CLAIMS

1. A cloud-based head-end system for automated metering infrastructure (AMI), comprising:

a data acquisition module, structurally configured to interface with a plurality of smart meters using one or more communication protocols adapted to normalize incoming metering data for downstream processing;

a cloud processing engine, operatively connected to the data acquisition module configured to perform real-time data validation, anomaly detection, and integration with utility billing systems;

a storage and data management system, operatively coupled to the cloud processing engine, and further comprising a distributed cloud-based storage architecture adapted to support scalable, redundant, and compliant archiving of metering data;

an AMI network communication module configured to provide bidirectional communication between smart meters and cloud servers, and ensuring secure, encrypted data transmission and remote meter control;

a security and access control module, operatively connected to the AMI network communication module configured to implement role-based user access, activity logging, and data protection in compliance with Philippine data regulations;

a monitoring and analytics module, structurally integrated with the processing engine and storage system, and functionally adapted to generate real-time insights, performance reports, and consumption analytics.

2. The system of claim 1, wherein the one or more communication protocols are selected from Radio Frequency (RF), Programmable Logic Controller (PLC), Cellular, and low-power, wide area networking (LoRaWAN).

3. The system of claim 1, wherein the cloud processing engine includes a validation sub-module for comparing real-time data against predefined operational thresholds; and an analytics sub-module employing predictive algorithms to detect anomalies and forecast energy consumption patterns based on historical data.

4. The system of claim 1, wherein the distributed cloud-based storage architecture of the storage and data management system further comprises: a distributed file system with automatic replication and failover mechanisms; and a metadata indexing system adapted to enable efficient querying, retrieval, and reporting of historical metering data in accordance with regulatory requirements of the Philippines.

5. The system of claim 1, wherein the AMI network communication module employs end-to-end encryption protocols selected from a Transport Layer Security (TLS) or an Advanced Encryption Standard (AES) for data security, and supports firmware over-the-air (FOTA) updates and remote service commands issued from the cloud processing engine to individual smart meters.