Material Specification code: GRI-GRI-MAT-NE&D-0010
Subject: GSSM001 – Polyphase and Monophase Smart Meter for direct and indirect connection on LV network

Version no. 3 dated 13/03/2025
Application Areas
Perimeter: *Global* Staff Function: - Service Function: -
Business Line: *Enel Grids and Innovability*

CONTENTS

THE HEAD OF GLOBAL NETWORK DEVICES
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1. DOCUMENT AIMS AND APPLICATION AREA

This document describes the requirements for the purchase monophase or multiphase energy meter for billing with direct and indirect connection, data concentrators and accessories, in accordance with ANEEL Normative Resolutions, ABNT Technical Documents and INMETRO Metrological Technical Regulations, which regulate the electrical energy measurement system of Group B consumer units.

This document applies to Enel Grids Brazil.

This policy applies to the Enel Group with the respect to its operations in Brazil, in accordance with applicable laws, regulations, collective agreements and governance standards, including the General Data Protection Law, which in any situation take precedence over the provisions contained in this document.

The General Data Protection Act, Law No. 13,709/2018 (LGPD) regulate the processing of personal data. The LGPD defines that treatment is any operation carried out with personal data, such as those related to collection, production, reception, classification, use, access, reproduction, transmission, distribution, processing, filing, storage, deletion, evaluation or control of information, modification, communication, transfer, dissemination or extraction, as well as that Personal Data is all information related to a natural person (physical person), which can make it identified or identifiable (such as: name, CPF, address, name of family members, consumption profile, geolocation, Consumer Unit number, etc. , which in isolation, or associated with two or more, may directly or indirectly identify a data subject).

The Processing of Personal Data carried out during the activities described in this document, must be duly mapped in the Enel Group personal data processing registry system, according to the Operational Instruction n. 3341 - Management of Personal Data Processing Registry and must take place in line with the rules of Personal Data Protection, SDG and Information Security of the Enel Group, established in the respective internal Policies and Procedures, listed in section 4 of this document.

This document shall be implemented and applied to the extent possible within the Enel Grids Business Line and in compliance with any applicable laws, regulations and governance rules, including any stock exchange and unbundling-relevant provisions, which in any case prevail over the provisions contained in this document.

1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document doesn’t require implementation of further documents.

Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids and Innovability Global Network Devices a detailed documents, according to the provisions of the present document and in case of specific needs.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
1	14/04/2023	First issuing of "Polyphase Smart meter for direct connection" Material Specification
2	17/05/2024	Inclusion of a single-phase meter with direct connection and a polyphase meter with indirect connection. It Replaces the Material Specification no. GRI-GRI-MAT-E&C-0040 of the same object.
3	13/03/2025	Review of items 7.1.1, 7.1.2, 7.1.4 to 7.1.18, 7.1.10, 7.1.11, 7.1.16 to 7.1.19, 7.1.21, 7.1.23, 7.2, 7.4., 7.5, 8.1 and inclusion of material new codes. After completing the ET, the points that were changed must be checked and included in this chapter. And addition of annex.

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Enel Grids and Innovability: Network Engineering and Development / Engineering Components and Devices / Network Devices unit.

Responsible for authorizing the document:

- Enel Grids and Innovability: Head of Network Devices unit;
- Enel Grids and Innovability: Operational Excellence and Processes Quality unit.

4. REFERENCES

- Integrated Policy for Quality, Health and Safety, Environment, anti-Bribery and Information security;
- ISO 9001- Quality Management System – Requirements;
- ISO 14001 - Environmental Management System - Requirements with guidance for use;
- ISO 45001 - Occupational Health and Safety Management System - Requirements with guidance for use;
- ISO 37001 - Anti-bribery Management System - Requirements with guidance for use;
- ISO 27001 - Information Security Management System – Requirements;
- Policy n.344 - Application of Privacy Regulation within the scope of the Enel Group;

- Organizational Procedure 375 - Documented Information Management;
- Organizational Procedure n.1626;
- Policy n.33 - Information Classification and Protection;
- Policy n.347 - Policy Personal Data Breach Management;
- Operational Instruction 3341 - Personal Data Processing Record Management;
- Operational Instruction 3340 - Methodology for the Data Protection Impact Assessment process;
- Policy n.241 - Crisis and Incident Management Brazil;
- Policy n.25 - Management of Logical Access to IT Systems;
- Policy n.37 - Enel Mobile Applications;
- NBR 14519: Electronic electrical energy meters;
- NBR 14520: Electricity electronic meters;
- NBR IEC 60529: Protection degrees provided by enclosures (IP codes);
- NBR 5426: Sampling plans and inspection procedures by attributes;
- INMETRO. INMETRO Ordinance No. 221/2022;
- ANEEL Resolution No. 1000/2021 - General Conditions for Electricity Supply;
- PRODIST. Module 5 - Metering Systems and Reading Procedures;
- NIE-DIMEL-123 - Sealing marks.
- Test Specification GRI-GRI-TST-E&C-0001 “GSSMC001: Tests and Test conditions of Static Meters”;
- Test Specification GRI-GRI-TST-E&C-0002 “GSSMC002: Qualification and reliability tests for meters production process validation”;
- GSSM001A: Packing, barcodes and key writing station requirements for Polyphase meters for direct connection supply
- Cyber Security Guideline no. 12
- Cyber Security Guideline no. 13

Notes:

1) The supplier must make available, for the Enel inspector, at the site of the inspection, all the abovementioned Standards, in their latest revisions.

2) The International System of Units (Metric System) must be used for any and all supplies to be carried out.

Group Pillar References:

- The Code of Ethics of Enel Group;
- The Enel Group Zero Corruption Tolerance Plan (ZTC);
- Human Rights Policy;
- Organization and Management Model as per Legislative Decree No. 231/2001;
- Enel Global Compliance Program (EGCP).

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering & Construction

Macro Process: Devices and Components Development

Process: Standard Catalog Management

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
ABNT	Brazilian Association of Technical Standards
Acceptable Quality Level (NQA)	Acceptable Quality Level
ANEEL	National Electric Energy Agency
ANATEL	National Telecommunications Agency
Brazilian National Institute of Metrology, Quality and Technology (INMETRO)	Brazilian National Institute of Metrology, Quality and Technology
Dado Pessoal/Personal Data	Personal Data is any information relating to an identified or identifiable natural person, such as name, identification number, location data, an online identifier, or to one or more of the characteristic elements of his/her physical, physiological, genetic, mental, economic, cultural or social identity (see also Special categories of personal data).
Distribution Line Carrier (DLC)	System technology used a frequency range of 9 to 500 kHz with data rate up to 576 kbit/s.
General Data Protection Law or LGPD	Brazilian Law No. 13.709/18 issued on 14 August 2018, subsequently amended by Law 13.853/19, which provides for the processing of personal data, including in digital media, by natural person or legal

	entity of public or private law, in order to protect the fundamental rights of freedom and privacy and the free development of the personality of the natural person.
IEC	International Electrotechnical Commission
Legal Metrology Board (DIMEL)	Legal Metrology Board
Low VoltageManager (LVM)	Low Voltage Manager
L1	Phase R
L2	Phase S
L3	Phase T
Metrological Technical Regulation (RTM)	Metrological Technical Regulation
NBR	Brazilian Standard
Personal Data Holder	Natural person to whom the personal data subject to processing refer to. He / she understood as an identified or identifiable natural person.
Power Line Communication (PLC)	carries data on a conductor that is also used simultaneously for AC electric power transmission or electric power distribution to consumers.
Processing	Any operation carried out with personal data, such as those relating to collection, production, reception, classification, use, access, reproduction, transmission, distribution, processing, filing, storage, elimination, evaluation or control of the information, modification, communication, transfer, dissemination or extraction.
PRODIST	Procedures of Electric Power Distribution in the National Electric System
Sensitive Personal Data (including biometric and health data)	In the context of data protection, particular attention deserves the category of personal data concerning racial or ethnic origin, religious conviction, political opinion, membership of a trade union or organization of a religious, philosophical or political nature, to data concerning to health or sex life, genetic or biometric data, if linked to a natural person. These data are defined by the LGPD as Sensitive Personal Data. - Genetic data: personal data concerning the genetic, inherited or acquired characteristics of a natural person which provide unambiguous information about the physiology or health of such natural person, and which result in particular from the analysis of a biological sample of the natural person in question; - Biometric data: personal data resulting from specific technical processing relating to the physical, physiological or behavioural characteristics of a natural person which allow or confirm the unique identification of that person, such as photo, video, facial images or fingerprint data

	Health data: personal data relating to the physical or mental health of a natural person, including the provision of health services, which reveal information about the state of health of that person

7. ENEL GRIDS CODES

METERS									
Item	N of phases	N of wires	Nominal Current (A)	Maximum Current (A)	Nominal Voltage (V)	Operating Voltage (V)	Cut-off Relay (A)	Connection / Communication	Brazil Code
1	2	3	15	120	120/240	0,8Vn a 1,15Vn	120	Direct / PLC	510344
2	3	4	15	120	120/240	0,8Vn a 1,15Vn	120	Direct /PLC	510339
3	1	2 or 3	15	100	120/240 or 240V	0,8Vn a 1,15Vn	100	Direct / PLC	510351
4	1	2	15	100	120/240	0,8Vn a 1,15Vn	100	Direct / PLC	510352
5	1	3	15	100	240	0,8Vn a 1,15Vn	100	Direct / PLC	510388
6	2	3	2,5/5	10/20	120/240	0,8Vn a 1,15Vn	Without	Indirect / PLC	510925
7	3	4	2,5/5	10/20	120/240	0,8Vn a 1,15Vn	Without	Indirect / PLC	510924
8	1	2	15	100	120/240	0,8Vn a 1,15Vn	Without	Direct / PLC Without display	510941
9	3	4	30	200	120/240	0,8Vn a 1,15Vn	Without	Direct / PLC	510943
10	2	3	15	120	120/240	0,8Vn a 1,15Vn	120	Direct / Mesh	510944
11	3	4	15	120	120/240	0,8Vn a 1,15Vn	120	Direct / Mesh	510945
12	1	2	15	100	120/240	0,8Vn a 1,15Vn	100	Direct / Mesh	510947
13	1	3	15	100	240	0,8Vn a 1,15Vn	100	Direct / Mesh	510955
14	2	3	2,5/5	10/20	120/240	0,8Vn a 1,15Vn	Without	Indirect / Mesh	510954
15	3	4	2,5/5	10/20	120/240	0,8Vn a 1,15Vn	Without	Indirect / Mesh	510953
16	1	2	15	100	120/240	0,8Vn a 1,15Vn	Without	Direct / Mesh Without display	510946
17	3	4	30	200	120/240	0,8Vn a 1,15Vn	Without	Direct / Mesh	510950

Concentrator/gateway/access point					
Item	Description	Nominal Voltage (V)	Operating Voltage (V)	Communication	Brazil Code
18	Measuring concentrator	120/240	0,8Vn a 1,15Vn	Mesh	510952
19	Measuring concentrator	120/240	0,8Vn a 1,15Vn	PLC	510971

METERS					
20	**Signal repeater**	**120/240**	**0,8Vn a 1,15Vn**	**PLC**	510956
21	**Signal repeater**	**120/240**	**0,8Vn a 1,15Vn**	**Mesh**	510942
22	**Home Display - PLC**	**120/240**	**0,8Vn a 1,15Vn**	**PLC**	510970
23	**Home Display - Mesh**	**120/240**	**0,8Vn a 1,15Vn**	**Mesh**	510969

Table 1 - Material codes and characteristics

7.1 Constructive Characteristics

7.1.1. General requirements

The meter must have a design that incorporates, as much as possible, the improvements that modern technique suggests, even when not referred to in this specification.

If several units of the same meter are provided in a supply, each meter must be the same and have the same design as the others, with all its corresponding parts identical and interchangeable.

The meter must have a valid INMETRO approval according to RTM 221.

The meter must be approved by ANATEL and with its certificate in force when receiving the equipment, including the certification label on the equipment body.

The meter must have self-diagnostics routines (watchdog) reaching all its internal functional modules.

Measurement records must only consider the fundamental component of the measured electrical quantities (without the influence of harmonics).

The meter must be delivered to the DSO with the energy registers zeroed, including the displayed values, with the exception of meters that undergo final inspection sampling, in accordance with INMETRO's technical metrological regulations.

The meter's power supply must not be considered as consumption of the consumer unit (line-load).

All meter technical literature, operating manuals, catalogs and software must be in Portuguese (Brazil).

The meter must offer sufficient shielding to external electromagnetic fields, so as to ensure stable performance and reliability under normal operating conditions.

The metrological accuracy and functionality of the meter must be immune to strong neodymium magnets of up to approximately 1.2 T (The test must be carried out with 1 (one) magnet of size 50x50x25 mm).

The meter must have a minimum useful life of 13 years with a failure rate of up to 1% p.a.

7.1.2. Electrical requirements

Meters **with direct connection** connection must contain the following characteristics:

- Mono-phase:1 element, 2 wires, 120/240V, nominal current 15A, maximum current 100A.
- Mono-phase:1 element, 3 wires, 240V, nominal current 15A, maximum current 100A.
- Bi-phase model: 2 elements, 3 wires, 120/240V, nominal current 15A, maximum current 120A.
- Three-phase model: 3 elements, 4 wires, 120/240V, nominal current 15A, maximum current 120A.
- Three-phase model: 3 elements, 4 wires, 120/240V, nominal current 30A, maximum current 200A.

Meters **with indirect connection** must contain the following characteristics:

- Bi-phase model: 2 elements, 3 wires, 120/240V, nominal current 2,5/5, maximum current 10/20A.
- Three-phase model: 3 elements, 4 wires, 120/240V, nominal current 2,5/5, maximum current 10/20A.
- The meter must be able to be used both at 120V and at 240V in auto-range (Phase-Neutral) mode.

The meter must come into operation as soon as it is energized, by any of the phases.

The nominal frequency must be 60Hz.

The operating voltage must be between 0.8Vn to 1.15Vn.

The temperature operative range must be from -10 ºC to +70º C.

The temperature storage range must be from -25 ºC to +70º C.

The meter must be able to operate from sea level up to a height, at least, of 2000 meters above sea level.

7.1.3. Measurement Registers

The meter must measure active and reactive energy, even if it must display active energy values only.

The meter must be bidirectional and it must have separate registers for import and export energy. It must have a “ratchet” type recorder for direct energy and a “ratchet” type recorder for reverse energy.

The meter must indicate on the display which phases are energized.

The meter must indicate on the display the direction of energy flow (import or export and, for reactive energy also inductive or capacitive).

7.1.4. Display Requirements

The meter must have an LCD display. The display must be active and showing information whenever the meter is mains supplied.

The display must be composed by two different areas: it must show at least 16 alphanumeric characters in one area and icons (special symbols or operating indicators). The dimension of the alphanumeric characters must not be less than 9 x 3 mm.

Icon's area must show icons related to the following information:

- Quadrant in use
- Measurement unit indication for active/reactive energy/power (kW, kWh, kvar, kvarh)
- Per phase voltage presence
- Per phase current presence and direction (for example, "+" -> import active energy, "-" -> export active energy, " " -> current not present).
- Alarm condition indicator
- Communication Indicator
- Cut-off element open

Display device must be capable of registering, starting from zero, for a minimum time of 1150h, the energy corresponding to the maximum current at the highest rated voltage and unitary power factor.

The display must show the energy quantity (kWh) with 5 (five) full digits.The display must have a viewing angle of at least 120º, and it must be possible to view all the information on the display at a 45-degree angle (horizontal and vertical) from a distance of 0.5 meters.

The display must be able to show all registers, with their respective identification code, at an interval time of 6s for each register.

The meter must display cyclically, the active energy in kWh, with at least the codes 03 and 88 bellow, according to ABNT 14522 standard, at the time of delivery.

Code	Magnitude
03	Import Active energy totalizer
88	Display test

Table 2 – Display code ABNT

In addition, the meter must allow the configuration, locally or remotely, of the display with the codes 01, 02, 04, 06, 08, 103, 104, 106 and 108 bellow, according to ABNT 14522 standard.

Code	Magnitude
01	Date
02	Hour
04	Active energy totalizer "da ponta"

06	Active energy totalizer “intermediário”
08	Active energy totalizer “do fora ponta”
103	Export Active energy totalizer
104	Export Active energy totalizer “da ponta”
106	Export Active energy totalizer “intermediário”
108	Export Active energy totalizer “do fora ponta”

Table 3 – ABNT display code

The meter must allow also other configurations of display messages showed on the display for future implementation.

In particular, it must guarantee the opportunity to display messages related to:

- Firmware version running into the meter
- Checksum of the Firmware version running into the meter
- N° of download of new Firmware performed on the meter
- Date of Last Billing period closure
- Instantaneous Voltage
- Instantaneous Current
- Instantaneous Power
- Instantaneous Frequency

7.1.5. Accuracy Class

Direct Meter: The meter must have an accuracy class equal to 1% (class B) or better according to RTM 221/2022 for active energy measurement.

Indirect Meter: The meter must have an accuracy class equal to 0,5% (class C) or better according to RTM 221/2022 for active energy measurement.

The meter must be able to measure reactive energy with an accuracy class equal to 2% (class B) or better according to RTM 221/2022 for measuring reactive power.

The meter must be able to provide and store in independent registers the following measurands:

- Active (imported and exported) energies per phase;
- Reactive (imported and exported) in the 4 quadrants energies per phase;
- Active and Reactive Power per phase;
- rms voltage and current values (phase and neutral currents with 1% accuracy);
- power factor and phases angle values;
- frequency.

7.1.6. Climat conditions

The meter that has a Type Approval Certificate based on RTM 221/2022 must withstand the climatic conditions established in table 1 of item 2.3.1 of RTM 221/2022

7.1.7. General mechanical requirements

The meter, intended for internal use, must conform to the degree of protection of the Brazilian technical standard ABNT NBR IEC 60529. The metrology compartment must ensure an IP52 protection degree to prevent any access (both intentional and unintentional) to inner components without visibly braking meter case.

The meter must be overvoltage category III according to IEC 62052-31.

The base and the cover of the meters must have the following characteristics:

- polycarbonate suitable for recycling (related symbol must be printed on bigger parts)
- color light resistant
- heat and flame resistant (class V0 in accordance with UL94)

The transparent window (display) must be made with a plastic material that isn't subject to degradation due to direct solar radiations. The transparency of the window must be guaranteed for the whole lifetime of the meter when installed indoor and within rated environmental conditions.

Metal parts of the meter subject to corrosion must be protected and must resist to abrasives substances and normal operating handling.

The assembly, base, terminal block, terminal cover and cover must be realized with insulating and non-

hygroscopic materials. Materials must also be able to withstand high temperatures without deforming during the meter's useful life.

The meter must have a clamping device in the upper rear part for mounting on the measurement panel.

The meter must have two holes in the lower part so that, by means of screws, the mounting on the measurement panel is completed (these screws must be protected by the sealing of the terminal block cover).

7.1.8. Cover

The meter must have a cover constructed and adjusted so that to ensure the perfect operation of the device in normal condition and in cases of non-permanent deformation.

The electromechanical parts of the meter must be assembled in such a way as to prevent any access to the internal electronics without making external damage evident. This means that the base and the cover must be anchored to each other through a process that makes them like a single body avoiding their disassembling. In addition, this process doesn't have to show residues from the joining (such as burrs or damages to the cover and/or base).

The meter cover must be attached to its base throughout its perimeter, so that it is possible to identify a possible opening of the lid.

The meter and other devices must have proper securing in their casing to leave traces in case of an attempt to open the casing. If the meter is opened by any tool, due to thermal shock or mechanical shock, it should not be possible to reassemble the casing (base and/or cover) without leaving any visible marks of tampering (such as cracks, fractures, deformations, breaks, and holes).

7.1.9. Terminal Block Cover

The meter must have the terminal block cover with the inscription "LINHA - CARGA", engraved externally and indelibly.

The terminal block cover must allow the use of an external seal (for more details please refer to section 7.1.16 Seals).

The terminal block cover of the Meter must be made of polycarbonate in a color that allows good visualization of the meter terminals. Moreover, the terminal cover material must comply with NBR 6527 (at 650°C ±10°C for 30s ±1s).

7.1.10. Terminals block

a) The meter must have a terminal block made of insulating material capable of not deforming after the meter has been submitted to the maximum current heating test.

b) The terminal material must comply with NBR 6527 (at 960°C ±15°C for 30s ±1s).

c) The meter must have the terminal block fixed to the base so that it can be removed only by breaking the seals of the meter cover and leaving on the cover the evidence of braking.

d) The meter must have an identification of the neutral terminal position in blue color, on the front face of the terminal block.
e) The meter must not allow the terminals to move inside the meter, regardless of the fastening screws of the connection cables.
f) The terminals must be arranged in the line-load format according to what defined into RTM 221/2022.
g) The meter terminal cross-section must comply with 221/2022.
h) Terminal block must prevent accidental contact or short circuit of any live part.
i) All terminals must be clearly, unequivocally, and indelibly numbered on their front face, from left to right (meter in operating position) showing the function of the connected wires.
j) Terminals and screws set must be dimensioned to resist to a torque of 4 Nm to direct meters.
k) The terminal screws for meters from 30 to 200 A must have screws sized to withstand a torque of 20 N.m;
l) Terminal screws for 30-200 A meters must be of the “allen” type;
m) The screws set must be of the "cross-slotted" type to direct meters.
n) The set of screws and terminals must be made of carbon steel with zinc-nickel.
o) The terminals must be of the drawer type to direct meters.
p) Terminals and communication device (if any) must be galvanically isolated from each other.
q) The meter must have a barrier for housing the terminal screws. In the event of complete loosening of the terminal screw, the barrier should not leave them exposed.

7.1.11. Visual Measurements Indication Device

The meter must have one or two optical test output for verification of energy consumption. If the device has only one optical test output, it must be selectable locally and remotely both active and reactive energy by a push - button or SW.

This output will emit light in the visible spectrum.

This output will allow the user a visual indication of the energy measurement.

7.1.12. Nameplate of the meter

Nameplate of the meter must comply with type approval report “Portaria de Aprovação de Modelo” and it must be agreed with the distribution company.

The name plate of the meter must include a serial number that allows its exclusive identification by the distribution company, be sent by the distribution company, according to the commercial agreements with each manufacturer.

Serial number of the meter must be available also into the meter memory to be available for remote reading and visualization on the display (if required).

7.1.13. Maximumdimensions

The meter must meet the maximum dimensions of the regulations in force (RTM221/2022).

7.1.14. Voltage outages

The meter must be capable of maintaining the internal clock time, configuration and recorded information during a power failure of at least 8.760 hours (365 calendar days).

The meter must be able to record and store, at least, the last 20 Voltage outages for each phase.

The meter must have a routine to automatically return to normal operation mode when power is restored.

7.1.15. Seals

The seal must meet the NIE Dimel -123 standardin addition to the requirements below:

- Every meter must have independent devices for sealing the meter cover, the terminal block cover, and the demand reset device, if any.
- The meter must be capable of including 2 seals (on opposite sides).
- The seal must conform to NIE Dimel-123.
- The sealing holes must not be smaller than 2.0 mm.
- The seals must be semi barrier" type or trank 4.

7.1.16. Firmware requirements

The meter firmware must be compliant with 221/2022 and it must be developed with line and table structure, maintaining its principles of openness, interoperability, efficiency, robustness and communication security.

The meter must support, among the other functionalities, firmware update through remote communication interfaces, complying with the characteristics of the meters offered, subject to prior approval by Enel and with guaranteed support from the supplier during the approval process.

In case the meter support PLC communication it is desirable it must be compatible and interoperable with other devices (smart meters and data concentrators) already installed into the DSO's low voltage network (these devices implement "Meters and More" technology) without having the need to make firmware changes to data-concentrators or having to install new ones.

In case PLC communication is implemented, It is desirable the meter must be able to be a repeater for single phase smart meters already installed into the DSO's low voltage networks (supporting Meters and More communication) and communicate with data concentrator and remote system that are currently used by DSO.

The meter must support a functionality for the optimization of communication paths, for automatic retransmission of messages when they are not received by the data concentrator and for the automatic network configuration and management as for example supported by Meters and More and/or "Wi Sun" protocols.

The meter must allow its remote programming (through PLC and/or RF) and local programming (through optical port) for different applications, such as simple tariffs (single tariff) set, hourly tariffs set, distributed generation, measuring quality indicatorsand others.

Remote and local programming must be done using the same protocol commands.

The Radio frequency meters must also support last gasp/ first breath functionality

The supplier must offer unlimited support for activities related to firmware updating, including communicating any FW changes that may have an impact on the meters already installed.

7.1.17. Security

The meter must guarantee a high level of encryption and authentication, using at least 128 bits AES algorithm. It must be provided with security keys to allow access only to authorized users and prevent the attempt of any unauthorized intervention, whether the access is local or remote.

Keys management must comply with Enel documentation.

The meter must allow the configuration of two secret keys (for authentication and encryption) with at least 16 bytes, one for reading and another for writing, in hexadecimal base (letters, numbers or both) and unique for each single device.

The meter must implement a procedure that locks for a programmable time period the optical communication interface (i.e., blocks of the access to the local meter by means of optical interface) after a programmable consecutive number of failed authentication attempts.

The meter must store the number of failed authentication attempts for each communication interface (PLC/ZVEI) even if the interface results already locked.

The device must guarantee the compliance to all security legal requirements applicable in Brazil for smart meters and Cyber Security Guideline n. 13.

7.1.18. Alarms

The meter must support at least the following sensors that must be monitored by the meter also to activate an alarm:

- Magnetic sensors for the detection of external magnetic fields.
- Sensor to detect removal of the terminal block cover (even with the meter off);
- Sensor to detect current flow with relay open Sensor (or alternative solution) to detect status of the relay (open/closed).
- Sensor (or any other solution) for detecting the presence of voltage on the consumer side. It means that being the customer disconnected (i.e., meter main relay open) the meter must be able to detect the presence of voltage at the “client side”, between any phase and neutral. If the voltage read is greater than a certain threshold when the cut-off device is in open status an alarm must be activated.

The meter must be able to detect and record (or activate an alarm) the following conditions:

- Fault and intervention alarms in the voltage and neutral circuits.
- Event to records Low Voltage Network overvoltage, undervoltage and voltage spikes in real time.
- The meter must generate alarms to identify the events occurring and must allow the alarms status to be extracted locally or remotely.
- Fault in a power supply backup element (necessary to keep the RTC and antitamper circuits running also when the meter is not powered).
- The meters must activate the Electromagnetic Pulse Display Alarm if subjected to any electromagnetic stimulus exceeding what is tested in items 5.7.10 and 5.7.11 of ABNT NBR 14520:2011.
- The Radio frequency meters have to support, among the others, last gasp ad first breath functionalities
- Voltage and storage interruption alarm
- Electricity supply quality alarm.
- Power limit violation alarm with history management in the meter's memory.
- Meter tampering alarm on first commissioning.

7.1.19. Battery

The battery must be a high-quality lithium battery to guarantee its correct operation for 13 years.

The battery must maintain the meter’s internal clock, preserve its programming and detect opening of the terminal block cover, in case of power failure for the entire lifetime of the meter.

The battery must be internal the meter or, if it is external, it must guarantee its functionality for the entire lifetime of the meter and it must be accompanied with the seal specified in 7.1.16.

7.1.20. Communication requirements

The filed devices must implement one or both of the following communication technologies described in the following paragraphs.

Considering the communication technology offered, the manufacturer must demonstrate that have all the experience and documentation necessary to develop autonomously the communication technology in the devices without the need of any documentation support by Enel Grids. A declaration must be submitted by the supplier on this item.

PLC Technology

In case the meter supports PLC communication technology; it must implement a standard communication protocol supporting the interoperability. It is desirable the device implements Meters and More technology so that it can be able to communicate with the data concentrators already installed in field, through PLC interface using band A of communication (according to EN 50065-1) implementing such protocol.

The meter must have a local communication interface (optical), which accepts parameter modification commands and data reading commands, with reserved protection keys (activable/deactivable), according to IEC 62056-21.

The communication protocol used for the local interface must be the same indicated for PLC channel.

The supplier must provide an updated version of the software for local reading and parametrization of the meter.

Mesh Network

In case the meter implements a Radio communication channel, the Communications between the meter, macro-measurements, concentrators/gateway/access point will be done via radio frequency using a mesh network and a standard communication protocol supporting the interoperability (it is desirable WI-SUN technology).

The Radio frequency meters must support, among the others, the Last Gasp functionality so that when an outage of power supply of electrify network occurs it is capable to inform the DSO regarding the outage event before its shut down. First breath must be also implemented,

Communication between the main concentrators and the measurement data management systems of each distributor must be via GPRS modem/standard cellular communication network available in Brazil.

The concentrator/gateway/access point must support remote communication at a logical communication level so that it can be efficiently controlled by Enel's automatic measurement management software.

Each concentrators/gateway/access point must have at least one standard Ethernet communication port in the case of distribution hubs and Open Communication Protocol.

Each concentrators/gateway/access point must act generally as slaves in communication events, that is, they must only respond or execute a command when requested by ENEL's automatic measurement management software.

7.1.21. Non volatile memory

Meter registers must store mass memory at least minus 5 minutes, but the meter must be able to set values for: 5, 10, 15, 30 or 60 minutes.

The meter must have at least 9 channels for load profiles recording. These channels can be configured in order to record load profile of voltage, current, direct and reverse active energy, and direct and reverse reactive energy (Q1, Q2, Q3, Q4).

The meter must be able to set the integration period to the following values: 5, 10, 15, 30 or 60 minutes. Integration period defines how often data must be saved in nonvolatile memory. Considering an integration period of 5 minutes, the meter must store information related to the 9 channels for at least 37 days.

7.1.22. Cut-Off Device

The meter must have an internal relay to allow the power disconnection and reconnect function.

Reconnecting function of the internal relay must be implemented in the following way:

- Automatic (depending on the functionality)
- Protocol command (by remote PLC and/or RF command of Data concentrator).
- Remote command triggered from the customer premises.

The internal relay must not have any parts accessible from the outside.

The meter must have a polyphase cutoff module that allows continuous conduction and switching of loads up to 120A for each phase.

The relay must operate in the ambient temperature range of -10 to 70°C and in the voltage range of 120-240V ± 20%.

The relay must be able to perform 1.000 operating cycles (10 s ON and 20s OFF) at operating voltage (240 V), I max (120A) and PF 1, then, on the same sample 1.000 operating cycles (10 s ON and 20s OFF) at operating voltage (240 V), I max (120 A) and PF 0,5 ind. This test must be done with the relay integrated in the meter completely assembled (endurance test).

The closing of the relay should only be allowed in the absence of voltage on the customer side.

Closing of the relay must only be allowed in the absence of line-side overvoltage

The relay must return to the same condition (open or closed) after irregular events (e.g. blackout).

The relay shall generate information about functionality success or functionality failure beyond the interface of communication.

NOTE: Table 1 lists the material codes that contain the cut and reconnect module.

7.2 Specific requirements

The meter must meet all the requirements of section 7.1 of this document, plus the additional requirements below, when necessary to display the “tarifa branca” energy registers with direct flow and/or reverse flow.

The meter must calculate consumption in at least 4 (four) tariffs (6 tariffs would be preferable to allow any future developments).
The meter must allow the configuration of at least 8(eight) different time slots throughout the day.

The meter must allow the start and end of each tariff band to be programmed.

The must support seasonal configuration to allow the customer to have at least two tariff structures during the year (one for summer and one for winter).

The meter must be able to show the active tariff on the display.

The meter must allow the automatic management (activation and de-activation) of the daylight-saving time (DST). This functionality must be configurable to be disabled or activated in other days of the year compared to the standard ones.

The meter must have sufficient memory to manage at least 20 public holidays (fixed or mobile) throughout its useful life or allow public holidays to be updated remotely, see 7.9.

7.3 Identification

7.3.1. Meter

The meter identification must be provided to the distributor by ENEL before starting the production process. The identification of the meter must be included into the marking of the meter. Marking of the meter must comply with Brazilian regulation and it must include also a QR code.

Markings of the meter must be indelible and easily readable.

The QR-code, printed on the meter, must comply with the following format indications:

- The type of coding to be used is "Alphanumeric".
- The QR code pattern is "Model 2".

The QR-code version to be used is 5 (up to 122 alphanumeric characters can be encoded with error correction level "M"). The meter identification must have the space reserved for the DSO with a minimum of: 12x60mm and a maximum of 15x90mm, while the area for QR code must be at least 19,5x19,5 mm.

The identification must have a contrast that allows reading.

Marking of the meter must include also logo of the DSO, that must be indelibly engraved in monochromatic colors.

The asset number must be engraved in bas-relief and completed with indelible monochromatic ink (according to requirement 7.1.13) alternatively the asset number must be laser engraved or conventionally printed.

7.3.2. Packaging label

Packaging must comply with requirements included in the Enel documentation

The packaging label must be approved by the DSO before starting the production process.

The packaging used for the materials for this acquisition must contain the following information:

a) name or trademark of the manufacturer.

b) Complete identification of the content;

c) Type and quantity;

d) Mass (gross and net) and dimensions of the envelope;

e) Client name;

f) Purchase order number.

7.4 Data concentrator

7.4.1. General characteristics overview

The Data concentrator is a device responsible for the collection of smart meters data from the field and their

following transmission to the remote system throw a standard telecommunication network accessed by means the coupling with a TLC device.

The device must be capable to receive information from the remote system (e.g. commands to be executed by the smart meters, configurations to be applied) and deliver them to the smart meters by means the communication interfaces (PLC and/or RF).

The data concentrators are installed inside the MV/LV electrical transformation substations ("secondary") of the DSO in those cases they support PLC communication.

If the data concentrators implement Radio frequency communication only, they can be installed even externally to the secondary substations (in addition to indoor ones); as consequence they must guarantee an adequate IP protection degree for both installation scenarios (internal / external) .

Data concentrator implement in all cases a local communication interface (e.g optical port) to support the infield activities by the operative people of the DSOs (e.g. first device installation).

The device must be powered by the low voltage distribution network as consequence its rated voltages and frequency values must be in line with the rated voltage and frequency ones of electricity LV networks in Brazil.

The data concentrator must be compliant and certified with all applicable regulations issued by INMETRO, and the other local Brazilian authorities, so that they can be freely installed in field by the DSO. The manufacturer has to provide in particular the list of certifications and certificates of the device in order to provide all the evidences regarding its compliance with all applicable regulations.

Regarding the sizes, the manufacturer has to provide a proposal, before the consolidation of the design, on the dimensions of the device so that they can be evaluated by ENEL, to verify its installation in field, and then approved for freezing the project.

For a Cyber Security point of view the device must guarantee the compliance to all security legal requirements applicable in Brazil for data concentrator and Cyber Security Guideline n. 12.

7.4.2. *Main functionalities*

The Data concentrator must guarantee at least the implementation/management of the following activities/functionalities (in massive and punctual way) for the control of the smart meters communicating with it. In particular the device has to guarantee, by means specific configurations/commands delivered by the remote system and/or local communication interface, the implementation of logics of operation that make efficient and effective the following processes:

- acquisition (daily) of energy and measurement data;
- acquisition of the daily load curves of the meters enabled for hourly/15 minutes processing.
- daily acquisition of data relating to QoS recorded by the meters;
- Census of active underlying meters and automatic acquisition of new installed ones;
- remote updating of software as well as the meter firmware.
- Clock synchronization as well as clocks of the smart meters managed

- acquisition of local cabin alarms;
- detection of alarm and diagnostic data;
- acquisition of alarm and diagnostic data from the meters;
- Configurations of the smart meters managed (e.g. new contract activation, tariff profile switch, etc.)
- Remote connection/disconnections commands delivered by the remote system to the smart meters
- For PLC technology the concentrator must have
- Last gasp/first breath

All the communications managed by the data concentrator (towards the smart meters and the remote systems) must be secured, as anticipated in paragraph 7.1.17, and in line with Enel Policies. The manufacturer must detail in the technical offer all the security measures implemented by the device itself.

7.5 KPIs *and performances*

It is required that the data concentrator implements the right intelligence in order to guarantee the effectiveness of the communication towards the smart meters by means the radio frequency communication channel and/or the PLC one. The manufacturer has to guarantee that in “standard” installation scenarios of the infield devices, it means that the smart meters and the data concentrator are installed by the DSO in line with the indications provided by the manufacturer itself, it will be possible at least to guarantee the following KPIs levels

Effectiveness of remote operations in the installation and technical operations process
- Commissioning/configuration – 100%
- FW update and remote configurations (48h) – 98%
- Last gasp and power up – 98%
- Integration system availability – 99.5%

Effectiveness of remote operations in the commercial process:
- Massive readings of daily data (up-word operations) – 98%
- Disconnection operation (8h) – 98%
- Reconnection operation (4h) – 96%

In those cases such KPIs will not be reached during the devices operations, and in any case during the first deployment, the manufacturer has to provide all technical support necessary (remotely and locally) to guarantee the compliance of the KPIs levels above.

7.6 Probes and tools for local communication with devices

The supplier has to provide, in addition to the infield devices, probes allowing the local communication with the smart meters and data concentrator. These probes must be in line with all applicable regulation (Brazilian ones and international ones) guaranteeing their compatibility with the infield devices offered and the tools available by the infield operators of the DSO,

The supplier has to describe the main characteristics of the probes, providing main technical details, so that

they can be evaluated and approved, if in line with enel needs, by Enel itself.

In addition to the probes the supplier has to provide also the tools supporting local activities over the devices, such as: first installation/activation, FW download, diagnostic collection, customer management, without additional costs (for example SW license payment) for Enel.

7.7 Tests

Suppliers must submit, compulsorily, upon product approval, or at any time, at the request of the DSO, under their responsibility, the following certificates and test reports:

- Ordinance approving model (initial and any modifications).
- Test reports referring to the type approval process at INMETRO, of all the regulations, for which the equipment is approved/mentioned in an approval decree;

All legal certificates need to allow the infield installation of the devices according to national regulation

All tests must be carried out by laboratories accredited to INMETRO and, in the absence of accredited laboratories, the laboratory must have a traceable standard. The tests described in the ordinance 221/2022 will be accepted for delivers.

NOTE: The material must have implemented all technical requirements that were determined during the approval process (TCA). If the material changes, the supplier must inform Enel to prior assessment of the impact on the distribution network. Depending on the change, the supplier must carry out new tests so that the change in material does not compromise the minimum requirements required in this design technique. As provided for in GSCG002, any change in technology, the supplier must carry out a new TCA process with Enel.

Functional tests will be also part of the TCA process. In particular, functional testing will be devided in two phases:

- The manufacturer will send a minimum of twenty prototype units for functional testing in a laboratory environment. The manufacturer may also submit intermediate beta versions to assess various functional aspects, and DSO will provide the necessary technical support. During this phase, hardware and metrological certifications are not mandatory.
- Upon successful completion of laboratory functional tests, the equipment will progress to the second phase of the acceptance process, which involves the installation of a specified number of units, corresponding to a pallet (quantity specified in the logistics requirements), in a field pilot. During this phase, the equipment must fulfil all final certifications. The acceptance phase in the field will extend for a duration of two months from the equipment's installation.

7.7.1. *Type* tests

Type tests to be carried out according to INMETRO Ordinance 221/2022:

a) Dielectric test (applied voltage and dielectric)
   I. Impulse voltage test
   II. Applied voltage test
b) Meter start-up test

c) Verification test of the active energy calculation method
d) Starting current test
e) Idling test
f) Current variation test
g) Ambient temperature influence test
h) Internal loss verification test
   I. Potential circuit and power supply test
   II. Current circuit test
i) Voltage variation influence test
j) Frequency variation influence test
k) Test of influence of harmonic component in voltage and current circuits
l) Phase sequence inversion influence test
m) One or two phase interruption influence test
n) Influence test of the DC component (1/2 wave) in the AC current circuit
o) Influence test of external DC magnetic induction
p) External AC magnetic induction influence test
q) Influence test of the operation of internal devices
r) Communication interface influence test
s) Short term overload test
t) Self-heating test
u) Heating test
v) Sudden voltage variation test
w) Display test
x) Autonomy time verification test
y) Electromagnetic compatibility tests
z) Combined impulse test
aa) Electrical transient test
bb) Electrostatic discharge immunity test
cc) Immunity test to radiated radio frequency electromagnetic fields
dd) Immunity test to radiated radio frequency electromagnetic fields
ee) Immunity test to short interruptions and voltage drops
ff) Conducted radiofrequency electromagnetic fields immunity test
gg) Moist heat cyclic test

hh) Odd harmonic influence test

ii) Subharmonic influence test.

jj) Meter clock accuracy

kk) Meter clock accuracy with operative reserve

ll) Influence of temperature on meter clock accuracy

mm) Influence of electromagnetic disturbances on the accuracy of the meter clock

nn) Display test by tariff stations

oo) Exchange test and registration of tariffs

7.7.2. *Additional tests*

The special tests are complementary to the type tests and must be complied with by the supplier.

a) Flammability test for plastic parts, following UL94 V0, according to IEC 60695-11.

b) Test to ensure compliance with the IP protection degree, according to NBR IEC 60529.

c) Test report for relay endurance according to requirement included in section 7.1.23

d) ANATEL Certificate of the product with its respective number

e) Sudden temperature variation test (NBR 14520)

f) Overvoltage test as established in this document

g) Terminals according to NBR IEC 60695-2-13

h) Firmware integrity test

i) Metallography test (ipc-a-610 acceptability of electronic assemblies)

The tests below for meter approval will be carried out, at the discretion of the ENEL group, in its own facilities or in laboratories indicated by it.

a) Vulnerability tests:

1. Analysis of the Influence of External Magnetic Fields (The test will be carried out with 1 (one) magnet neodymium strong of size 50x50x25 mm);
2. Analysis of the Mechanical Parts of the Meter;
3. Analysis of Internal Access through the Cover;
4. Analysis of Internal Access through the Meter Base;
5. Analysis of Internal Access by the Terminal Block;
6. Analysis of Tampa Solidarity;
7. Analysis of Cover Screws;
8. Seals;
9. Display Analysis.

b) Accuracy test, according to Inmetro Ordinance 221/2022;

c) Display test, according to NBR 14520.

d) Display test, exchange and registration of tariff stations, according to Inmetro Ordinance 221/2022 (if the meter has an hourly tariff)

e) Functional Tests (cyclic test of the display, analysis of the displayed channels, indication of phases and lack of phases, test of indication of reverse flow, test of indication of leds, indication of quadrants (if available), test of connection of cables for the biggest section)

f) Interoperability with other devices (smart meter and data concentrator) used by the DSO (see section 7.1.17);

g) Communication tests to ensure integration to the system used by the ENEL group for measurement and functionalities management. During integration into the Enel system, the supplier must provide all necessary technical support.

h) Other tests may be carried out or requested to be carried out by the supplier, by the DSO, in addition to those mentioned above, if deemed necessary.

i) The supplier must perform accelerated life testing on the devices to ensure the designed service life.

In addition to the previous tests (carried out to ensure product compliance with mandatory regulations in Brazil and with requirements included into this document) meters must comply with requirements included in the document “Tests and Test Conditions of Static Meters (GSSMC001).

7.7.3. Acceptance *tests*

Receipt tests will be carried out in accordance with INMETRO Ordinance 221/2022;

a) visual inspection of correspondence to the approved model;

b) general inspection of the system or meter;

c) applied voltage test;

d) accuracy test;

e) starting current test;

f) control test of functions and magnitudes with temperature increase;

g) testing of auxiliary circuits, if applicable;

h) testing to verify the lower limit of the operating voltage;

i) display test;

j) software integrity verification test, if applicable; It is

k) clock accuracy test (for multiple billing systems or meters).

l) The supplier must develop the integration platform with Enel's operating system, carrying out all tests to certify the full functioning of the proposed system.

7.7.4. Production process and Sampling

Before starting production, manufacturer must guarantee that “Product Qualification Test” and “Accelerated Life Test” are done according to requirements included into the document “GSSMC002”.

Production process of meter must comply to Brazilian standards and regulation, and it must be constantly monitored to ensure the quality and reliability of the produced meters over time.

The sampling plan of the DSO must consider inspection level II for a NQA of 1%. Depending on the batch size, the inspection must consider sampling plans.

The procedure for monitoring the production process quality must be agreed with the DSO before the award of the tender. At least it must include the following test steps during production process:

- In Circuit Tests (ICT)
  These parametric tests must be done on 100% of produced boards, at least on the principal boards (boards performing power supply, measurement and data management).
  During technical evaluation of the tender procedure, specific boards to be checked at ICT will be defined for each bidder.
- Functional test at circuit level (Functional Circuit Test - FCT)
  These functional tests must be done on 100% of produced boards at least on the principal boards (boards performing measurement and data management).
  During technical evaluation of the tender procedure, specific boards to be checked at FCT will be defined for each bidder.
- Functional test on assembled meter (FMT)
  These tests must be done on 100% of produced meters to verify at least the main functionalities required in section 7.1)
  During technical evaluation of the tender procedure, main functionalities to be checked at FMT will be defined for each bidder.
- Calibration of 100% of produced meters
- Verification of the accuracy of 100% of produced meters after calibration process. This process can be performed on the same calibration's rack and it is preliminary and independent from the sampled required accuracy verification required by Brazilian Regulation.
  Verification benches for calibration and sampled verification must be realized by two different suppliers.
  During technical evaluation of the tender procedure, load points to be verified will be defined for each bidder.
- The areas dedicated to calibration and sampled accuracy verification for acceptance test equipment are installed must be controlled in temperature and humidity:
  - Environmental temperature = 23° C ±2° C
  - 20% < RH < 75%

7.7.5. Further documentation to support the TCA process

With regard to each Field Device, the manufacturer must deliver all the technical documentation listed below, necessary for the fully autonomous management of the functionalities of the products supplied as updated from time to time, in the event of any HW and/or SW modification developed by the manufacturer - through the Technical Conformity Assessment process - and with a guarantee of confidentiality by Enel for the management of such documents. The following is a list of documents that must be considered an integral part of the TCA process in addition to the documentation necessary for the tests and certifications indicated in the previous paragraphs:

- Functional technical specification of the devices describing HW and SW operation

- Technical specification of the communication protocol describing the procedure and the structure of the messages exchanged between the filed devices ;
- Technical specification of the communication protocol describing the procedure and the structure of the messages exchanged between the filed devices and remote system allowing the integration of the device into Enel remote systems;
- Software Default values specification
- Identification parameters specification allowing their integration from a supply chain point of view;
- Adress communication programming;
- Secret key management;
- Release notes;
- Installation requirements;
- Software to support problem determination and diagnostic analysis

The documents will be managed in accordance with the provisions of MAT-O&M-NCS-2021-0033-EGIN through the use of the MLM system.

7.8 Transport, packaging and conditioning

Provide packaging that aid the circular economy and the environment, i.e.:

- Use of reusable packaging;
- Packaging made with recycled raw material.

The material must be packed so as to prevent the penetration of water and contain the identification referred to in 7.3.2.

7.9 Supply

For the supply to DSO, a prototype must be homologated in advance.

7.10 Warranty

The equipment, as well as its components and accessories must have a factory warranty for the minimum period 5 years or as indicated in the acquisition processes, against any manufacturing defect, counted from the date of delivery.

The equipment must have a failure rate of up to 1% per year throughout the warranty period and if this rate exceeds the limit of 1.00%, the supplier must automatically extend the guarantee for another 12 months, up to a limit of 7 years.

The meter must have a minimum useful life of 13 years.

The mm2 must have a useful life of at least 13 years with the meter installed and at least 3 years if the meter is installed is not installed.

The equipment must have 1 (one) year of local technical support to resolve problems, if necessary.

The supplier must provide the necessary support for the installation and use of the equipment.

7.11 Guaranteed Technical Characteristics – CTG

8. Annex – Services for AMI Infrastructure Development

8.1 Objective

The objective of these services is to ensure the successful deployment, operation, and ongoing support of the Advanced Metering Infrastructure (AMI). They focus on providing a robust design, effectiveness in corrective and evolutionary actions, and continuous performance optimization. By ensuring system efficiency, reliability, and compliance, these services drive extended technological optimization and improved operational effectiveness.

8.2 Purpose

The aim of these services is to establish comprehensive sustainability for the implementation and upkeep of a fully functional and robust AMI infrastructure. This includes:

- Remote and, if necessary, technical analysis in the field to ensure the best performance of the solution taking advantage of the availability of the power grid.
- Agility to solve any problems, under standard emergency conditions, to reestablish the best performance of the solution.
- Specialized technical support created to solve complex corrective or evolutionary problems that may appear in system operations, then firmware and hardware ensuring identification of components and replacements to correct defects.
- Internal training with the objective of professionals to be able and with the necessary knowledge to manage and maintain the AMI effectively functional, ensuring operational efficiency and technological adaptation.

8.3 Scope of Services

8.3.1. Technical Design and Planning

Develop the AMI project and plan, assisting the DSO in its execution and implementation. Ensure the integration of hardware and firmware developments, maintaining functional interoperability for the DSO's remote management operations.

Conduct, in collaboration with the DSO, a comprehensive analysis of the system infrastructure, telecommunications, technical environments, equipment, and existing power grid, to define the AMI implementation model, ensuring compliance with technical requirements and maximum interoperability.

The supplier is also responsible for supporting the selection and quantification of necessary components/field devices, such as smart meters, concentrators, gateways, filters, access points, antennas, management software, protocols and

other items that are part of the AMI infrastructure.

The supplier must be available for site visits to validate preliminary planning, evaluate performance, and address interference issues related to PLC and/or RF technologies, including noise and signal coverage.

8.3.2. Technical Help Desk Services

Provide extended support for analysis and diagnosis of the solution, both during and after implementation, enabling contact with the supplier to report damages, failures and/or manufacturing defects, and initiating the problem resolution process.

The service must be available preferably by telephone and/or chat through an application provided by the supplier, ensuring call logging and ticket creation to comprehensively address technical issues. The supplier must maintain full control over service requests, enabling efficient ticket management.

The support must cover all aspects of the AMI infrastructure, including smart meters, peripheral equipment, middleware, system integration for data management, firmware, hardware, telecommunications, and protocols.

Additionally, the service must allow remote issue resolution and technical interventions to restore system health (AMI), including configuration of remote devices, troubleshooting commissioning issues, performance degradation, and firmware-related analysis and solutions

8.3.3. Analysis and Development Services

If performance issues are identified during the project implementation or the contractual period, the supplier must intervene promptly and proactively to solve them, ensuring operational normalization and compliance with the established KPIs, as well as facilitating the integration of devices into the system (HES), providing also technical support, allowing interoperability at all the possible levels of integration for DSO.

The supplier must act immediately, in case of:

a) Design or planning error that partially or wholly compromises the performance of the AMI.

b) Technical failures in hardware, firmware, or operating system (MDC/HES), if provided.

c) Bursts due to signal levels, noise, protocols, firmware, and gateways.

It will be up to the supplier to offer extended support to the AMI solution, meeting any need for evolutionary improvement of the DSO that involves technology, equipment and devices/hardware and software (MDC/HES) considering the scalability acquired.

Analysis and diagnostic

It will be up to the supplier to have a laboratory and operational structure capable of analyzing and diagnosing problems of failures and defects in equipment, devices (hardware and firmware), integrations and systems. This includes proactively and reactively actions, at the request of DSO.

Activities:

a) The service must have mobility for field inspections.

b) The service must monitor and manage instabilities in solutions and technologies.

c) The service must develop and apply corrective solutions in compliance with the DSO's rules, ensuring the proper functioning of the solution and preventing business disruptions.

d) The supplier must always provide detailed reports of the analyses, diagnoses and solutions applied, keeping the DSO duly informed.

e) The service must include corrective actions for firmware and/or hardware for all devices that are part of the technology.

Improvement and enhancement

It will be up to the supplier to offer extended support for the AMI solution, addressing any evolutionary improvement needs of the DSO that involve technology, equipment, devices (hardware and firmware), and system (MDC/HES), if provided. This includes supporting scalability.

Activities:

a) The service must cover planning, development, implementation and monitoring of improvements and enhancements.

b) The service must offer evolutionary support and development for firmware, middleware, hardware and software.

c) The service must allow alarm improvements at the level of devices/hardware and software according to the structure of the AMI solution.

d) The service must cover integration interfaces of the AMI solution and, when integrated, HES/MDM software.

The supplier, when dealing with defects, failures, technical and evolutionary problems, whether as a member or solving agent, must provide all information about the functionalities of the technology and protocol, to allow the full solution of the problem under treatment or in evolution.

8.3.4. Technical training and continuous update for installations

It will be up to the supplier, as the manufacturer of the equipment and responsible for the contracted technology, to develop a modular and comprehensive training plan, online or on site, to ensure that the DSO acquires full knowledge of the AMI solution at all operational levels, guaranteeing its proper functionality. This training should be designed in collaboration with the DSO to maximize knowledge transfer and practical application.

Training application structure:

a) The service must provide recorded distance learning visual materials and downloadable virtual handouts.

b) Training must cover all aspects of the technology, including equipment, devices/hardware, software purchased, and any improvements or corrective measures implemented

(i) The courses should be modular, structured into key topics: Understanding equipment/hardware and firmware functionalities.

(ii) Operational knowledge, such as commissioning, failure analysis, alarms, and troubleshooting, etc.

(iii) Technical knowledge of interfaces and integrations between technologies and implemented solutions.

(iv) Field installation procedures for devices and equipment.

Additionally, this service must also ensure that the DSO remains up to date with the latest technologies, new standards and best practices in the industry.

8.4 Service Level Agreements (SLAs)

8.4.1. Response Time Targets:

- **Technical Design and Planning:**

  Taking charge of the request within 1 working day from the registration of order/ticket.

- **Technical Help Desk:**

  Taking charge of the request within 1 hour from the registration of order/ticket.

- **Analysis and Development:**

  Taking charge of the request within 1 working day from the registration of order/ticket, for every service.

8.4.2. Resolution Time Targets:

- **Technical Design and Planning:**

  Resolution or workaround within 5 working days from taking charge of the order/ticket.

- **Technical Help Desk:**

  Resolution or workaround within 8 hours from taking charge of the order/ticket.

- **Analysis and Development:**

  Analysis and diagnostic:

  Initial assessment and feedback within 3 working days from taking charge of the order/ticket.

  Response to design changes or provide update solutions within 5 working days of defect analysis feedback.

  Improvement and Enhancement:

  Response to requests for design changes or updates within 5 working days from taking charge of the order/ticket.

  Implementation timelines may be subject to project complexity and agreement with the client.

8.4.3. Service Quality Metrics:

- **Stability of the solution:** in any case of applied solutions and/or firmware changes that compromise performance and create instability in the AMI, contingency actions must take place within 4 hours of registering the incident ticket to guarantee the performances defined in the present document.
- **Mean time between failures:** For equipment with repeated failures and/or software and firmware changes, the time the equipment is inoperable for a new repair must not exceed 73 hours.
- **Resolution Rate:** Achieve a resolution rate of at least 97% for requests or reported incidents within the defined SLA timeframes.

8.5 Responsibilities

8.5.1. Service Provider

- **Qualified Personnel**: Deployment of certified and experienced technical staff with expertise in system architecture and diagnostics.
- **Availability**: Ensure continuous availability of technical support services, including remote interventions.
- **Reporting and Documentation**: Detailed incident reports, diagnostics data, root cause analysis, and action plans for each intervention.
- **Tools**: Provide tools for real-time monitoring and configuration of device parameters, ensuring optimal performance and proactive issue resolution. It is designed to support AMI infrastructure components, smart meters, peripheral equipment, and middleware.
- **Generation of service:** order and/or ticket formalizing the request for the service.
- **Guaranteed AMI System Operation**: Total guarantee of operation of the equipment and software supplied to AMI, including smart meters, concentrators, probes, filters, repeaters, measuring equipment and other items that are part of the AMI infrastructure.
- **AMI Support and Optimization**: Support, fault handling, development and implementation of corrective actions or improvements throughout the structure of the AMI in operation, ensuring the complete coverage of the solution and the DSO meeting the technical and commercial needs, considering the scalability of the technology.
- **Technology Knowledge Transfer**: Transfer of operational knowledge of the technology to DSO, complete technical guidance on the solution, covering hardware, software and connected devices, as well as the flexibility to provide the solution's operating information, allowing the possibility of interfaces between technologies and inter-solutions, allowing interoperability at the possible levels of integration for DSO.

8.5.2. Client

- **Access Provision**: Provide remote and physical access to systems, devices, and relevant documentation as required.
- **Issue Reporting**: Timely reporting of issues with detailed information for effective diagnosis.
- **Cooperation**: Facilitate communication and collaboration with in-house teams to support troubleshooting efforts.