

ANNEX 1.2: TECHNICAL SPECIFICATIONS

LOT 2 - PRIME 1.4 Data Concentrators

I. BACKGROUND:

Under the "Accelerating a Just Energy Transition in the Republic of Moldova" (JET) Programme, UNDP has been supporting the Government of Moldova, under the leadership of the Ministry of Energy, in piloting Advanced Metering Infrastructure (AMI) as a foundational measure for energy efficiency, rational consumption, evidence-based tariff reform, and alignment with EU energy legislation.

This support is anchored in two key national policy frameworks: the National Integrated Energy and Climate Plan (NECP) 2025–2030, which under Policy Measure PM_EE5 explicitly quantifies smart metering as a binding energy efficiency measure and directly references the UNDP pilot as the national implementation reference; and the National Programme for Digital Transformation of the Energy Sector 2026–2030, approved by the Government of Moldova in October 2025, which sets a binding target of 500,000 smart meters deployed by 2030, covering at least 40% of residential consumers. Both frameworks are further underpinned by Moldova's legal obligation under the Electricity Law No. 164/2025, which fully transposes EU Directive 2019/944/EU on the internal electricity market and establishes a national smart metering rollout target in the future.

Under the First Financing Arrangement (2024–2025), funded by the Government of Italy, UNDP implemented an initial Smart Metering Pilot Phase covering more than 40,000 electricity consumers across Moldova's two licensed Distribution System Operators (DSOs) — Premier Energy Distribution (south-central grid area) and RED Nord (northern grid area).

Building on this operational evidence base, the Pilot has been scaled up under additional Financing Arrangements with the Government of Italy (2025–2028), supporting the deployment of smart metering to an additional 65,000 consumers across both DSOs, applying the validated technical architecture and sampling methodology developed during the Pilot Phase. This scale-up is expected to reach at least 100,000 consumers by 2027, achieving 20% of the national target established under the National Programme for Digital Transformation of the Energy Sector 2026–2030.

The reliable real-time collection and forwarding of consumption data from smart meters to the Head-End System is contingent on the performance, interoperability, and scalability of the Data Concentrator infrastructure. Data Concentrators / Gateways are the central hardware component of the AMI architecture, managing PRIME PLC networks at the low-voltage level, aggregating meter data, and providing secure backhaul communication to the HES across both DSOs' grid areas.

II. SCOPE OF PROCUREMENT:

This procurement covers the supply and delivery of 495 new, unused, production-grade PRIME 1.4 certificated Data Concentrators for low-voltage PLC networks, to be deployed across the grid areas of Moldova's two licensed Distribution System Operators — Premier Energy Distribution and RED Nord.

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The scope includes:

- Data Concentrators with embedded PRIME OFDM PLC modem/base-node function;
- Firmware, configuration files and applicable software licenses;
- Certification evidence, technical documentation, and installation manuals;
- Sample units for pre-award laboratory verification, if requested;
- Factory Acceptance Testing (FAT) support; and
- Mandatory training on operation and maintenance for direct beneficiaries (distribution system operators).

Installation, site works, and Head-End System (HES) implementation are excluded from this procurement and are addressed under separate arrangements.

III. TECHNICAL SPECIFICATION:

ID	Category	Requirement	Minimum technical specification	Evidence required
GEN-01	Scope	Equipment scope	Supply of 495 new, unused, production-grade PRIME 1.4 Data Concentrators for LV PLC networks, including embedded PLC modem/base-node function, backhaul communications, firmware, documentation, and optional training/sample units. No installation or HES implementation services unless explicitly requested.	Technical datasheet, product code, firmware version, delivery scope statement
GEN-02	Architecture	Open multi-vendor architecture	The DC shall operate in an open PRIME ecosystem and shall not impose proprietary lock-in preventing future onboarding of PRIME-certified meters or gateways from other vendors.	Interoperability statement; supported meter families; API/protocol documentation
GEN-03	Certification	PRIME certification	The offered DC shall be PRIME Alliance certified or shall have equivalent accredited lab certification evidence accepted by PRIME Alliance for the exact hardware/firmware profile offered. Also should be compliant with STG 4.0 (Spanish specification) for DC	PRIME certificate/report or accredited lab report; certificate must match offered model and firmware
GEN-04	Compatibility	PRIME 1.4 with backward compatibility	DC shall support PRIME Specification v1.4 and shall support interoperability/backward compatibility with PRIME v1.3.6 service nodes/meters in mixed or phased migration networks.	Certificate, manufacturer declaration and/or lab/interoperability test report proving PRIME 1.4 operation and 1.3.6 compatibility PRIME 1.4 certificate; optional backward compatibility evidence
GEN-05	Standards	ITU/IEEE reference	The PLC implementation shall be aligned with ITU-T G.9904 for PRIME networks and shall support coexistence mechanisms consistent with relevant narrowband PLC	Standards compliance matrix

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ID	Category	Requirement	Minimum technical specification	Evidence required
			standards including IEEE 1901.2 where applicable.	
ELE-01	Electrical	Nominal voltage	Nominal operating voltage: 230/400 V AC +/- 20%, suitable for three-phase LV transformer/substation installation.	Datasheet; type-test report
ELE-02	Electrical	Supply voltage range	Supply voltage range shall be at least 85-460 V AC or wider, with automatic restart after voltage recovery.	Datasheet; test report
ELE-03	Electrical	Frequency	Rated frequency: 50 Hz +/-2%.	Datasheet
ELE-04	Electrical	Power consumption	Maximum active consumed power shall not exceed 12 W; average total apparent consumption shall not exceed 30 VA, or bidder shall justify lower/higher values with efficiency data.	Datasheet; power consumption declaration
ENV-01	Environment	Operating temperature	Operating temperature range shall be at least -25 C to +70 C.	Datasheet; type-test report
ENV-02	Environment	Storage temperature	Storage and transportation temperature shall be at least -40 C to +85 C.	Datasheet; type-test report
ENV-03	Environment	Humidity	Maximum relative humidity up to 95%, non-condensing, or equivalent environmental classification suitable for indoor substation cabinets.	Datasheet; environmental test report
ENV-04	Environment	Ingress protection	Minimum IP54 protection for the DC enclosure when installed as specified; bidder to state if IP rating requires cabinet mounting or additional enclosure.	Datasheet; IP test certificate
ENV-05	Environment	Mechanical protection	Minimum IK08 mechanical impact protection or better; polycarbonate or equivalent self-extinguishing, UV-stable enclosure material.	Datasheet; material declaration
EMC-01	EMC / Safety	Impulse voltage	Impulse voltage withstand: 12 kV, 1.2/50 us, 40 ohm between power circuits and neutral combinations; 6 kV, 1.2/50 us, 500 ohm between phases/neutral/earth, or equivalent IEC-compliant test profile.	Type-test report
EMC-02	EMC / Safety	Radiated immunity	High-frequency radiated field immunity per IEC 61000-4-3, minimum 10 V/m or better.	EMC test report
EMC-03	EMC / Safety	Electrostatic discharge	Electrostatic discharge immunity per EN/IEC 61000-4-2, minimum 15 kV air discharge where applicable.	EMC test report
EMC-04	EMC / Safety	Fast transients	Electrical fast transient/burst immunity per IEC 61000-4-4, minimum 4 kV.	EMC test report

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EMC-05	EMC / Safety	Surge immunity	Surge immunity per IEC 61000-4-5, minimum 6 kV or equivalent LV substation requirement.	EMC test report
EMC-06	EMC / Safety	Insulation protection	Insulation protection Class II or equivalent safety design suitable for LV network installation.	Safety certificate; design declaration
LIFE-01	Reliability	Lifetime	Mean lifetime shall be not less than 15 years under specified environmental conditions.	Manufacturer declaration; reliability model
LIFE-02	Reliability	MTBF	Mean time between failures shall be at least 100,000 hours under normal operating conditions; bidder shall state annual failure rate and warranty replacement process.	Reliability calculation; warranty terms
PLC-01	PLC PRIME	OFDM PLC base node	The DC shall operate as a PRIME OFDM PLC base node for LV networks and manage service nodes/meters connected over the power line.	Architecture description; PRIME certificate
PLC-02	PLC PRIME	Bands and band planning	Support CENELEC band and FCC band operation.	Supported bands declaration; regulatory certificates
PLC-03	PLC PRIME	Robust mode and adaptive operation	Support robust mode/adaptive operation available in PRIME 1.4 to improve communication in noisy LV environments.	Feature statement; test results
PLC-04	PLC PRIME	Auto-discovery and repeating	Support automatic discovery/registration of meters and route/repeating mechanisms for LV PLC communication.	Network management documentation
PLC-05	PLC PRIME	PLC signal injection	DC shall inject PLC signal into all three phases simultaneously or provide an equivalent engineering solution with phase coupling/phase management ensuring three-phase LV coverage.	Design statement; installation manual
PLC-06	PLC PRIME	Scalability	Support at least 1,000 end-point devices/service nodes, subject to engineering design and traffic profile, with recommended design not exceeding operator-approved loading and with minimum 30% headroom for planned topology.	Capacity test report; sizing assumptions
PLC-07	PLC PRIME	Communication quality metrics	Provide PLC quality metrics including registered nodes, topology, route quality, SNR/link quality where available, retries, unreachable meters, and last communication time.	HES screens/API samples; data model

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ID	Category	Requirement	Minimum technical specification	Evidence required
NET-01	Network management	Two-way communication	Full two-way communication: transmitting metering data, events and alerts to HES/MDC, and transmitting commands/configuration from HES/MDC to meters.	Protocol description; interoperability test
NET-02	Network management	Endpoint management	Automatic detection, registration, authentication, de-registration and lifecycle status management of end-point devices within the network.	Device lifecycle workflow; test report
NET-03	Network management	Outage function	Support last gasp or equivalent outage notification where power and network conditions allow, and event reporting after restoration if immediate sending is not possible.	Functional description; test plan
NET-04	Network management	Addressing modes	Support unicast, broadcast and multicast transmission modes for commands/configuration where permitted by HES and security policy.	Protocol implementation statement
DATA-01	Data collection	Collection modes	Data collection shall be supported on request, by pre-set schedule, and on event occurrence.	Functional description; HES/MDC interface evidence
DATA-02	Data collection	Data buffering	All received data shall be written immediately to non-volatile memory. DC shall buffer meter reads/events during backhaul outage and forward on recovery without data loss within stated memory limits. a minimum autonomy threshold (e.g. min. 60 days of profiles at 15 min + billing values).	Memory capacity; buffering test result
DATA-03	Data collection	Long-term storage	Provide long-term non-volatile storage sufficient for operational continuity during backhaul interruptions; bidder shall state capacity in days/events/meters.	Memory specification; sizing calculation
TIME-01	Time	RTC accuracy	RTC accuracy shall be 0.5 s/24 h at 25 C according to IEC 62052-21.	Type-test/datasheet
TIME-02	Time	Temperature drift	Timekeeping variation from -40 C to +70 C shall not exceed +/-0.1 s/C/24 h, or bidder shall provide equivalent RTC performance.	RTC datasheet/test report
TIME-03	Time	NTP and daylight saving	Support Network Time Protocol (NTP) synchronization, backup-supply mode timekeeping and automatic daylight-saving time changeover where configured.	Configuration guide

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IF-01	Interfaces	Ethernet	2 Ethernet ports for LAN/WAN communication, minimum 10/100 BASE-T IEEE 802.3 compliant.	Datasheet
IF-02	Interfaces	Cellular backhaul	Integrated or modular cellular backhaul with private APN/VPN support shall be available if required by operator topology.	Backhaul module datasheet; antenna details
IF-03	Interfaces	Local management	Secure local management via Ethernet/serial/USB as applicable; default passwords must be changed during commissioning.	User manual; security guide
METER-01	Balance metering	Integrated or external balance meter support	Support a transformer-connected balance meter as an integral part of the DC or via external connection, enabling transformer/LV feeder balance measurements and power-quality supervision if required.	Design option; meter interface list
METER-02	DLMS/COSEM	DLMS/COSEM support	DC shall communicate with meters using DLMS/COSEM profiles and OBIS codes, with standard data models and open protocols.	Protocol implementation statement; object list
SEC-01	Cybersecurity	Secure communication	Provide secure data transmission based on DLMS/COSEM authentication/encryption and secure backhaul communication.	Security architecture; cipher suite list
SEC-02	Cybersecurity	Encryption	Support AES-128 or stronger cryptographic protection for applicable communication layers; AES-GCM-128 or equivalent authenticated encryption.	Security declaration; compliance matrix
SEC-03	Cybersecurity	Backhaul security	Support HTTPS/TLS and VPN tunneling, including IPSec or equivalent, with private APN/VPN operation for cellular backhaul.	Network security guide; certificates
SEC-04	Cybersecurity	Access control	Support role-based access rights, unique credentials, no shared default production credentials, and auditable administrative access. Blocking function after N failed attempts.	Access control model; sample audit logs
SEC-05	Cybersecurity	Firmware protection	Firmware shall be protected against unauthorized modification. Remote firmware update shall use signed packages, integrity checks and rollback/recovery procedure.	Firmware security statement; update test
SEC-06	Cybersecurity	Tamper protection	DC case and terminal block opening sensors, continuous monitoring including backup mode where available, and sealing arrangement with at least two protective seals.	Mechanical design; event list

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SEC-07	Cybersecurity	Audit logs	Maintain and export logs for login/access, configuration changes, firmware updates, communication faults, tamper events and critical commands.	Audit log sample; retention configuration
MGMT-01	Remote management	Remote parameterization	Support remote parameterization/configuration via HES/MDC and local parameterization via secure local interface.	User guide; test case
MGMT-02	Remote management	DHCP/static IP	Support DHCP and static IP configuration.	Network configuration guide
MGMT-03	Remote management	Web interface	Secure web interface may be used for parameterization, protected by HTTPS, role-based access and disable/enable control by administrator.	Web UI security guide
MGMT-04	Remote management	Firmware update	Support remote DC firmware update via HES/MDC and/or secure web interface; scheduled automatic update from approved URL may be supported but shall be controllable and logged.	Update procedure; rollback evidence
MGMT-05	Remote management	Managed meter firmware update	Support managed remote firmware update workflow for connected meters where permitted by meter/HES functionality and security policy.	Workflow evidence; supported meter list
MGMT-06	Remote management	Schedule reboot	The system shall support automated, scheduled reboots based on a user-defined, programmable calendar (e.g., daily, weekly, or monthly configurations). The reboot process must trigger automatically without requiring manual operator intervention.	a scheduled reboot must send a message to the HES and a register in the dc log.
LED-01	Indications	Status LEDs	LED indications shall show status of LV/PLC, Ethernet, RS-485, power supply and UPS/external backup where applicable.	Front panel drawing; user manual
EVENT-01	Events and alarms	Event handling	Continuous real-time control of DC current state: registration/unregistration, power failures, tamper, communication events, firmware update and device health.	Event catalogue; OBIS/event mapping
EVENT-02	Events and alarms	Immediate alarm notification	Immediate notification to HES/MDC in case of critical alarms where backhaul is available; otherwise buffered and forwarded after recovery.	SLA statement; test results
EVENT-03	Events and alarms	Timestamps	All events and data records shall include timestamps synchronized to network time and traceable in local time/UTC as required.	Data model; sample event export

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BACKUP-01	Backup power	External connection	Provide possibility to connect external backup power supply.	Wiring diagram; electrical spec
BACKUP-02	Backup power	Backup mode functions	During backup supply mode, maintain RTC, tamper monitoring, event storage and controlled notification where communications are available.	Functional description; test report
DES-01	Design	Connection diagram	Connection diagram shall be printed on the nameplate or permanently affixed inside the enclosure, and included in installation manual.	Sample label; installation manual
DES-02	Design	Identification	Device shall include durable nameplate with manufacturer, model, serial number, firmware/hardware version, voltage rating, certification marks and barcode/QR asset ID.	Nameplate sample
DOC-01	Documentation	Documentation package	Supplier shall provide datasheets, installation manual, configuration guide, safety instructions, protocol implementation statement, event list, DLMS/COSEM object list, cybersecurity guide, certificates and warranty documents.	Document list with sample extracts
DOC-02	Documentation	Language	Documentation shall be provided in English; local-language quick installation/safety guide may be requested.	Document samples
ACC-01	Acceptance	Pre-award sample test	Visual inspection, nameplate and labelling check, power-up and status verification, local management interface access, PRIME 1.4 base-node operation and registration of a certified PRIME 1.4 meter, DLMS/COSEM data readout through the DC, event reporting, WAN connectivity and HES communication check, clock synchronization, firmware version readout and update verification, cybersecurity baseline check — if requested by UNDP.	Commitment to sample testing participation
ACC-02	Acceptance	FAT	Factory acceptance shall verify hardware/firmware version, certificates, PLC registration, HES/MDC connectivity, data reads, event reporting, security baseline and firmware update.	FAT plan and checklist