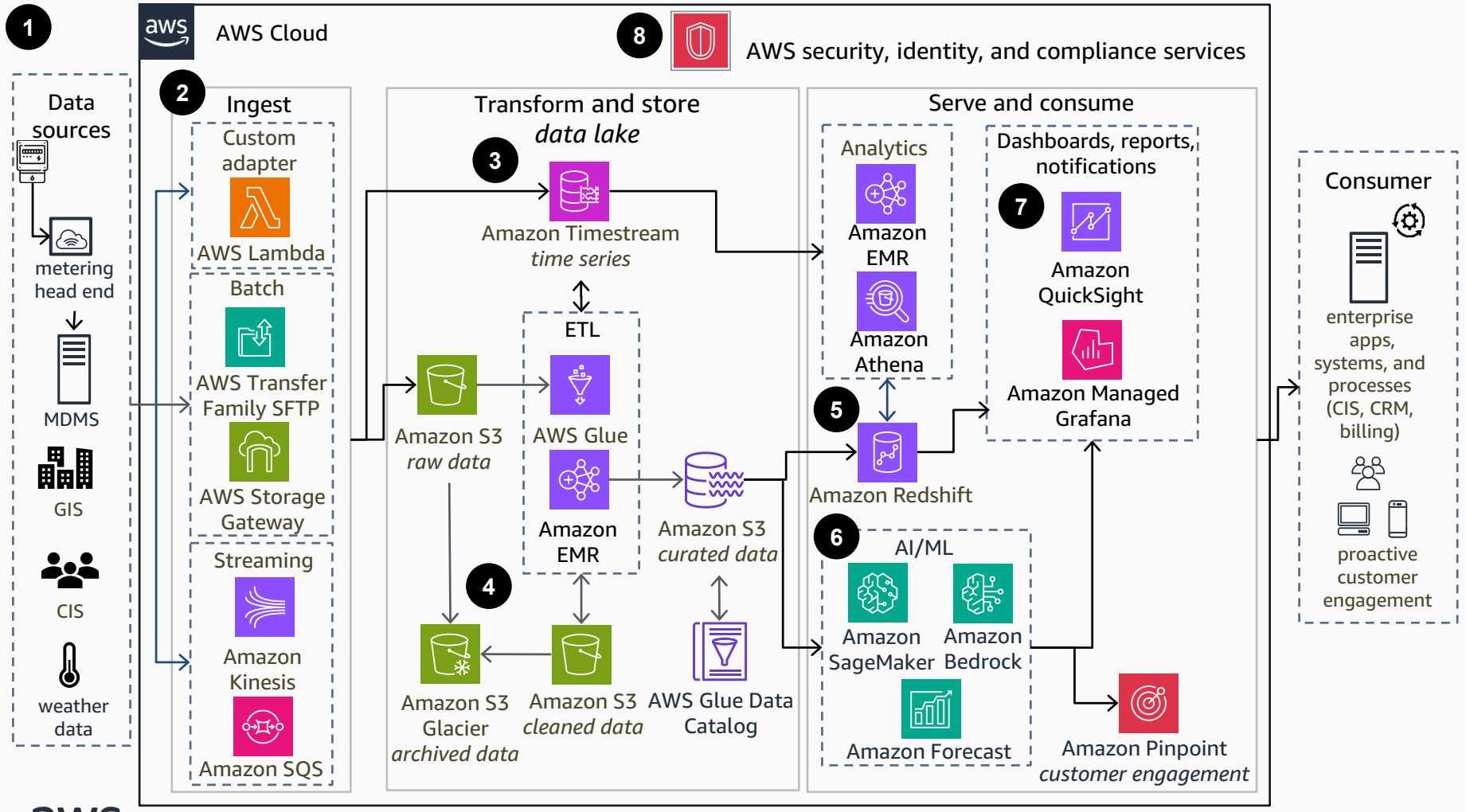
Meter Data Analytics for Utilities

This reference architecture enables energy companies to build modern meter data analytics solutions, improving meter data availability for operational and customer insights. It unlocks data silos, utilizing appropriate data stores, analytics, and AI/ML tools. Key capabilities include detecting meter and circuit anomalies, circuit balancing, energy theft prevention, demand prediction, and enhanced customer engagement through proactive analytics and ML-based forecasting.



1. Data comes from various sources, including meter data management systems (MDMS), head end systems (HES), customer information systems (CIS), and geographic information systems (GIS).

2. Ingest customer and meter data to AWS using both batch and streaming, depending on your use case. Choose from multiple AWS tools to ingest customer and meter data, such as **AWS Lambda** for custom adapters, **AWS Transfer Family for SFTP** and **AWS Storage Gateway** for batch processing, and **Amazon Kinesis**, and **Amazon Simple Queue Service** (Amazon SQS) for streaming data.

3. **Amazon Timestream**, a time series database service, enables storing and analyzing meter data efficiently, powering near real-time dashboards and time series analytics for energy companies' mission-critical applications.

4. With **AWS Glue**, you can automate extract, transform, and load (ETL) processes, such as file transforms and deduplication, or value-add processing, such as running meter data VEE process and creating billing determinants. Use **Amazon Simple Storage Service Glacier** as low cost storage for archival copies and retention compliance. Your final curated data sets are stored in an **Amazon Simple Storage Service** (Amazon S3) bucket; your data lake serves as the "single source of truth" for downstream analytics and machine language (ML) work. **AWS Glue** automates the process of data schema discovery and metadata tagging to create a metadata catalog that makes all data visible and searchable.

5. Query petabytes of structured and semi-structured data or time series across your data warehouse and your data lake using standard SQL with **Amazon Redshift**. Perform complex analytics with **Amazon EMR** and one-time data discovery and query against your lake and warehouse with **Amazon Athena**.

6. Use **Amazon SageMaker** to detect grid anomalies, forecast energy usage, and predict equipment failures, or **Amazon Bedrock** integration to chat with your meter data.

7. Create and publish interactive dashboards that include AI/ML insights with **Amazon QuickSight** or **Amazon Managed Grafana**. Dashboards can be accessed from any device and embedded into your apps and websites. Proactively communicate with customers using **Amazon Pinpoint** and measure customer engagement across multiple channels including email, SMS, and mobile push notifications. Use analytics and ML outputs with **Amazon Pinpoint** to create personalized customer target segments and campaigns.

8. Use AWS security, identity, and compliance services to keep your data safe and secure.

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AWS Reference Architecture