IoT ONE

Advanced Metering Infrastructure (AMI)

Overview

Advanced metering infrastructure (AMI) solutions are integrated systems of smart meters, communications networks, and data management software that enable two-way communication between utilities and customers. AMI systems are comprised of electronic or digital hardware and software, which combine interval data measurement with continuously available remote communications. These systems enable measurement of detailed, time-based information and frequent collection and transmittal of information to various users. AMI typically refers to the full measurement and collection system that includes meters at the end user site, communication networks between the end user and a service provider, such as an electric, gas or water utility, and data reception and management systems that make the information available to the service provider.

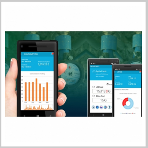
Applicable Industries

- Renewable Energy
- Smart City
- Smart Grid

Applicable Functions

- Facility Maintenance

Case Studies



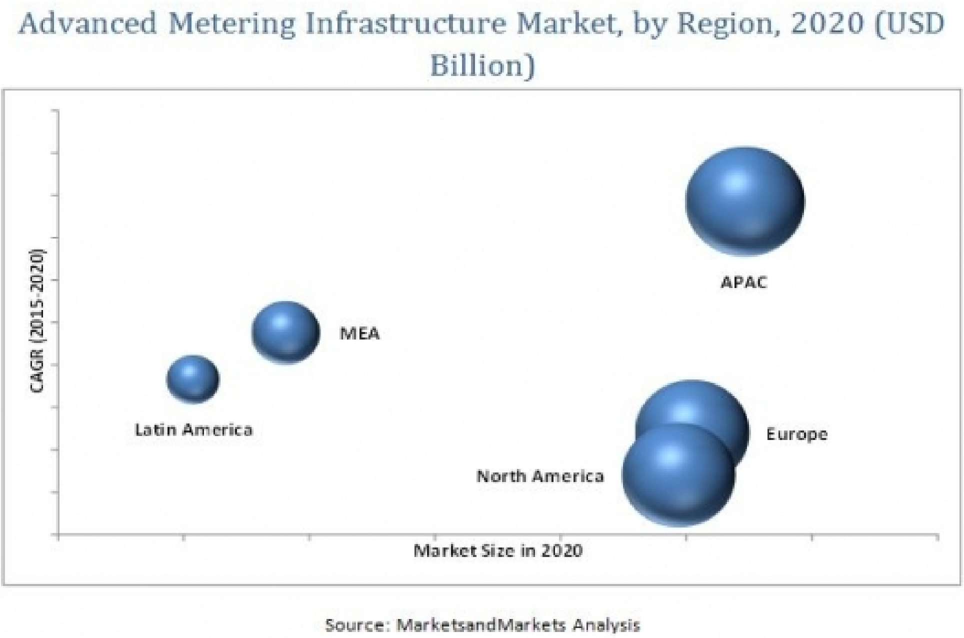
Transforming Water Utilities with IoT, saving a Billion Gallons every year!

The big problem that Utilities face includes:(i) How to make meters “smart” and ingest the data from homes to the companies and;(ii) how to derive intelligent actions from huge amounts of ...

Market Size

Estimate A

According to MarketsandMarkets the AMI market is expected to grow from USD 4.5 Billion in 2015 to USD 9.2 Billion by 2020, at a Compound Annual Growth Rate (CAGR) of 15.5%. Increasing adoption of Internet of Things (IoT) technologies is driving market growth. For the forecast period, the AMI analytics segment is expected to grow most rapidly. APAC is projected to be the largest market for AMI solutions and services by 2020.



User Viewpoint

Business Value

How does this use case impact an organization's performance?

Key objectives of AMI systems include improving utility service quality, increasing management visibility into real-time consumption, enhancing the reliability of utility services and automating safety mechanisms and other activities.

According to the Electric Power Research Institute, there are three primary benefits associated with AMI deployments. These include System Operation Benefits, Customer Service Benefits and Financial Benefits.

System Operation Benefits are associated with a reduction in manual meter readings and associated management and administrative support. Meter reading accuracy is improved due to the elimination of manual errors. AMI systems can also improve theft detection to energy systems by identifying anomalies. Finally, outages can be identified in real-time and may be addressable remotely.

Customer Service Benefits are associated with early detection of meter failures, billing accuracy improvements, faster service restoration and flexible billing cycles. AMI systems enable utilities to provide time-based rate options to customers.

Financial Benefits accrue to the utility from reduced equipment maintenance costs, reduced support personnel expenses, and faster restoration and shorter outages. Utilities may also improve pricing by matching revenue more closely to the cost of supplying energy.

Key Performance Indicators

How is the success of the system measured for users and for the business?

In order to measure AMI deployment progress, two KPI's are typically defined:

- Number of advanced meters installed; and

- Percentage of total demand served by advanced meters.

These KPI's enable benchmarking of the penetration level and the load that is served with advanced meter infrastructure.

System performance KPIs can vary broadly depending upon the objectives of the system owner. Common examples include:

- Frequency of meter readings;

- Time to address system outages;

- Service cost per unit or cost per outage;

- Average energy rate billed;

- Proportion of energy consumption during peak vs. non-peak hours;

- Time to service after a system outage; and

- Number of units served per maintenance personnel, among others.

System Capabilities & Requirements

What are the typical capabilities in this use case?

A number of industries, such as telecommunications and commercial airlines, offer attractive off-peak rates to even out customer demand and prevent system overload. O&R's Time-Of-Use (TOU) electric rate is based on the same concept. By reducing the electric use during peak periods, it is possible to lower the annual energy costs, without reducing the overall amount of electricity used.

In order to ensure correct and smooth data relay, the system in which the AMI will be installed should be able to maintain system-time synchronization across all devices to ensure data accuracy. The system in question should support the interfacing with the future Smart Grid functionalities like outage management system, distribution automation including self-healing system, distribution transformer monitoring units, distributed energy resources. The communication network should preferably be able to support multiple applications.

Deployment Environment

Where is the ’edge’ of the solution deployed?

The endpoints (smart meters) of AMI systems can be deployed in any infrastructure that consumes electricity. Common deployment environments include factories, commercial buildings, residential buildings, and power plants. System requirements differ significantly based on the environment due to safety, data security, and regulatory factors. For example, in factories that produce flammable gases, wireless battery-powered sensors must meet high safety standards since a spark could ignite a gas leak.

Technology Viewpoint

Sensors

What sensors are typically used to provide data into the IoT system, and which factors define their deployment?

The performance of AMI systems is heavily reliant on a wide range of sensors.

Common sensor requirements are well defined in the article Advanced Metering Infrastructure Based on Smart Meters in Smart Grid, they include:

Quantitative measurement: Smart meters have to accurately measure the quantity of the medium by using various topologies, physical principles, and approaches.

Control and calibration: Smart meters should be providing the ability to compensate the small variations according to each system type.

Display: Smart meters will send and display information usage of electrical energy to customers for billing in real time. Besides, the information of real-time consumption displayed on smart meters helps customers to manage their demand efficiently.

Synchronization: Typically, smart meters transmit data of customers to the collector systems or central hubs for billing and data analysis. Hence, timing synchronization is very important for the reliable transmission of data, particularly in case of wireless communication.

Security communication: The meters have ability receiving operational commands and sending stored data as well as upgrades for its firmware trustworthily.

Power management: Smart meters have to help the system to exactly maintain its functionality when the primary source of energy is lost.

Analytics

What types of analysis are typically used to transform data into actionable information?

Meter data analytics plays a vital role in AMI system which helps utility to manage their resources and business process efficiency. Advanced Metering Infrastructure Analytics illustrates the use of meter data analytics such as meter data validation, energy audit & accounting of distribution transformer, missing information, peak demand identification, consumer profile analysis, load forecasting, abnormal energy pattern analysis helps utilities through improved visualization and enhanced situational awareness. The analytics also help in providing better quality of service to consumers and empower them to better manage energy usage

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Connectivity

What factors define the connectivity solutions used to provide both device-to-device and device-to-cloud communication?

AMI applications differ greatly in network and connectivity requirements related to data payloads, sampling rates, latency, and reliability. Generally, a multi-layer architecture is required. This architecture typically comprises a Home Area Network

(HAN), Neighbourhood Area Network (NAN) and Wide Area Network (WAN).

Implementation Viewpoint

Integration Challenges

What integration challenges could impact deployment?

AMI is a complex system of technologies that must be integrated with utilities' information technology systems, including Customer Information Systems (CIS), Geographical Information Systems (GIS), Outage Management Systems (OMS), Work Management (WMS), Mobile Workforce Management (MWM) and Distribution Automation System (DAS).

Source

Installation Challenges

What installation challenges could impact deployment?

Installation of the system depends on the exact existing infrastructure of the building/residential/business area.

Regulatory Challenges

What regulatory challenges could impact deployment?

Depends on the governing body of the country. In the USA, overlapping federal, regional, state and municipal agencies create an impediment for adoption of AMI systems. Thus, the industry is neither fully regulated nor completely deregulated, which presents a regulatory challenge.

IoT ONE Use Case

Accelerating the Industrial Internet of Things

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