes the plural and vice versa, and a term that imports gender includes both the masculine and feminine.
- 1.4. In this Procedure, headings are for reference purposes only and shall not affect the construction or interpretation of this Procedure.

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	means any day other than a Saturday, Sunday, or public holiday in the Republic of Zambia;
Check Meter	means a secondary metering device installed alongside the Main Meter to provide verification and backup measurement capabilities;
Contestable Consumer	means a Market Participant who is eligible to purchase electricity from any Eligible Seller and includes an Embedded Consumer, Mining Consumer, Industrial Consumer, End-use Consumer, Commercial Retailer, Exporter, Battery Energy Storage, System Operator and Intermediary Power Trader;
Day	has the meaning assigned to this term in the Grid Code being a period of 24 consecutive hours commencing at 00:00 hours;
Data Protection Act	means the Data Protection Act No. 3 of 2021;
Distribution Code	means the Zambian distribution grid code as issued and published by the ERB, as may be amended and/or updated from time to time;

Distribution Network Service Provider (DNSP)	has the same meaning assigned to this term in the Electricity Act being a licensee responsible for operating, maintaining and developing a distribution system in an area and, where applicable, the distribution system's interconnection with other systems;
Electricity Act	means the Electricity Act No. 11 of 2019;
Energy Regulation Act	means the Energy Regulation Act No. 12 of 2019;
Eligible Seller	has the meaning assigned to this term in the Market Guidelines being, a Supplier or licensee that holds a Licence to trade in electricity as defined in the Electricity Act, including but not limited to an independent power producer, importer, embedded power producer, battery energy storage system operator and intermediary power Trader;
Energy Regulation Board (ERB)	means the Energy Regulation Board established under the Energy Regulation Act;
Engineering Institution of Zambia	of has the meaning assigned to this term in the Engineering Institution of Zambia Act No. 17 of 2010;
Equipment	has the meaning assigned to this term in the Electricity Act being, machinery, appliances, meters, fittings, apparatus and other equipment owned by, or under the control of, a licensee and used for conducting the licensed activity;
Generator	has the meaning assigned to this term in the Grid Code being, an entity operating a generating unit or power station;
Governing Documents	means, collectively, the Electricity Act, the Energy Regulation Act, the Open Access Regulations, the Market Guidelines, the Grid Code, the System Operator Guidelines, and any other rules, procedures, or codes issued by the ERB;
Grid Code	means the Electricity (Grid Code) Regulations, Statutory Instrument No. 79 of 2013;
IEC Metering Standard	means the IEC 62053 (Electricity Metering) Standard published by the International Electrotechnical Commission;
Information	has the meaning assigned to this term in the Grid Code being, a type of knowledge represented by some data, which can be exchanged, stored or processed electronically or otherwise;
Interconnected Power System	has the meaning assigned to this term in the Electricity Act being, means a number of transmission and distribution lines, and includes associated power generation systems that are linked together for the purpose of transmitting or distributing electricity;

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 Guidelines	means the Open Access Market Guidelines for the Electricity Sub-Sector 2025;
Market Participant	has the meaning assigned to this term in the Market Guidelines, being an Open Access User who has met the conditions of regulation 16 of the Open Access Regulations and includes a Contestable Consumer or Public Service Trader (PST) that is registered or admitted in accordance with the Market Guidelines to participate into the Market;
Main Meter	means the primary metering device used for billing and settlement purposes;
Meter	has the meaning assigned to the term Metering in the Grid Code being, Equipment used in measuring supply parameters installed at supply points;
Metering Installation	has the meaning assigned to this term in the Grid Code being, an installation that comprises an energy meter that is interrogated and has a communication link;
Metering Installation Owner	means a Participant 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	Means: an Eligible Seller or Contestable Consumer; · a Generator; · a Trader; · the Public Service Trader (PST); · a Distributor; · a Supplier; · an Energy Storage Operator; · an Importer; and/or · an Exporter;_
Regional Operator	has the meaning assigned to this term in the Grid Code being, an entity, subordinate to the SO and independent from other market participants responsible for short-term reliability of the IPS, which is in charge of controlling and operating part of the TS in real time;

Statistical Metering Installation	means a Metering Installation for the purpose of providing statistical metering Information;
System Operator (SO)	has the meaning assigned to this term in the Electricity Act being, an entity responsible for the short term reliability of an interconnected power system, which is in charge of controlling and operating the transmission system and dispatching generation or balancing the supply and demand in real time in a non-discriminatory manner;
System Operator Guidelines	means the System Operator Guidelines for Open Access to Transmission and Distribution Systems 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;
Trader	means the holder of a licence to trade in electricity issued by the ERB under the Energy Regulation Act;
Transmission Network Service Provider (TNSP)	has the meaning assigned to this term in the Electricity Act being, a licensee responsible for developing, maintaining and operating a transmission network in the area where the transmission provider operates and where applicable, the transmission network interconnects with other networks;
Zambian Metering Standards	means Zambian standards series ZS640 to ZS647 and ZS387 published by the Zambian Bureau of Standards.

1.2 Abbreviations

AMI	Advanced Metering Infrastructure
COSEM	Companion Specification for Energy Metering
DGC	Distribution Grid 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
MOU	Market Operator Unit
OAREG	Open Access Regulations
SAPP	Southern African Power Pool
SO	System Operator
TNSP	Transmission Network Service Provider
GC	Grid Code
GC Ch3	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 standardised approach for metering and managing metering data in Zambia's Open Access energy market in accordance with the Open Access Regulations and Market Guidelines, ensuring transparency, accuracy, and compliance with the Governing Documents while facilitating the efficient operation of the Open Access Market.

2.2 Scope

This procedure applies to all Participants, Transmission Network Service Providers, Distribution Network Service Providers, and the ERB.

This procedure applies to Metering Installations for the following purposes:

- grid connection to the Interconnected Power System and compliance with technical requirements;
- ensuring accurate measurement of electricity consumption and generation for billing and tariff application purposes;
- facilitating half-hourly data collection for tracking peak and off-peak consumption patterns;
- determining energy flows and calculating transmission and distribution losses;
- confirmation of compliance with scheduling and dispatch instructions by Participants; and
- calculation of financial settlements in accordance with the Market Guidelines.

This procedure shall also apply to metering points at boundaries between Participants in accordance with the Grid Code Chapter 3 (Metering).

2.3 Referenced Documents

This procedure makes reference to and shall be read in conjunction with the **Governing Documents**.

3. Metering Installation Requirements

3.1 Statistical Metering Installations Specifications

All Statistical Metering Installations shall comply with the following requirements:

- have full four quadrant metering installed where active and reactive energy flow is in both directions;
- comply with minimum Class 0.5 accuracy (active energy) in line with the Zambian Metering Standard ZS647;
- have annual calibration intervals for Meters in accordance with the Zambian Metering Standards; 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 (including voltage, frequency, and harmonics).

3.2 Quality of Supply Metering Installations Specifications

All Quality of Supply Metering Installations shall:

- comply with minimum Class A accuracy in accordance with the Zambian Metering Standard ZS387 series;
- have calibration intervals not exceeding five (5) years or as otherwise specified by the ERB; and
- be capable of measuring voltage regulation, voltage unbalance, total harmonic distortion, voltage sags, voltage swells, transients, supply interruptions, and flicker.

3.3 Tariff Metering Installations Specifications

All Tariff Metering Installations shall:

3.3.1 Main and Check Metering Installations:

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

Both Meters must be of the same class and comply with minimum Class 0.2S accuracy (active energy) and Grid Code specifications.

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

Calibration intervals for Check Meters shall align with Main Meters.

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 (including voltage, frequency, harmonics).

3.4 System Operator Access to Metering Installations

The SO shall have unrestricted real-time access to metering data via Advanced Metering Infrastructure at all injection and withdrawal points on the Interconnected

Power System.

For physical access to Metering Installations, the SO shall provide twenty-four (24) hours' notice to the site owner, except in cases of emergency that pose an immediate threat to grid stability or system security.

Metering Installations shall support remote access protocols, including Device Language Message Specification (DLMS) and Companion Specification for Energy Metering (COSEM), to enable secure monitoring by the SO.

3.5 Metering Installation and Maintenance

3.5.1 Compliance with Governing Documents:

All Meters must meet technical specifications outlined in the Governing Documents.

3.5.2 Requirements:

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

3.5.3 Installation Process:

Participants shall conduct site assessments to identify appropriate metering points in accordance with the Grid Code and Distribution Code requirements.

Participants shall install Meters at connection points in accordance with the specifications set out in sections 3.1, 3.2, and 3.3 of this procedure, ensuring compatibility with existing infrastructure and bi-directional energy flow requirements.

Participants shall ensure that only Licensed Installers carry out installations. Installation documentation, including calibration certificates and sealing records, must be maintained for at least five (5) years for audit purposes in accordance with the Grid Code (GC Ch. 3 §8).

3.5.4 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; and
- implement firmware and software updates for smart Meters to enhance performance and security.

3.5.5 Tamper Detection and Prevention:

Participants shall install tamper-proof Meters with anti-tampering alarm capabilities.

Participants and the SO shall implement automated monitoring systems to detect irregular consumption patterns that may indicate tampering with Metering Installations.

3.6 Metering Data Collection

3.6.1 Automated Systems:

Automated collection of metering Information shall:

- deploy Advanced Metering Infrastructure for real-time data collection and to minimize human errors;
- integrate backup systems to prevent data loss during communication failures.

3.6.2 Manual Data Collection:

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

The Eligible Seller or Contestable Consumer connected to the TNSP or DNSP shall be given no less than three (3) Business Days' notice of when the Metering Installation shall be read and have the option to be present.

All Parties shall sign a Metering Installation reading log to validate the accuracy of manual readings.

Metering Information shall be collected on or before the third (3rd) Business Day of each month.

Manual readings shall be submitted to the SO within twenty-four (24) hours of collection and shall be cross-verified against historical data for accuracy.

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

3.6.3 Data Validation:

All Metering Information shall be validated through the following procedures:

- implementation of cross-verification protocols to identify and correct anomalies in collected Metering Information;
- completion of all data corrections prior to financial settlements; and
- validation of Metering Information against grid-level flow readings to ensure consistency.

3.7 Data Management

3.7.1 System Operator Audit Protocols:

The System Operator shall conduct annual audits of Metering Installations to ensure compliance with accessibility requirements and data integrity standards.

During such audits, tamper-evident seals and access logs shall be inspected to verify the integrity and security of Metering Installations.

3.7.2 *Centralized Information Storage:*

The System Operator shall establish and maintain centralized data storage systems in accordance with the following requirements:

- establish a common nomenclature for Metering Installations on the Interconnected Power System;
- establish a centralized and secure database for storing all metering Information. The database shall maintain a comprehensive audit trail recording all Information modifications, including the date, time, and identity of the person making such modifications.
- implement encryption of all Information using industry-standard protocols to prevent unauthorized access and ensure data integrity.

3.7.3 *Information Access and Transparency Requirements*

The **SO** shall:

- provide stakeholders with access to relevant metering **Information** through a secure online portal in accordance with predefined roles and permissions and applicable data protection requirements; and
- retain metering Information for at least five (5) years to facilitate audits and compliance assessments.

3.8 **Data Sharing and Reporting**

3.8.1 *Equitable Access to Information:*

The SO shall share metering Information with all authorized stakeholders in accordance with open access transparency requirements and the information exchange provisions set out in Chapter 5 of the Grid Code.

3.8.2 *Reporting:*

The SO shall:

- publish monthly and annual reports summarizing energy consumption, generation, and transmission losses based on metering Information; and
- allow stakeholders to request customized reports as needed, with any associated costs to be borne by the requesting stakeholder.

3.9 **Data Protection**

All Parties shall, in performing their respective rights and obligations under this procedure, comply with applicable data protection legislation.

3.10 **Compliance, Penalties, and Auditing**

3.10.1 *Alignment with Governing Documents:*

The ERB shall:

- ensure all metering procedures align with the Governing Documents; and
- conduct regular stakeholder consultations on metering standards and compliance requirements in accordance with the Governing Documents.

3.10.2 *Audits:*

Participants shall conduct biannual internal audits to verify adherence to metering procedures and compliance with the requirements set out in this procedure.

The ERB shall conduct independent audits to assess compliance with this procedure and the Governing Documents and may recommend improvements as necessary.

3.10.3 *Compliance and Penalties:*

Non-compliance with this procedure may result in financial penalties or disconnection as provided for in the Grid Code.

Participants may request an independent audit of metering installations. The requesting Participant shall be responsible for any costs relating to the audit unless the metering installation is proved to be outside the defined standard.

If Main Meter and Check Meter readings diverge by more than one percent (1%), the Parties shall seek an amicable resolution of the discrepancy. If such resolution is not achieved within seven (7) Business Days, the metering data dispute must be resolved through the dispute resolution procedures outlined in the Grid Code and the Market Guidelines.

Metering disputes among Participants shall follow the dispute resolution procedures set out in the Market Guidelines, unless expressly governed by the Grid Code dispute mechanism.

All dispute resolution logs, witness signatures for manual readings, and related documentation shall be retained for at least five (5) years in accordance with audit requirements.

4. Roles and Responsibilities

4.1 Energy Regulation Board (ERB)

The **ERB** shall:

- oversee implementation, enforcement, and compliance with this procedure and the Governing Documents; and
- ensure certification of Meters and accreditation of Meter installers in accordance with the Governing Documents.

4.2 Transmission Network Service Providers and Distribution Network Service Providers

TNSPs and **DNSPs** shall:

- facilitate Meter installation, maintenance, and Information collection at transmission and distribution levels;
- ensure consistent and timely submission of validated Information to the centralized database;

4.3 System Operator

The System Operator shall:

- monitor grid operations to ensure balance between generation and consumption using metering Information;
- aggregate metering Information from TNSPs and DNSPs, verify its accuracy, and report on system performance to the ERB;
- analyse system losses and recommend optimization measures based on metering Information;
- maintain and manage the centralized metering Information repository;
- ensure physical and digital access to all Metering Installations for monitoring and auditing purposes in accordance with the access provisions set out in section 3.4 of this procedure.
- maintain comprehensive access logs for all Metering Installations and investigate any instances of unauthorized access in accordance with the security protocols established under this procedure; and
- conduct annual audits of Metering Installations to verify accessibility, integrity of tamper-proof seals, and data consistency.

4.4 Generators and Contestable Consumers:

Generators must ensure generation meters comply with **Zambian Metering Standards** as outlined in the **Grid Code** and provide metering Information to the relevant TNSP or DNSP.

Contestable Consumers shall ensure their Metering Installations are functional and shall promptly report any faults or discrepancies to the relevant TNSP or DNSP.

Metering Installation Owners shall:

- facilitate SO access to Metering Installations during inspections or emergencies in accordance with the access provisions set out in section 3.4 of this procedure; and
- appoint a representative to witness manual Metering Installation readings when AMI is unavailable.

4.5 Traders shall:

- appoint representatives to witness Metering Installation readings at relevant connection points;
- initiate and participate in dispute resolution processes for metering Information discrepancies related to their trades in accordance with the procedures outlined in the Grid Code and Market Guidelines; and
- submit nominations to the MOU that can be verified against actual metering Information.

5. Metering Installation Certification Workflow

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

1. Metering Installation Specifications:

Metering Installation specifications shall meet the requirements of the Grid Code, Distribution Code, and Zambian Metering Standards.

2. Metering Installation Installer Licensing:

The Licensed Installer shall be a fully paid-up member of the Engineering Institute of Zambia and shall be approved by the relevant Metering Installation Owner prior to commencing any installation work.

3. Installation Supervision:

The Metering Installation Owners shall supervise all Metering Installation work to ensure compliance with the requirements set out in this procedure.

4. Post-Installation Validation:

The Participant shall ensure proper calibration and sealing of all Metering Installations and shall maintain comprehensive records of such calibration and sealing activities for at least five (5) years in accordance with the audit requirements set out in this procedure.

The System Operator shall audit metering Information integrity and accessibility in accordance with the requirements set out in this procedure.

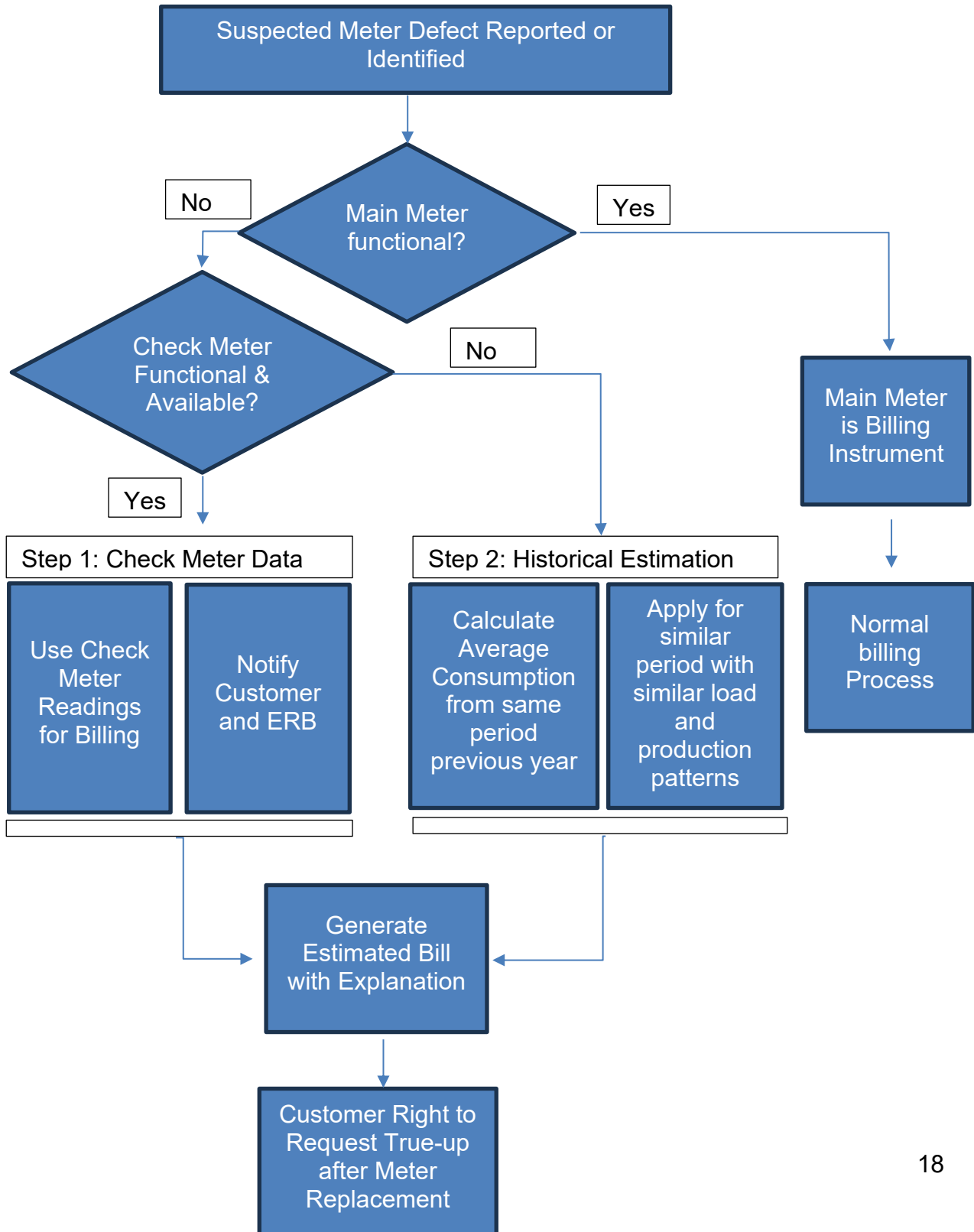
6. Maximum Service Delivery Timeframes

1. A **Participant** shall process a complete application for Metering Installation certification within thirty (30) Business Days of receipt.
2. The System Operator shall grant data portal access to a newly licensed Participant within fourteen (14) Business Days of receiving notification from such Participant.
3. The initial phase of metering Information dispute resolution, including independent verification, shall be concluded within fifteen (15) Business Days of such dispute being formally logged.

7. Mechanism for Handling Defective Main and Check Meters

1. Procedural Steps

The following flowchart shall govern the standard decision-making process for handling defective Main Meters and Check Meters, with detailed procedural steps set forth below.



Step 1: Identification and Notification of Defective Metering Installations

This process shall be triggered when any of the following circumstances occur:

- a Metering Installation fails a remote diagnostic check, including communication failure or abnormal data patterns;
- a site inspection reveals physical damage or malfunction of a Metering Installation;
- a Participant reports a suspected problem with a Metering Installation, including display malfunction or erratic consumption patterns; or
- a significant and unexplained discrepancy arises between Main Meter and Check Meter readings.

The Participant discovering the suspected defect shall formally notify all concerned Participants of the suspected defect and the intention to investigate.

Step 2: Investigation and Testing

The responsible Participant shall facilitate isolation of the affected Metering Installation and conduct testing.

- If the Main Meter is defective: The Check Meter is read and its data is used for the estimation process (see Step 3a).
- If the Check Meter is defective: The Main Meter remains the basis for billing. The Check Meter shall be repaired or replaced as an operational task, but such repair or replacement has no billing impact.
- If both the Main Meter and Check Meter are defective: estimation shall proceed to Stage 2, relying entirely on historical data (see Step 3b).

Step 3a: Estimation Based on Check Meter Data (Stage 1)

If the Main Meter is defective but the Check Meter is functional and available, the Check Meter readings shall be used as the primary basis for estimation.

- Billing shall be based on the Check Meter's recorded energy for the relevant period.
- A correction factor may be applied if there is a known, consistent percentage difference between the Main Meter and Check Meter established from periods when both were functional. Such correction factor must be justified and agreed upon by the affected Participants and approved by the ERB.

Step 3b: Estimation Based on Historical Data (Stage 2):

If both Metering Installations are defective, the Participant shall estimate consumption based on historical usage patterns. Common methods include:

- **Same Period Previous Year:** using the consumption from the exact same billing period in the previous year;
- **Average Daily Consumption:** calculating the average daily consumption from the last known healthy period (e.g., the last three (3) to six (6) months) and applying it to the number of days in the current billing period; and
- **Benchmarking:** for Participants with no historical data (new connections), consumption may be estimated based on the connected load and typical usage profiles for similar Participant types (e.g., other industrial facilities or commercial operations of similar size and type).

Step 4: Communication and Billing:

The responsible Participant shall generate an estimated bill that must be clearly marked as "ESTIMATED" or "UNDER DISPUTE".

- The bill shall include a detailed explanation of the reason for estimation and the methodology used.
- The affected Participant has the right to query the estimation methodology and provide supporting evidence (e.g., production records demonstrating a shutdown period).

Step 5: Resolution and True-Up:

Once the defective Metering Installation has been repaired or replaced:

1. The Participant shall be promptly notified that normal metering has resumed.
2. The first bill after Metering Installation replacement shall be based on actual readings from the new Metering Installation.
3. True-Up Adjustment: Once a sufficient period of actual data has been collected (e.g., one billing cycle), the Participant shall compare the estimated energy with the actual energy recorded.
 - If the affected Participant was overcharged, a credit shall be applied to their account in accordance with the terms specified in the contract.
 - If the affected Participant was undercharged, the outstanding amount shall be calculated and recovered in accordance with the terms specified in the contract, which may include adding the

amount to the next bill or amortizing it over several months to avoid bill shock.

2. Key Factors Influencing the Mechanism:

- **Duration of Defect:** The longer the period during which the Metering Installation remains defective, the more complex the estimation process becomes.
- **Participant Profile:** Estimation procedures for large industrial Participants with highly variable loads are more complex than those for residential Participants with consistent usage patterns.
- **Availability of Data:** The accuracy of the estimation is directly dependent upon the availability and quality of historical data from the Main Meter, Check Meter, or comparable Participants.
- **Regulatory Oversight:** For large Participants, the ERB may require approval of the estimation method to ensure fairness and regulatory compliance.

3. Best Practices for Participants

- **Clear Contracts:** This process shall be explicitly stated in the Power Supply Agreement, and the estimation methodology shall be approved by the ERB.
- **Transparency:** Proactive communication with the affected Participant throughout the process is essential to maintain trust and ensure procedural fairness.
- **Data Analytics:** Using advanced metering infrastructure (AMI) to store frequent interval data (e.g., half-hourly or hourly readings) provides a comprehensive dataset for accurate estimation in the event that a Metering Installation fails.
- **Prompt Action:** Metering Installations shall be tested, replaced, or repaired as expeditiously as possible to minimize the period during which estimation is required.