Unified Head End System Guidelines, 2026

Bangladesh

Power Division

Ministry of Power, Energy and Mineral Resources

Government of the People's Republic of Bangladesh

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EXECUTIVE SUMMARY

Bangladesh's six power distribution utilities—Bangladesh Power Development Board (BPDB), Dhaka Power Distribution Company Limited (DPDC), Dhaka Electric Supply PLC (DESCO), Bangladesh Rural Electrification Board (BREB), Northern Electricity Supply PLC (NESCO), and West Zone Power Distribution Company Limited (WZPDCL)—have deployed millions of prepaid and smart prepaid meters using multiple proprietary Head End Systems (HES) and heterogeneous communication technologies such as PLC, RF, GPRS, and NB-IoT. While this expansion has accelerated smart metering adoption, the absence of a unified framework has created fragmentation, interoperability challenges, vendor lock-in, licensing constraints, cybersecurity complexity, and operational inefficiencies. The lack of standardized technical specifications and common integration architecture limits the ability of utilities to bring all meters online seamlessly and to scale future deployments efficiently.

To address these structural gaps, the Power Division has formulated the Unified Head End System (HES) Guidelines, 2026 to establish a single, secure, interoperable, scalable, and vendor-neutral national smart metering communication backbone with full source code ownership under government authority. The Unified HES will standardize device communication APIs, OBIS and event codes, data formats, security parameters, and interoperability requirements while ensuring compliance with internationally recognized standards including IEC, DLMS/COSEM, IDIS, and STS. Designed with a modular, service-oriented, and layered architecture, the system will support multi-vendor DCUs and meters, multiple communication technologies operating simultaneously, high availability and disaster recovery mechanisms, encrypted end-to-end communication, secure key lifecycle management, and centralized governance with logical data segregation for all DISCOs.

The initiative mandates national certification for meters and communication devices, structured migration from legacy systems, secure integration with MDM, billing, and enterprise platforms, and prohibition of future proprietary standalone HES deployments. A qualified Consulting Firm will develop, pilot, implement, and hand over the fully functional Unified HES—including source code and intellectual property—along with post-implementation support. By consolidating fragmented infrastructures into a standardized national platform, the Unified HES will enhance operational efficiency, cybersecurity resilience, regulatory oversight, scalability to millions of meters, and long-term sustainability, while creating the technological foundation for future smart grid initiatives such as net metering, rooftop solar integration, electric vehicle infrastructure, demand response, and advanced analytics across Bangladesh's power sector.

Key Definitions

The following terms are used throughout this Guideline. All stakeholders must interpret these terms consistently to ensure uniform implementation.

Term	Definition and Explanation
Advanced Metering Infrastructure (AMI)	AMI is an integrated system of smart meters, communication networks, and data management systems that enables two-way communication between utilities and consumers. It encompasses the full infrastructure from the smart meter at the consumer premises through the wide-area network to the control center, enabling near-real-time collection and transfer of energy usage data, remote meter operations, and demand response capabilities.
AMI Head End System	The server-side application component of an AMI system that manages bidirectional communication with AMI network equipment and endpoints (smart meters) on one side, and with enterprise backend systems such as the Meter Data Management System (MDMS) and billing platforms on the other. The HES is responsible for device provisioning, data collection, command dispatch, and event management.
Common Information Model (CIM)	An internationally standardized data model developed by the electric power industry and adopted by the IEC (International Electrotechnical Commission). CIM provides a common language for describing the structure and behavior of a power network, enabling seamless information exchange between heterogeneous software systems including SCADA, GIS, ERP, and metering systems.
CIM-compliant	A term signifying compliance with the IEC Common Information Model. For purposes of this specification, CIM-compliant also signifies compliance with the IEC 61968-9 Standard
Data Concentrator Unit (DCU)	A field-deployed device that aggregates data from multiple smart meters within its domain (using PLC, RF, or RS-485 communication) and relays that data to the Head End System over a wide-area network (GPRS, LTE, NB-IoT, etc.). DCUs can also receive and forward commands from the HES to individual meters.
DLMS/COSEM	Device Language Message Specification / Companion Specification for Energy Metering is the internationally recognized suite of standards (IEC 62056) governing smart meter communication. DLMS defines the messaging layer, while COSEM defines the object model and data structures. Together, they provide a comprehensive, vendor-neutral framework for smart meter data exchange.
End Device / End Point	A generic term referring to a smart meter or any metering device installed at a consumer's usage point. In the context of the Unified HES, all end devices must be certified compliant and capable of communicating using approved protocols.
End Device Control	A command sent to an End Device with the intent of creating a change in state of the End Device or causing the End Device to perform an action
End Device Event	An event, typically involving a change of state, which is detected and reported by or with respect to an End Device.
Enterprise System	A system in the utility enterprise that is communicating with the MDMS or other Enterprise Systems. Examples include, but are not limited to, Metering Systems (which can be AMI Head End Systems), Customer Information Systems, Outage Management Systems, Asset Management Systems, and Work Management Systems.
Head End System (HES)	The server and application software that manages the interface between field devices (smart meters and DCUs) and enterprise systems. The Unified HES, as defined in this Guideline, is a centralized, national-level platform that serves all DISCOs under a common governance framework.
IDIS Association	The Interoperability Data Interoperable Systems Association defines interoperability profiles built on top of DLMS/COSEM, ensuring that meters and systems from different

	manufacturers work seamlessly together. Compliance with IDIS profiles is a mandatory requirement under this Guideline.
Meter Data Management System (MDMS)	An enterprise system that stores, processes, validates, and distributes meter data received from the HES. The MDMS acts as the central repository for billing data, consumption analytics, energy audit, and regulatory reporting. It interfaces with billing systems, CRM, ERP, and other enterprise platforms.
Meter Exchange	A business operation that involves the removal of one Meter and the installation of another meter at a Usage Point.
Metering System (MS)	An IEC term for meter data acquisition system typically consisting of meters, communications infrastructure and a server that controls the system and serves as a point of integration with utility Back Office Systems. Metering Systems are not necessarily AMI systems. For example, handheld reading systems and MV-90 systems, in addition to AMI Systems, are considered Metering Systems.
OBIS Code	Object Identification System (OBIS) codes are standardized identifiers used in DLMS/COSEM to uniquely reference meter data objects such as active energy, reactive energy, voltage, current, power factor, events, and load profiles. Standardized OBIS implementation across all meter models is mandatory.
STS Association	The Standard Transfer Specification Association defines the prepayment token standard widely used in the global electricity prepayment metering sector. STS compliance ensures that prepaid credit tokens are secure, interoperable, and non-replicable across certified meters and vending systems.
Unified HES	A centralized, standards-compliant, multi-utility smart metering communication platform that aggregates, manages, and secures bidirectional data exchange between AMI endpoints (smart meters and DCUs) and downstream utility enterprise systems through a unified, vendor-neutral integration framework serving all DISCOs under a single national governance structure..
XML	eXtensible Markup Language, a method of organizing data so that individual data items are delimited by descriptive tags.

List of Abbreviations

AMI	Advanced Metering Infrastructure
AMISP	Advanced Metering Infrastructure Service Provider
API	Application Programming Interface
BPLC	Broadband Power Line Communication
CIM	Common Information Model
CMS	Cryptographic Message Syntax
DCU	Data Concentrator Unit
DISCO	Distribution Utility / Distribution Company
DLMS	Device Language Message Specification
DR	Disaster Recovery
FOTA	Firmware Over-the-Air
GPRS	General Packet Radio Service
HA	High Availability
HES	Head End System
HSM	Hardware Security Module
IEC	International Electrotechnical Commission
JSON	JavaScript Object Notation
LTE	Long Term Evolution (4G)
MDMS	Meter Data Management System
NB-IoT	Narrowband Internet of Things
NFMS	National Feeder Monitoring System
NMS	Network Management System
OBIS	Object Identification System
PLC	Power Line Communication
PKCS#7	Public Key Cryptography Standards - Cryptographic Message Syntax
RBAC	Role-Based Access Control
REST	Representational State Transfer
RF	Radio Frequency
RPO	Recovery Point Objective
RTO	Recovery Time Objective
SOAP	Simple Object Access Protocol
STS	Standard Transfer Specification
WAN	Wide Area Network
XML	Extensible Markup Language
XSD	XML Schema Definition

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1. Background

1.1 Introduction

Currently, six distribution utilities operate within the power sector of Bangladesh. These utilities have deployed a significant number of prepaid meters across their consumer base, and several ongoing projects aim to replace existing postpaid meters with prepaid systems. Initially, utilities installed conventional offline prepaid meters. However, with advancements in communication technologies, utilities have progressively transitioned to deploying smart prepaid meters. The following table presents the current status of prepaid and smart prepaid meter installations across the different distribution utilities.

Sl.	Organization	Traditional Prepaid	Smart Prepaid	Total
01.	BPDB	27,12,279	6,90,914	34,03,193
02.	DPDC	7,96,657	2,82,527	10,79,184
03.	DESCO	5,648	9,11,262	9,16,910
04.	BREB	10,20,000	7,80,000	18,00,000
05.	NESCO	0	9,39,303	9,39,303
06.	WZPDCL	73,251	5,38,982	6,12,233
Total		**46,07,835**	**41,42,988**	**87,50,823**

[* As on: 28 Feb, 2026]**

Smart prepaid meters utilize various communication technologies such as GPRS, PLC, RF Mesh, and RS-485. A Head End System (HES) is required to manage and facilitate communication between the smart meters and the central server. At present, different utilities are operating HES platforms supplied by different manufacturers. The following table illustrates the current status of the HES platforms and the communication technologies used by the respective distribution utilities (as on 28 Feb, 2026).

Sl.	Organization	Present HES Used in Different Utilities		Present Communication Technology Used in Different Utilities	
		HES	No. of Meters	Communication Technology	No of Meters
01.	BPDB	Hexing Electrical Company Limited	5,75,240	PLC	5,75,240
		Inhemeter (Ideal Electrical Enterprise Ltd.)	1,11,359	PLC	1,11,359
		Shenzhen Star Instrument Co., Ltd.	4,315	GPRS	4,315
02.	DPDC	Hexing Electrical Company Limited	23,390	GPRS RS485	4,388 19,002
		Shenzhen Kaifa Technology (Chengdu) Co., Ltd.	21,981	GPRS RS485	5,388 16,593
		Star Meter (Star Meter Manufacturing Co., Ltd)	3,397	GPRS	3,397
		Wasion International Co., Ltd.	250	GPRS	250
		Landys+Gyr	2,33,509	RF Mesh	2,33,509
03.	DESCO	Shenzhen Kaifa Technology (Chengdu) Co., Ltd.	4,15,034	GPRS RS485	67,136 3,47,898
		Hexing Electrical Company Limited	4,96,228	GPRS. BPLC	19,933 4,76,295
04.	BREB	Bangladesh Power Equipment Manufacturing Company Ltd.	7,80,000	RF	7,80,000
05.	NESCO	Shenzhen Star Instrument Co., Ltd.	5,12,994	G3PLC	3,89,752
				BPLC	1,23,242
		Wasion International Co., Ltd.	4,26,309	BPLC	4,26,309
06.	WZPDCL	Inhemeter (Ideal Electrical Enterprise Ltd.)	2,55,000	G3PLC & GPRS	255,000
		Hexing Electrical Company Limited	2,83,982	BPLC & GPRS	2,81,732
				GPRS	2,250
Total			**41,42,988**		**41,42,988**

As illustrated above, most utilities currently operate multiple Head End Systems (HES) supplied by different manufacturers. This fragmented arrangement makes the management of smart prepaid meters complex and inefficient. Consequently, a significant number of prepaid meters remain offline due to the absence of a Unified HES platform capable of integrating meters from different vendors.

To address this challenge and ensure that all prepaid meters installed in the future by the distribution utilities in Bangladesh's power sector can be seamlessly brought online, the Power Division has formed a committee to prepare guidelines for developing a Single and Unified Head End System (HES) with accessible source code. This initiative aims to ensure interoperability, centralized management, and long-term sustainability of smart metering infrastructure across all utilities.

The committee has been formed to prepare the guideline by considering the following key factors, as outlined in Power Division Memo No. 27.00.0000.071.16.012.25.864 dated 21/10/2025 issued by the Power Division:

a) The proposed Head End System (HES) must ensure **interoperability** among DCUs/communication modules and meters manufactured by different vendors, enabling seamless integration across multi-vendor environments.

b) A **standardized Device Communication API** must be developed for the proposed HES to facilitate smooth device integration and ensure long-term system scalability.

c) Key technical specifications for DCUs/communication modules and meters—such as **OBIS codes, event codes, communication parameters, data formats, and security standards**—must be clearly defined and finalized. In this regard, the technical specification titled **'Specification for Three Phase and Single-Phase Smart Pre-Payment Energy Meter with Communication Module'** prepared by the Power Division should be duly considered.

d) Appropriate communication technologies (e.g., **PLC, RF, GPRS, NB-IoT**) must be determined based on the geographical and operational characteristics of the respective power distribution utilities, and the proposed HES must effectively support these technologies.

e) Relevant international standards and compliance frameworks for smart metering—such as **DLMS/COSEM, IDIS Association, and International Electrotechnical Commission standards**—must be strictly followed to ensure interoperability, security, and global best practices.

1.2 Current Challenges

- Different distribution utilities operate multiple proprietary Head End Systems (HES) from various manufacturers.
- In many cases, a single utility manages more than one vendor-specific HES platform.
- No unified technical standard exists for bringing prepaid meters online—either within a utility or across the national power sector.
- Vendor-specific HES platforms typically support only their own Data Concentrator Units (DCUs) and communication modules.
- Interoperability barriers prevent seamless onboarding of meters from different manufacturers.
- Source codes of existing HES platforms are not provided to utilities.
- Licensing is meter-count based, restricting expansion beyond contracted limits.
- Vendor lock-in increases long-term operational costs and reduces strategic flexibility.

1.3 Strategic Solution: Single & Unified Head End System (HES)

To overcome these structural limitations, a Single, Unified Head End System (HES) with full source code ownership is proposed for all Power Sector Distribution Utilities in Bangladesh. A qualified Consulting Firm will develop, pilot, implement, and hand over the fully functional Unified HES—including source code and intellectual property—along with post-implementation support. By consolidating fragmented infrastructures into a standardized national platform, the Unified HES will enhance operational efficiency, cybersecurity resilience, regulatory oversight, scalability to millions of meters, and long-term sustainability, while creating the technological foundation for future smart grid initiatives such as net metering, rooftop solar integration, electric vehicle infrastructure, demand response, and advanced analytics across Bangladesh's power sector.

1.4 **Key Advantages of Unified HES**

a) **Full Multi-Vendor Interoperability** – Seamless integration of meters, DCUs, and communication modules from different manufacturers.
b) **Standardized Technical Framework** – Uniform OBIS codes, event codes, communication parameters, data formats, and security protocols.
c) **Vendor-Neutral Architecture** – Elimination of proprietary lock-in mechanisms.
d) **Unlimited Scalability** – No licensing ceiling on the number of connected meters.
e) **Source Code Ownership** – Full control, transparency, and long-term sustainability under national authority.
f) **Simplified Meter Onboarding** – Any compliant meter can be brought online without core system modification.
g) **Improved Customer Support Efficiency** – Common OBIS and event structures enable faster technical issue resolution.
h) **Streamlined Data Management** – Standardized data formats simplify analytics, billing integration, and reporting.
i) **Enhanced Cybersecurity Governance** – Unified security standards and centralized key management.
j) **Cost Optimization** – Reduced recurring licensing fees and lower long-term operational dependency.
k) **Future-Proof Infrastructure** – Ready for nationwide scaling and smart grid evolution.

This guideline is prepared in accordance with the Office Order issued by the Power Division, Government of Bangladesh, regarding the standardization and interoperability of Smart Pre-Payment Energy Metering infrastructure. This Guideline shall be called the **"Unified Head End System (HES) Guidelines, 2026".** It shall come into effect on the date of its publication in the Official Gazette.

2. **Purpose of the Guideline**

The purpose of this Guideline is to:

a) Establish a single, secure, interoperable, and scalable Unified Head End System (HES) for all DISCOs in Bangladesh;
b) Ensure vendor-neutral integration of smart meters and communication technologies;
c) Eliminate proprietary vendor lock-in;
d) Enable centralized governance with logical separation of multiple DISCO operations;
e) Align national smart metering infrastructure with international standards and best practices.

3. **Applicability of the Guideline**

3.1 This Guideline shall apply to:

a) All Distribution Utilities (DISCOs);
b) All smart meter manufacturers and suppliers;
c) All Data Concentrator Unit (DCU) providers;
d) All communication module vendors;
e) All system integrators and software development entities engaged in HES implementation.

3.2 Compliance with this Guideline shall be mandatory for procurement, deployment, and integration of smart metering systems.

4. **Objectives of the Unified HES**

a) Ensure interoperability among smart meters, DCUs, and communication modules from different vendors.
b) Eliminate proprietary lock-in mechanisms and ensure vendor-neutral interoperability with long-term sustainability.
c) Enable secure onboarding of all compliant smart meters.
d) Provide scalability for nationwide deployment (millions of meters).
e) Enable centralized monitoring, control, billing, and analytics.
f) Support future scalability and technology upgrades.
g) Support multi-DISCO operations under centralized governance.
h) Ensure compliance with international smart metering standards.
i) Enable future smart grid initiatives.

5. Governing Standards

5.1 Mandatory International Standards

The Unified HES shall comply with internationally recognized standards, including but not limited to:

Standard Body	Standard / Suite	Scope of Application
IEC	IEC 62056 Series	DLMS/COSEM protocol suite for smart meter communication, data models, and security
IEC	IEC 61968-9	CIM-based integration standard for meter reading and control systems
DLMS User Association	DLMS/COSEM Security Suite 1 & 2	End-to-end authenticated encryption for meter communications
IDIS Association	IDIS Package 1, 2, 3	Interoperability profiles ensuring multi-vendor meter-HES compatibility
STS Association	STS IEC 62055-41	Standard Transfer Specification for prepayment token generation and validation
IETF / ISO	TLS 1.2 / 1.3, AES-128/256	Transport-layer encryption for network communication
PKCS	PKCS#7 / CMS	Secure key distribution and cryptographic message wrapping

5.2 National Regulatory Compliance

In addition to international standards, the Unified HES must fully comply with all applicable national regulations of Bangladesh, including:

- National Cybersecurity regulations and data protection laws as enacted and amended by the Government of Bangladesh.
- Bangladesh Computer Security Incident Response Team (BGD e-GOV CIRT) guidelines for critical infrastructure protection.
- Data sovereignty requirements: all consumer data must be hosted within Bangladesh territory, subject to government data residency policies.
- The Power Division's technical specification: 'Specification for Three Phase and Single Phase Smart Pre-payment Energy Meter with Communication Module.'

5.3 Deviation Policy

Any deviation from the standards specified in this section — whether technical, procedural, or administrative — shall require prior written approval from the Power Division. Unauthorized deviations shall constitute a compliance breach subject to the enforcement provisions of the respective Section in this guideline.

6. Unified HES Architecture Requirements

6.1 Layered Architecture Mandate

The Unified HES shall be designed and implemented following a modular, layered architecture that ensures clean separation of concerns, independent scalability, and technology flexibility. The architecture shall comprise the following five distinct layers:

Architecture Layer	Description and Responsibilities
1. Device & Communication Layer	The outermost layer that interfaces directly with field devices — smart meters, DCUs, NB-IoT gateways, and communication modules. Responsible for managing physical and logical connectivity over PLC, RF, GPRS, LTE, NB-IoT, and RS-485 channels.
2. Communication Abstraction Layer	Provides protocol translation and normalization services, abstracting the complexity of multiple physical communication technologies and vendor-specific protocol dialects into a

Architecture Layer	Description and Responsibilities
	uniform internal representation. Ensures that upper layers are insulated from communication technology specifics.
3. Core HES Layer	The intelligence engine of the platform. Manages device registration and provisioning, session management, command scheduling, firmware orchestration, event processing, and data validation. All business logic governing meter interactions resides in this layer.
4. Data & Processing Layer	Responsible for persistent storage, caching, time-series data management, and analytics processing. Manages load profiles, billing data, event histories, and audit logs. Provides the data foundation for MDMS integration and reporting.
5. Integration & Application Layer	The northbound interface layer providing standardized APIs (REST, SOAP, CIM-compliant) for integration with MDM systems, billing platforms, ERP, GIS, NFMS, and other enterprise systems. Also provides the operator portal and monitoring dashboards.

6.2 Architecture Design Principles

The following design principles are non-negotiable and must be demonstrably incorporated in the system architecture submission:

- **Independent Scalability:** Each architectural layer shall be independently scalable without impacting other layers. Horizontal scaling must be achievable through addition of compute nodes without service interruption.
- **High Availability:** The system shall be designed for a minimum availability target of 99.9% (approximately 8.76 hours downtime per year), with 99.99% as the aspirational target for critical control functions.
- **Redundancy:** All critical components including databases, message queues, application servers, and network interfaces shall be deployed with N+1 or N+N redundancy.
- **Multi-Vendor, Multi-Technology:** The architecture must natively support simultaneous operation of meters and DCUs from different manufacturers using different communication technologies.
- **Deployment Flexibility:** The architecture must support both fully centralized deployment (national data center) and hybrid deployment models with regional compute nodes.
- **Service-Oriented Design:** System components shall communicate through well-defined internal service interfaces, enabling component replacement and upgrade without full system re-deployment.
- **Disaster Recovery:** A complete DR framework with defined RPO and RTO shall be embedded in the architecture from inception, not treated as an afterthought.

7. Unified Head End System Architecture Guidelines

7.1 Proposed Unified HES Architecture

The architecture of the Unified Head End System (HES) enables seamless communication across a multi-vendor environment. According to the proposed architecture shown below, the HES is capable of communicating with Data Concentrator Units (DCUs) from multiple vendors. Each DCU can interface not only with meters from its own vendor but also with meters supplied by other vendors, ensuring interoperability and flexibility within the system.

Meters equipped with GPRS modules can communicate directly with the HES. Additionally, such GPRS-enabled meters can function as "mother meters," connecting to multiple "child meters" (from both the same and different vendors) via RS-485 communication. These child meters transmit their data to the HES through the mother meter. Furthermore, the architecture includes an HES Integration API, which enables seamless integration between the HES and the Utility's Meter Data Management (MDM) system.

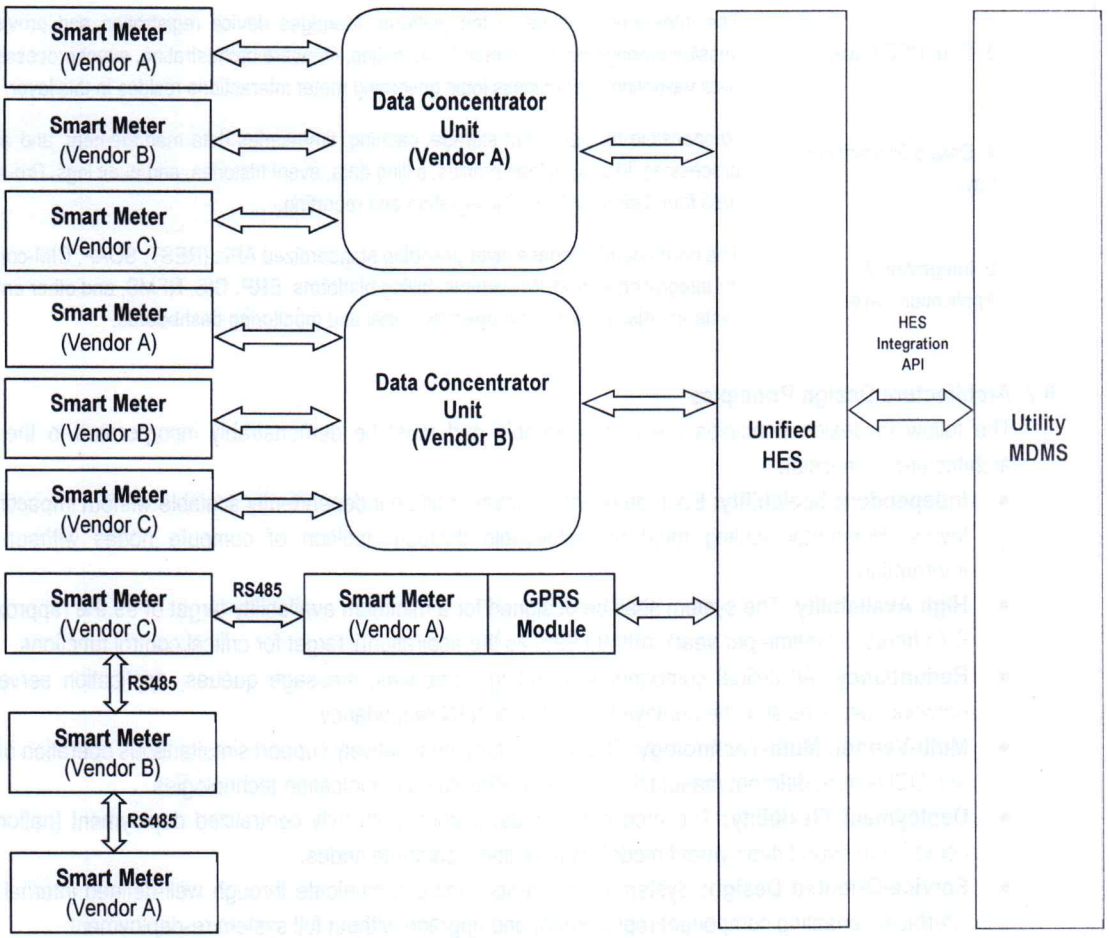

Figure 1: Proposed Unified HES Architecture

7.2 System Components

(a) **Smart Meter** – electrical meter which measures, records, and monitors key electrical parameters—such as voltage, current, power, energy, and power factor—and enables remote data acquisition and control by communicating with the Head-End System (HES) through integrated communication modules.

(b) **Data Concentrator Unit (DCU)** - DCUs collect data from multiple nodes, before forwarding the data to the HES. The Data Collector Unit receives information from the nodes on a scheduled/need basis and stores the data, which can be accessed by HES. Main functionalities typically include: Automatic detection of nodes, Node registration, Node synchronization and periodic and on-demand reads, Configuration and firmware upgrade.

(c) **Communication module** – It facilitates communication between Meter and DCU/HES for the given communication media.

(d) **Unified Head End System (HES)** – Unified HES acquires data from nodes automatically avoiding any human intervention and monitor parameters acquired from the nodes. It performs network management of the communication network created by the underlying nodes. HES performs the acquisition of data from the nodes, across the communication infrastructure automatically avoiding any human intervention and monitor parameters acquired from meters. Unified HES performs meter reading and transmits control messages to the meters either directly or through the designated communication interface. It should facilitate to measure and monitor the SLA defined for interaction with Meters.

(e) **Meter Data Management System (MDMS)** – The MDMS supports storage, billing (prepaid & postpaid), archiving, retrieval & analysis of meter data and various other MIS along with validation & verification algorithms. It acts as a central data repository. MDMS have capability to import raw or validated data in defined formats and export the processed and validated data to various other systems sources and services

in the agreed format. It provides validated data for downstream systems such as billing (Postpaid & Prepaid), Customer Information System, Customer Care, Analytics, Reporting, Network Planning & Analysis, Load Analysis/Forecasting, Peak Load Management, Outage Management etc.

7.3 Interface Framework

Interfaces within the Unified HES ecosystem are categorized into three types: Southbound interfaces (HES to field devices), Internal interfaces (between system components), and Northbound interfaces (HES to enterprise systems).

Interface Type	Direction	Description
Southbound	HES to DCU/Meter	DLMS/COSEM over TCP/IP, UDP, or SMS. Encrypted per Security Suite 1 or 2. Supports PLC, RF, GPRS, LTE, NB-IoT transport.
Southbound	DCU to Meter	DLMS/COSEM over PLC, G3-PLC, RF Mesh, or RS-485. Meter-DCU interoperability mandated per IDIS profiles.
Northbound	HES to MDM	CIM-compliant REST or SOAP APIs. IEC 61968-9 message schema. Supports batch file transfer and real-time event push.
Northbound	HES to Billing	Secured REST API with OAuth 2.0. JSON/XML data exchange for consumption data, prepayment transactions, and events.
Northbound	HES to NFMS	Secured API for feeder-level aggregated data, outage detection, and power quality reporting.
Internal	Engine-to-Engine	Message queue based (e.g., Apache Kafka or equivalent) for asynchronous, scalable inter-component communication.

7.4 Key Architecture Guidelines

7.4.1 Multi-Vendor Interoperability

7.4.1.1 The Unified HES shall support communication with DCUs from all certified vendors simultaneously, with no operational preference or capability difference between vendors.

7.4.1.2 The system shall ensure full interoperability in heterogeneous multi-vendor environments where a single DCU may serve meters from multiple manufacturers.

7.4.1.3 All device communications shall use open, documented protocols. Proprietary protocol extensions that cannot be published or shared with third parties are prohibited.

7.4.1.4 The Unified HES shall maintain a Device Compatibility Registry documenting tested and certified meter-DCU combinations.

7.4.2 DCU–Meter Communication Requirements

7.4.2.1 Each DCU shall be certified capable of communicating with meters from its own manufacturer and at least two additional certified meter manufacturers.

7.4.2.2 Protocol compatibility between DCUs and meters shall be validated through formal interoperability testing in the national certification facility.

7.4.2.3 DCUs shall support firmware updates delivered by the Unified HES, enabling protocol support extensions without hardware replacement.

7.4.3 Direct GPRS/LTE Meter Communication

7.4.3.1 Meters with integrated GPRS or LTE modules shall establish authenticated, encrypted sessions directly with the Unified HES without requiring an intermediate DCU.

7.4.3.2 Such meters shall authenticate using certificate-based mutual TLS (mTLS) or DLMS HLS authentication as applicable.

7.4.3.3 The Unified HES shall manage session persistence, reconnection logic, and data buffering for direct-connect meters.

7.4.4 Mother–Child Meter Architecture

7.4.4.1 GPRS-enabled meters designated as Mother Meters shall maintain persistent GPRS connections to the Unified HES.

7.4.4.2 Up to a defined maximum number of Child Meters may connect to a single Mother Meter via RS-485 (maximum to be specified in the technical guideline developed by the Consulting Firm).

7.4.4.3 Child Meters may belong to any certified manufacturer, provided DLMS/COSEM compliance and standardized OBIS implementation are maintained.

7.4.4.4 The Mother Meter shall perform data buffering for Child Meter data during WAN connectivity interruptions and resume data delivery upon reconnection.

7.4.4.5 Load disaggregation and accurate attribution of billing data to individual Child Meter consumers shall be maintained end-to-end.

7.4.5 HES Integration API Requirements

7.4.5.1 The Unified HES shall expose a comprehensive, versioned, and documented API for northbound integration with enterprise systems.

7.4.5.1 APIs shall follow REST architectural principles where applicable, with JSON as the primary data interchange format. SOAP/XML shall be supported for legacy system compatibility.

7.4.5.1 API authentication shall use OAuth 2.0 with scoped tokens, ensuring that each enterprise system is granted only the minimum necessary permissions.

7.4.5.1 The integration framework shall support real-time event push (WebSocket or SSE), scheduled batch data delivery, and on-demand pull requests.

7.4.5.1 All API endpoints shall be comprehensively documented using OpenAPI (Swagger) specification and made available through a developer portal.

8. Guidelines for Meter Suppliers and Manufacturers

8.1 A national vendor certification framework shall be established.

8.2 Only certified meters, DCUs, and communication modules shall be permitted for integration with the Unified HES.

8.3 Certification shall include interoperability testing, security validation, and performance assessment.

8.4 All meters shall comply with nationally adopted international standards, including those of the International Electrotechnical Commission, DLMS User Association, IDIS Association, and STS Association. DLMS/COSEM protocol support and standardized OBIS implementation shall be mandatory.

8.5 Meters must be fully interoperable with the Unified HES without requiring modification of the core system. Proprietary protocols or vendor-locked solutions shall not be permitted.

8.6 Meters shall support encrypted two-way communication, secure key management, and compliance with approved DLMS security suites. Compatibility with centralized key management systems is mandatory.

8.7 All meter models must undergo interoperability, security, and performance testing under the national certification framework prior to deployment.

8.8 Manufacturers shall provide firmware updates, security patches, and long-term technical support. Any design or firmware changes affecting compliance must be revalidated before rollout.

9. Guidelines for Existing Meters and Head End Systems

9.1 All utilities shall conduct a comprehensive inventory and technical assessment of existing meters and Head End Systems (HES) to determine compatibility with the Unified HES framework.

9.2 Existing meters supporting DLMS/COSEM and nationally adopted standards shall be considered eligible for integration, subject to interoperability verification.

9.3 Before integration into the Unified HES, existing meters and HES platforms shall undergo formal interoperability, communication, and performance testing.

9.4 All existing systems shall comply with defined cybersecurity requirements, including encrypted communication, secure authentication, and centralized key management alignment.

9.5 Utilities shall ensure secure migration and preservation of historical consumption data, event logs, billing records, and audit trails during transition.

9.6 Meters or HES platforms that do not meet interoperability or security requirements shall be subject to phased upgrade, retrofit, or replacement under an approved migration plan.

9.7 Existing integrations with billing, MDM, ERP, and other enterprise systems shall be aligned with the Unified HES standardized API framework.

9.8 After adoption of the Unified HES framework, no new proprietary or standalone HES deployments shall be initiated. All future expansions must align with Unified HES requirements.

9.9 During the migration period, temporary coexistence of legacy systems may be permitted under strict governance to ensure operational continuity and system stability.

10. Guidelines for Consulting Firm / Third-Party Vendor for Development and Implementation of Unified HES

10.1 Consulting Firm should develop Unified HES as per the architecture of this guideline and the ToR described in the following section.

10.2 Consulting Firm should prepare a technical guideline including but not limited to OBIS codes, event codes, key management, API documents etc. and that technical guideline should be integrated in this guideline.

11. Terms of Reference for Consulting Firm

The Power Division has recently finalized a comprehensive technical specification titled **"Specification for Three Phase and Single Phase Smart Pre-payment Energy Meter with Communication Module"** to standardize the deployment of prepaid smart meters across various electricity distribution utilities in Bangladesh. In parallel, the **"Unified Head End System (HES) Guidelines, 2026"** has been formulated to establish a national framework for interoperability, cybersecurity, data governance, and system integration.

In continuation of these strategic initiatives, it has become critically imperative to develop a centralized and interoperable Unified Head End System (HES) capable of integrating prepaid smart meters from multiple manufacturers into a single, secure, scalable, and vendor-neutral platform. Furthermore, there is a necessity to formulate standardized technical specifications for associated Data Concentrator Units (DCUs), communication modules, and related infrastructure to ensure seamless integration with the Unified HES.

In this context, and with the objective of preparing comprehensive technical guidelines, implementation frameworks, and strategic recommendations for bringing prepaid smart meters online through a Unified HES using appropriate and future-ready communication technologies, it is proposed that a qualified and experienced Consulting Firm be engaged. The Terms of Reference (ToR) for the Consulting Firm shall include, but not be limited to, the following:

Terms of Reference (ToR)

(a) For the purpose of developing a **single, Unified Head End System (HES)** with source code to bring online all prepaid meters to be installed in the future under various power distribution utilities in Bangladesh, the **Consulting Firm shall develop and implement a Unified HES** as well as formulate a technical guideline considering the following aspects:

I. The Head End System (HES) shall ensure **interoperability** with DCUs/Communication Modules and meters manufactured by different vendors.

II. A **standard Device Communication API** shall be developed for the Head End System (HES) to ensure seamless device integration and system scalability.

III. Relevant **technical specifications** for DCUs/Communication Modules and meters (such as OBIS codes, event codes, communication parameters, data formats, security standards, etc.) shall be defined and finalized. In doing so, due consideration must be given to the Power Division's technical specification titled *"Specification for Three Phase and Single Phase Smart Pre-payment Energy Meter with Communication Module."*

IV. **Area-specific appropriate communication technologies** (PLC / RF / GPRS / NB-IoT) shall be determined for different power distribution utilities, and the Head End System (HES) must effectively support and operate with these communication technologies.

V. The smart meters shall comply with relevant **international standards and compliances**, including but not limited to DLMS/COSEM, IDIS, and IEC standards.

(b) The Consulting Firm shall design, develop, and implement the Unified Head End System (Unified HES) in strict compliance with the **Unified Head End System Guidelines, 2026,** ensuring full adherence to all technical, security, interoperability, and regulatory requirements stipulated therein.

(c) During the development phase, the Consulting Firm shall conduct a comprehensive pilot implementation of the Unified Head End System (HES) incorporating smart meters from at least three (03) different manufacturers, along with Data Concentrator Units (DCUs), Network Interface Cards (NICs), or equivalent communication devices from at least three (03) different manufacturers. The three smart meter manufacturers shall be selected by the respective distribution utilities to ensure representation of the technologies and vendors currently deployed in the field. The pilot project shall be implemented across six (06) distinct operational areas, each under a different electricity distribution utility in Bangladesh, in order to rigorously validate interoperability, scalability, system performance, and cross-vendor integration capability of the proposed Unified HES.

(d) The Consulting Firm shall design and implement standardized, secure, and well-documented Application Programming Interfaces (APIs) within the Unified Head End System (HES) to ensure seamless interoperability and integration with the existing Meter Data Management (MDM) systems of various electricity distribution utilities. The system architecture shall incorporate adequate scalability, configurability, and future integration capabilities to support heterogeneous MDM platforms, data exchange protocols, and evolving operational requirements without requiring major structural modifications.

(e) Upon successful completion and acceptance, the Consulting Firm shall formally hand over the fully functional Unified HES, including complete source code, system documentation, configuration files, database schemas, APIs, integration modules, and all associated intellectual property rights, to the Power Division. Also, the Consulting Firm shall demonstrate the developed Unified Head End System (HES) to ensure that the system architecture, functionalities, operational procedures, and integration mechanisms are clearly explained and understood by the concerned officials.

(f) Within 180 (One Hundred and Eighty) working days of the successful development and commissioning of the Unified Head End System (HES), the Consulting Firm shall submit to the Power Division, Ministry of Power, Energy and Mineral Resources, a comprehensive Technical Guideline detailing the system architecture, integration framework, data migration strategy, cybersecurity controls, operational and maintenance procedures, scalability roadmap, and governance structure. The Guideline shall also define and finalize standardized technical specifications for DCUs, Communication Modules, and smart prepaid meters—including OBIS codes, event codes, communication protocols and parameters, data formats, and security standards—ensuring full alignment with the approved specification titled **"Specification for Three Phase and Single Phase Smart Pre-payment Energy Meter with Communication Module."**

(g) The Consulting Firm shall conduct structured knowledge transfer and capacity-building programs for the relevant technical and operational personnel of the distribution utilities. This shall include technical training sessions, hands-on workshops, system administration training, and operational demonstrations, aimed at enabling the concerned stakeholders to efficiently operate, manage, maintain, and further expand the Unified HES platform independently in the future.

(h) The Consulting Firm shall provide post-implementation support services for a period of **03 (Three) years**, including corrective maintenance, adaptive enhancements, security patch management, performance optimization, interoperability upgrades, technical assistance, and capacity-building support for designated personnel.

12. Vendor Neutrality and Interoperability

12.1 The Unified HES shall ensure full interoperability of smart meters, DCUs, and communication modules from multiple manufacturers.

12.2 Proprietary lock-in mechanisms shall not be permitted.

12.3 Onboarding of new vendors shall not require modification of core HES components.

12.4 A standardized Device Communication Interface (API) shall be established and maintained under national authority.

13. Functional Requirements

13.1 Core Metering Functions

The Unified HES shall support the following core metering functions as a mandatory minimum capability set:

Function	Detailed Requirement
Periodic Meter Reading	Automated collection of load profiles, billing data, and power quality metrics on configurable schedules (minimum: 15-minute intervals). Multi-threaded collection to support millions of meters without bottlenecks.
On-Demand Reading	Operator-initiated real-time data retrieval from individual meters or meter groups with configurable priority scheduling.
Event and Alarm Reporting	Real-time receipt, classification, and routing of meter events including tamper, power outage, overload, communication failure, and prepayment events.
Remote Connect / Disconnect	Secure, audited remote control of the meter's internal relay for connecting or disconnecting the consumer's load. All operations must require operator authorization and generate audit records.
Load Control	Remote configuration of load limiting setpoints, time-of-use profiles, and maximum demand thresholds. Supports demand response programs.
Firmware Over-the-Air (FOTA)	Secure, reliable, and resumable delivery of firmware updates to meters and DCUs. Updates must be cryptographically signed and verified by the receiving device before installation.
Time Synchronization	Centralized time synchronization broadcast to all managed meters, ensuring billing accuracy and event timestamp consistency across the network.
Prepayment Management	Support integration with STS-compliant vending systems for secure token delivery, validation feedback collection, and prepaid balance monitoring. The system shall enable near real-time processing of prepaid token transactions and remote token transfer to smart meters. The system shall interface with vending systems to enable secure and near real-time processing of prepaid token transactions.
Device Lifecycle Management	End-to-end management of device registration, provisioning, configuration, testing, active service, and retirement.
Power Quality Monitoring	Collection and analysis of power quality parameters including voltage, current, power factor, harmonics, and frequency from qualifying meters.

14. Communication Technology Support

14.1 Supported Communication Technologies

The Unified HES shall provide native support for all of the following communication technologies, enabling each DISCO to deploy the most appropriate technology for its geographic, demographic, and infrastructure context:

Technology	Standard	Primary Use Case	Coverage Priority
G3-PLC	IEC 61334, IEEE 1901.2	Urban/dense residential areas with shared LV distribution infrastructure	Urban priority
BPLC (Broadband PLC)	IEEE 1901, HomePlug AV	Medium-voltage and LV networks with high bandwidth requirements	Commercial/industrial
RF Mesh	IEEE 802.15.4g	Areas with challenging PLC propagation; suburban and semi-urban deployments	Suburban
GPRS/2G	3GPP	Legacy areas with 2G coverage; direct-connect meters; mother meters	Rural transitional

Technology	Standard	Primary Use Case	Coverage Priority
LTE/4G	3GPP LTE	High-bandwidth requirements; primary WAN backhaul for DCUs in urban areas	Urban/commercial
NB-IoT	3GPP Release 13+	Deep indoor penetration; low-power devices; large-scale rural deployments	Rural expansion
RS-485	TIA/EIA-485	Child meter to mother meter connections; short-range wired local networks	Local only

14.2 Multi-Technology Operation

The Unified HES shall operate all supported communication technologies simultaneously without performance degradation. The following requirements apply:

- **Technology-agnostic data model:** meter data received over any communication channel shall be normalized into the same internal data schema before processing.
- **Communication Network Performance Monitoring:** the HES shall collect and display metrics for each communication technology including packet loss rate, latency, reconnection frequency, and throughput, enabling proactive network management.
- **Fallback Communication:** where meters support multiple communication interfaces, the HES shall support configurable fallback communication paths (e.g., primary PLC with GPRS fallback).

15. Scalability and Performance

15.1 Scalability Requirements

The Unified HES must be designed from inception for national scale. The following scalability parameters define the mandatory design envelope:

- **Target Scale:** Designed to support a minimum of 30 million meters as the national deployment ceiling, with architectural provisions for further expansion.
- **Horizontal Scalability:** All processing components shall scale horizontally by adding server nodes without service interruption or re-architecture.
- **Elastic Scaling:** Cloud-native or cloud-compatible deployment shall support automatic scaling based on demand metrics.
- **Data Ingestion Rate:** The system shall sustain a minimum ingestion rate of one million meter reads per hour during peak collection windows, with burst capacity of 3x sustained rate.

15.2 Performance Benchmarks

The following minimum performance benchmarks shall be defined as system acceptance criteria and continuously monitored in production:

Performance Metric	Minimum Requirement	Aspirational Target
Meter data ingestion latency (DCU to HES database)	< 5 minutes end-to-end	< 60 seconds
Remote command dispatch to meter response	< 30 seconds 95th percentile	< 10 seconds
API response time (northbound)	< 2 seconds 99th percentile	< 500ms
Concurrent operator sessions	Minimum 500 simultaneous users	2,000+ users
System availability	99.9% (annual)	99.99%
Data collection success rate	99.5% of scheduled reads completed	99.9%

16. High Availability and Disaster Recovery

16.1 The system shall incorporate redundancy and automatic failover mechanisms.

16.2A Disaster Recovery (DR) framework shall be established with clearly defined Recovery Point Objective (RPO) and Recovery Time Objective (RTO).

16.3Backup and restoration procedures shall be automated and periodically tested.

17. Key Management and Security

17.1The Unified HES shall support DLMS/COSEM Security Suite 1 and Suite 2, with readiness for future security suites.

17.2All communications between meters, DCUs, and HES shall be encrypted and authenticated.

17.3Secure key lifecycle management shall be implemented, including generation, distribution, rotation, and revocation.

17.4Hardware Security Module (HSM) integration shall be supported where required.

17.5Role-Based Access Control (RBAC) and audit logging shall be mandatory.

17.6 Meter keys must be exchanged using a standardized key file format.

17.7PKCS#7 (CMS) shall be used for secure key distribution.

17.8 Unified HES shall support - secure key storage, key rotation and key change mechanisms.

18. Data Governance and Audit

18.1 The Unified HES shall implement data validation mechanisms including duplicate detection, timestamp validation, OBIS validation, and format verification.

18.2All meter data, commands, and events shall be traceable end-to-end.

18.3Audit logs shall be retained in accordance with regulatory requirements.

19. Multi-DISCO Support

19.1The Unified HES shall provide logical segregation of data and operations for each DISCO.

19.2Centralized governance and monitoring by the Power Division shall be enabled.

20. Integration Requirements

20.1 Enterprise System Integration

The Unified HES shall be the central hub for meter data delivery to all enterprise systems. The following integration requirements apply:

Target System	Integration Type	Data Exchanged
Meter Data Management System (MDMS)	CIM REST API, IEC 61968-9 compliant	Load profiles, billing data, events, device registry, configuration changes
Billing System	Secured REST API	Consumption data for invoice generation, prepayment token transactions, connect/disconnect status
National Feeder Monitoring System (NFMS)	REST API	Feeder-aggregated consumption, outage events, power quality data
Asset Management System	REST API	Device registration, lifecycle status, maintenance records
Customer Information System (CIS)	REST API, event push	Consumer identification, service point data, event notifications
Prepayment Vending Systems	STS-compliant API	Token generation, credit management, balance queries

20.2 Integration Standards

All integrations shall conform to the following standards to ensure long-term maintainability and replaceability of individual enterprise systems:

- **API-First Design:** All integrations shall be mediated through documented, versioned APIs. Direct database connections between systems are prohibited.
- **Open Standards:** CIM (IEC 61968), REST, OAuth 2.0, OpenAPI, JSON, and XML shall be the preferred standards for all integrations.
- **Backward Compatibility:** API versions shall maintain backward compatibility for a minimum of two major versions, allowing enterprise systems to upgrade on independent schedules.
- **Integration Monitoring:** The Unified HES shall provide real-time monitoring of all integration endpoints including availability, message throughput, error rates, and latency.

21. Governance and Oversight

21.1A National Steering Committee shall oversee implementation, compliance, and updates of this Guideline.

21.2Periodic compliance audits shall be conducted.

21.3Amendments to this Guideline may be issued by the Power Division as necessary.

22. Future Readiness

22.1 Smart Grid Integration Roadmap

The Unified HES shall be designed not merely for today's smart metering use cases but as the foundational communication and data platform for Bangladesh's future smart grid. The following future capabilities shall be accommodated in the architecture:

Future Capability	Architecture Provision Required
Net Metering / Rooftop Solar	Bidirectional energy flow measurement support, generation register reading via DLMS, and integration with solar registry and net billing systems.
Electric Vehicle (EV) Charging	Smart charging protocol integration, time-of-use rate signal delivery to EV charge points via HES, and load management for grid stability.
Demand Response Programs	Real-time load control signal delivery to consumer devices via meters, demand response event management, and performance measurement and settlement.
Advanced Analytics and AI	Structured, high-frequency, time-stamped data streams suitable for ML/AI consumption; anomaly detection APIs; non-technical loss detection modules.
Grid Edge Intelligence	Support for programmatic meter event-driven automation, distribution automation integration, and real-time grid state estimation using meter data.
IPv6 and 5G NB-IoT	IPv6 addressing support in device management; 5G NB-IoT communication protocol adapter readiness in the Communication Abstraction Layer.

22.2 Technology Upgrade Philosophy

The modular architecture of the Unified HES is explicitly designed to allow technology evolution at each layer independently. New communication technologies shall be added through new protocol adapters in the Communication Abstraction Layer without modifying the Core HES Layer. New enterprise system integrations shall be added through new API modules in the Integration Layer without disrupting existing integrations. New device types shall be onboarded through the certification framework and device plugin mechanism without core system changes.

23. Compliance and Enforcement

23.1 Compliance Obligations

All entities covered under Section 3.1 of this Guideline are subject to the following compliance obligations:

- **Technical Compliance:** All technical specifications, architecture requirements, security standards, and functional requirements defined in this Guideline must be met.
- **Certification Compliance:** All devices must be certified before deployment. Use of uncertified devices constitutes a compliance breach.
- **Reporting Compliance:** All required reports, audit submissions, and incident notifications must be delivered within specified timeframes.
- **Procurement Compliance:** No procurement of smart metering equipment or HES software that does not comply with this Guideline may be undertaken using public funds.

23.2 Enforcement Actions

Non-compliance with this Guideline may result in the following graduated enforcement actions, applied based on severity and persistence of non-compliance:

- **Written Notice:** Formal notification of non-compliance with a defined remediation timeline.
- **Remediation Order:** Mandatory corrective action plan to be submitted and executed within a defined period.
- **Suspension of Certification:** Temporary suspension of device or vendor certification pending remediation, preventing further integration with the Unified HES.
- **Restriction of Integration:** Removal of existing device integrations from the Unified HES until compliance is restored.
- **Regulatory Action:** Referral to appropriate regulatory authorities for action under applicable laws and regulations.
- **Public Disclosure:** Publication of non-compliance findings in the national compliance register for serious or persistent breaches.

23.3 Enforcement actions shall be proportionate, transparent, and subject to a defined appeals process managed by the National Steering Committee.

24. Conclusion

The Unified Head End System Guidelines, 2026, represents the most significant and consequential policy framework in the history of Bangladesh's smart metering journey. It transforms what has been a fragmented, vendor-controlled, and technically inconsistent landscape into a unified, secure, nationally governed, and future-ready digital energy infrastructure.

At its core, this Guideline is about national ownership — of data, of infrastructure, of standards, and of the strategic direction of the power sector's digital transformation. By mandating open standards, eliminating vendor lock-in, requiring source code transfer, and establishing a national governance structure, Bangladesh takes decisive control of its smart metering destiny.

The Unified HES will serve as the National Smart Meter Communication Backbone of Bangladesh — a designation that carries with it enormous responsibility and enormous opportunity. Every smart meter brought online through this platform represents a consumer who gains access to transparent billing, reliable service, and the benefits of a modern energy system. Every DISCO that migrates to the Unified HES gains operational efficiency, reduced costs, and the analytical intelligence needed to manage distribution networks in the 21st century.

The road from this Guideline to a fully deployed national Unified HES will require sustained commitment, technical excellence, and collaborative effort from the Power Division, all six DISCOs, meter manufacturers, technology vendors, and the Consulting Firm engaged for implementation. The governance structures defined herein are designed to sustain that effort through challenges and to adapt the framework as technology and operational needs evolve.

This Guideline is not the end — it is the beginning. The true measure of its success will be counted in meters brought online, consumers served, kilowatt-hours accurately billed, losses detected and recovered, and renewable energy

sources seamlessly integrated. Bangladesh's power sector stands at the threshold of a digital transformation that will serve the nation for generations. This Guideline provides the roadmap for that transformation.

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