

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 collection and forwarding of meter data to the HES/MDM environment depends on the performance, interoperability and scalability of the Data Concentrator infrastructure. Data Concentrators / Gateways are central components of the AMI architecture, managing PRIME PLC networks at low-voltage level, aggregating meter data and providing secure backhaul communication 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 certified Data Concentrators for low-voltage PLC networks, **together with the testing, documentation, training and integration support required for their onboarding within the multi-vendor AMI architecture of Premier Energy Distribution and RED Nord.**

The Data Concentrators shall provide open interfaces, protocol documentation and technical support required to onboard the awarded meters and to integrate the complete meter-to-concentrator-to-HES/MDM chain.

The Moldova Reference Smart Meter Data Model and the Reference DLMS/COSEM AMI Smart Meter COSEM Profile for Communication Interfaces v2.0 are project reference documents. At bid submission, the Bidder shall provide the data-object, OBIS, event-code, access-right, security and interface mapping already supported by the offered Data Concentrator firmware and shall identify any gaps or adaptations required for the project.

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Full implementation of every project-specific mapping is not required at bid submission. The awarded Supplier shall complete all mandatory Data Concentrator firmware, configuration, mapping, security and interface adaptations before FAT. Final DSO and permanent HES/MDM parameters, key provisioning and end-to-end integration shall be completed and verified before or during SAT, as defined in the approved integration plan.

Standard, openly documented functional equivalents are acceptable where they provide the required function and are demonstrated during FAT/SAT. No operational function may depend on an undisclosed proprietary interface, object, translation layer or middleware.

The scope includes:

- Data Concentrators with embedded PRIME OFDM PLC modem/base-node function;
- Firmware, configuration files, applicable software licenses and temporary testing/integration tools required for FAT, onboarding and interoperability verification, without separate license fees;
- Certification evidence, technical documentation, and installation manuals;
- Sample units for pre-award laboratory verification, if requested;
- Factory Acceptance Testing (FAT), including meter-to-concentrator and concentrator-to-HES/MDM interoperability support;
- Site Acceptance Testing (SAT) and integration support at one representative transformer station per DSO (two sites in total); and
- Mandatory training on operation, configuration, cybersecurity, diagnostics and maintenance for direct Beneficiaries (distribution system operators).

Installation and site works, including implementation of the permanent HES/MDM platform, are excluded from this procurement and are addressed under separate arrangements. The permanent HES/MDM provider will lead system integration, while the Supplier shall provide the open documentation, samples, configuration support, APIs/protocol interfaces and technical assistance required for FAT, SAT and onboarding.

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 base-node function, backhaul communications, firmware, documentation, training, FAT/SAT and integration support. Installation and permanent HES/MDM implementation are excluded.	Technical datasheet; product code; firmware versions; delivery scope statement
GEN-02	Architecture	Open multi-vendor architecture	The Data Concentrator shall operate in an open multi-vendor PRIME 1.4 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/protocol documentation;
GEN-03	Certification	PRIME certification	The offered Data Concentrator shall have valid PRIME Alliance certification or accredited-laboratory certification evidence recognized under the PRIME certification scheme for the exact offered model,	PRIME certificate or accredited-laboratory report matching the exact offered model, hardware, firmware

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ID	Category	Requirement	Minimum technical specification	Evidence required
			hardware, firmware and base-node profile. The evidence shall state the tested bands/channels and any limitations.	
GEN-04	Compatibility	PRIME 1.4 with backward compatibility	PRIME 1.4 operation is mandatory. Support for PRIME v1.3.6 service nodes. The Bidder shall state the exact backward-compatibility capability and limitations.	Certificate; manufacturer declaration and lab/interoperability test report proving PRIME 1.4 operation and 1.3.6 compatibility
GEN-05	Standards	ITU/IEEE reference	The PLC implementation shall conform to PRIME applicable ITU-T G.9904 requirements. Coexistence with other narrowband PLC technologies shall be supported where included in the certified profile or required by the approved network design. References to IEEE 1901.2 are informational and shall not override PRIME certification requirements.	Standards compliance matrix
GEN-06	Project integration	Reference profiles and implementation stages	The Data Concentrator shall support the Reference DLMS/COSEM AMI Profile v2.0 and the Moldova Reference Smart Meter Data Model through native support, documented mapping, configuration or agreed firmware adaptation. At bid stage, the Bidder shall provide an as-is compliance/gap matrix. Mandatory adaptations shall be completed before FAT; HES/MDM-specific settings shall be completed before or during SAT.	Compliance/gap matrix; binding adaptation commitment
GEN-07	Software and licenses	Open operation and licensing	The Supplier shall provide all licenses required for Data Concentrator operation, configuration, monitoring, FAT/SAT and integration for the delivered equipment. No recurring license, termination fee or proprietary restriction may prevent access to utility-owned data, documented interfaces or normal operation through the HES/MDM.	License and commercial-use statement
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

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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
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

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LIFE-02	Reliability	MTBF	Mean time between failures shall be at least 100,000 hours under the stated operating conditions. The Bidder shall state the 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 A 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
NET-01	Network management	Two-way communication	Full two-way communication between the meters and the HES/MDM through the DC : transmitting metering data, events and alerts to HES/MDC, and transmitting commands and configuration from HES/MDC to meters.	Protocol description; interoperability test

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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
NET-05	Network management	Cross-vendor interoperability	PRIME 1.4 meters from one supplier shall register, authenticate and exchange the required billing, load-profile, event and status data through the offered Data Concentrator and onward to the HES/MDM. Normal configuration, documented mapping and agreed firmware adaptation before FAT are permitted. Hardware modification, undisclosed proprietary lock-in or mandatory proprietary middleware is not permitted.	Cross-vendor test plan; meter/DC/HES mapping
DATA-01	Data collection	Collection modes	Data collection shall be supported on request, schedules and upon event occurrence.	Functional description; HES/MDC interface evidence
DATA-02	Data collection	Data buffering	All received data shall be stored in non-volatile memory. DC shall buffer meter reads/events during backhaul outage and forward on recovery without data loss within stated memory limits.	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; The Bidder shall state the capacity by meters, days, profiles and events, the allocation and overwrite policy, behavior when capacity is reached and the recovery/backfill process indicating how retention of billing data, critical events and configuration/audit records are prioritized.	Memory specification; sizing calculation
DATA-04	Data collection	Data-model and OBIS/event mapping	The Data Concentrator shall transparently carry, collect and expose all required DLMS/COSEM objects, OBIS codes, profiles, event codes and security metadata of the awarded meters. Manufacturer-specific internal storage is acceptable only if the	Active-firmware object/interface list; OBIS/event mapping

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ID	Category	Requirement	Minimum technical specification	Evidence required
			external mapping is complete, documented and accessible to the HES/MDM.	
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 timekeeping and configurable daylight-saving changeover. Time shall be traceable in UTC and local time, and synchronization actions shall be logged and exposed to the permanent HES/MDM.	Configuration guide;
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 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. It shall support the project reference profiles through native implementation, transparent mapping, configuration or agreed adaptation. The as-is mapping shall be submitted with the bid and the final mandatory mapping shall be completed before FAT.	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

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SEC-02	Cybersecurity	Encryption	DLMS/COSEM Security Suite 0 using AES-GCM-128 authenticated encryption and AES-128 key wrapping, consistent with the meter requirements and Moldova Reference Smart Meter Data Model. Security Suite 1 or a stronger standard-compliant implementation is acceptable where compatible with the final architecture. The Data Concentrator shall not require a higher suite as a condition for basic interoperability unless approved in the integration plan.	Security declaration; compliance matrix
SEC-03	Cybersecurity	Backhaul security	Support HTTPS/TLS and VPN tunnelling, including IPSec or an equivalent with private APN/VPN operation where 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
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
SEC-08	Cybersecurity	Key management and security alignment	Provide documented support for key provisioning, storage, rotation, revocation and recovery, together with the security-association and invocation-counter handling required by the approved meter and HES/MDM profiles. The Data Concentrator shall not require access to keys that, under the approved architecture, are retained only by the HES/MDM or meter.	Security architecture; key flow and ownership matrix; access matrix; invocation-counter procedure
MGMT-01	Remote management	Remote parameterization	Support remote parameterization/configuration via HES/MDC	User guide; test case

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ID	Category	Requirement	Minimum technical specification	Evidence required
			and local parameterization via secure local interface.	
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 a managed remote meter-firmware-update workflow using standard DLMS/COSEM image-transfer mechanisms or a fully documented functional equivalent, where permitted by the meter, HES/MDM and security policy. The cross-vendor workflow shall be demonstrated during FAT with the awarded meter supplier.	Workflow evidence; supported security and recovery controls
MGMT-06	Remote management	Schedule reboot	Support controlled remote or scheduled reboot for maintenance and recovery. Every reboot shall be logged with the reason, initiator and timestamp and shall be reported to the HES/MDM after communication is available.	Management guide; reboot control and audit-log example
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 synchronized timestamps traceable in UTC and local time.	Data model; sample event export;
BACKUP-01	Backup power	External connection	Provide possibility to connect external backup power supply.	Wiring diagram; electrical spec

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ID	Category	Requirement	Minimum technical specification	Evidence required
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	The Supplier shall provide datasheets, installation and safety manuals, configuration guides, exact-model PRIME certification , protocol implementation statement, active-firmware object/interface list , APIs, DLMS/COSEM and OBIS/event mappings, Moldova Reference Data Model gap matrix , security and key-management architecture , firmware-update procedure , event catalogue , lifecycle/warranty documentation , training materials and HES/MDM integration guide .	Document register with sample extracts
DOC-02	Documentation	Language	Documentation shall be provided in English; local-language quick installation/safety guide may be requested.	Document samples
DOC-03	Documentation	Technical compliance and gap matrix	The Bidder shall submit a line-by-line response using Comply / Partially comply / Do not comply with exact documentary references. For the project reference data model, the response shall distinguish: supported as specified; standard functional equivalent; configurable or adaptable before FAT; or not supported.	Compliance and gap matrix with evidence references and adaptation commitment
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

ID	Category	Requirement	Minimum technical specification	Evidence required
ACC-02	Acceptance	FAT	FAT shall verify hardware/firmware versions, certificates; cross-vendor meter registration and authentication; scheduled and on-demand reads; billing/load profiles; events and alarms; remote configuration; security associations, keys and invocation-counter handling; buffering and recovery; open API/HES/MDM connectivity; Data Concentrator and managed meter firmware update; and the final mandatory Moldova data-model, OBIS and event mappings. FAT shall not be passed until all mandatory pre-FAT adaptations are implemented and demonstrated.	FAT plan and checklist;
ACC-03	Acceptance	SAT and HES/MDM integration	The Supplier shall support SAT at one representative transformer station per DSO (two sites in total). SAT shall verify installation readiness, provisioning, PRIME registration, two-way DLMS/COSEM communication through the Data Concentrator and HES/MDM-specific OBIS/event mapping, security and key provisioning, time synchronization, billing/load profiles, events and alarms, buffering/recovery, remote management and end-to-end transfer to the permanent HES/MDM. Final site-specific parameters may be completed during SAT in accordance with the approved integration plan.	SAT plan and checklist; HES/MDM integration-support commitment

Mandatory disqualification triggers

- No valid PRIME 1.4 certification evidence for the exact offered Data Concentrator model, hardware, firmware and base-node profile.
- No protocol/interface documentation, active-firmware object list, OBIS/event mapping, security declaration or project compliance/gap matrix.
- No acceptable cybersecurity documentation covering access control, key management, firmware update, audit logs and secure backhaul.
- Refusal to provide requested samples or to participate in FAT, SAT and permanent HES/MDM integration testing.
- Refusal to complete mandatory project-specific firmware, configuration, data-model, security or interface adaptations within the agreed pre-FAT/pre-SAT milestones.
- Proprietary restrictions that prevent onboarding of other PRIME-certified equipment, access to utility-owned data or normal operation through the selected permanent HES/MDM.
- Failure to commit to the required lifecycle, warranty replacement, firmware-support and cybersecurity-remediation obligations.

Mandatory requirements

- All offered Data Concentrators shall be new, unused production-grade units and shall match the sample-tested hardware, firmware and PRIME profile.
- The Supplier shall provide exact-model PRIME 1.4 certification evidence and shall support interoperability with the awarded PRIME 1.4 meters.
- At bid submission, the Bidder shall provide complete as-is protocol/interface documentation and a transparent compliance/gap matrix against the project reference profiles.
- The awarded Supplier shall complete all mandatory Data Concentrator-side mappings, security functions, interfaces and meter-interoperability adaptations before FAT and the final DSO/HES/MDM-specific integration before or during SAT.
- The Supplier shall cooperate with UNDP, PED, RED Nord, the awarded meter supplier and the selected permanent HES/MDM provider throughout FAT, SAT and integration.
- No shared production credentials, unaudited remote-access mechanism, undeclared mandatory object/interface or proprietary lock-in is permitted.
- The Beneficiaries shall own all meter, network, event, configuration, audit and asset data. Export and access shall be available through open documented interfaces without termination fees.