



WIRELESS ADVANCED METERING INFRASTRUCTURE

The following explanation extends an understanding of the current state of Wireless Advanced Metering Infrastructure (AMI) and its use of Automated Meter Reading (AMR) systems.

Problems facing Utilities:

For many years Utility Authorities have been aware that there is a significant loss of revenue as equipment ages and degrades. Whether it is water, gas, or electricity, municipalities throughout the country are seeing rising costs and are seeking ways to reduce the negative effect of these costs. Contributing factors to the loss of revenue are: outdated equipment and technologies, and inefficient collection and recording methods. One estimate is that the average rural municipality collects only 80% of the “true” water usage that should be billed. It is not unusual to find communities that are “under billing” their customers by 30%, 50%, or more. To a lesser degree this applies to both the gas and electrical utilities as well. Although percentage loss may be less with these 2 utilities the dollar amounts are usually significant due to the higher costs of these utilities. As water becomes a more valuable commodity there is a need for a more reliable and accurate method of collecting meter readings. Advanced Metering Infrastructure (AMI) solutions attain this objective while improving efficiency and effectiveness. Thus achieving the dual goals of lowering overhead costs while increasing revenue.

Previous AMR Options:

Automated Meter Reading (AMR) solutions have been around since 1962. Until recently, the latest innovation was drive-by AMR. Since these drive-by systems still require human interaction at many of the data transfer levels, they suffer from accuracy and efficiency issues. Fixed wireless solutions initially relied on above ground antennas to transmit the data from the meter. In the case of water meters this created problems with locating the antenna. Either it would be in the way of the homeowner, or underground wiring was required to move the antenna to a more unobtrusive location. Power sources for water data transmissions were an added flaw in early systems.

Solution:

The solution to this problem has been through the use of solid state technology creating what is referred to as Advanced Metering Infrastructures (AMI). This is accomplished through the use of battery-powered wireless AMI units with “in-the-pit” antenna. These are used in conjunction with wireless collection devices that use industry recognized data transfer methods with database implementation to store and report meter data collected. Technological advances allow for the placement of antennas below ground in the case of water meters, and in the housing of the meter in the case of electric meters. These new electric meters are (usually) solid state digital meters with no moving parts. The radio transmitter is easily added to the existing circuitry and draws its low voltage from the meter itself. Gas meters require a small unobtrusive battery powered antenna attached to the meter.

Primary Benefits

An ongoing operating cost savings through accurate automated meter reading. This cost savings is achieved through the use of a fixed based network system utilizing existing technology.

The system requires little, disturbance to the user’s property. In the case of water meters for instance; the changes are invisible to the property owner. This is achieved through the use of a transmission system, which is capable of transmitting from an underground environment. Electric meters have built-in antennas, and gas meters require only a minor addition of a transmitter to the register.

New AMI solutions are stable and use redundant techniques. The communications protocol between the meter reader and the collector system is designed to minimize disruptions caused by power outage or component failure.

System Overview:

An AMI system consists of three sections: the meters equipped with radio transmitters, a network of collectors, and a main server. The collectors receive the different transmitted readings and then forward the data to a main server. The number of data readings and transmissions in a 24-hour period may vary according to the city’s needs. The server is connected by a Wireless Broadband network to the collectors stationed throughout the city.

Water Meter AMI:

The water meter AMI uses a water-proofed sensing device that attaches to the newer models of water meters. Readings taken by the AMI system is based either on the position of the “odometer” wheels on the meter or by counting the revolutions of the meter’s needle through a magnetic reed switch. An onboard microprocessor records the meter reading at user-specified

intervals. Again, at user-specified times, the meter reader transmits its data. The recorded data transmitted from the meter may be read by any collector within range. The collectors then send the data through the network to the server. The server automatically removes duplicate readings. This redundancy in the collector network further ensures system reliability.

To prolong the life of the battery the AMI radio spends most of its time in a “sleep mode” using just enough power to count the pulses from the dials or reed switches. For most brands the transmitter can be configured individually, allowing for special configurations as needed.

Water meters placed in an underground housing traditionally have used cast-iron lids. These have to be replaced with a plastic or fiberglass lid, in order to increase the transmissions range to assure the signal reaches the collector. The transmitter itself is attached to the underside of the lid to prevent the transmitter being covered by more than a few inches in a pit filled with water, again allowing the signal to reach its destination in these situations.

Gas Meter AMI:

The AMI technology for Gas Meters is virtually identical to the Water Meter AMI. However, there is a huge advantage in having the antenna above ground due to the added distance that the signal can travel.

Electric Meter AMI:

Most electric meter manufacturers are going to an all solid state meter with no moving parts. The meters are built to add a transmitter through a simple connection directly on the circuit board. A simple antenna mounts under the glass. For electric applications, the AMI transmitter usually acts as a collection unit forming a mesh network that improves the gathering of data and improves the range between Collectors. Typically, when Electric Meter AMI is used, the Water Meter AMI and Gas Meter AMI utilize this mesh network to transmit their data as well. The data is kept separate and flows seamlessly to the appropriate billing systems. The addition of a simple collar allows the utility company to remotely turn meters off and on at their office, if desired. In the newest models this feature can be a built-in feature of the electric meter.

Collector

Collectors, as the term implies, collect meter reading data via a wireless interface. The wireless connection is low bandwidth, highly reliable, and non line-of-sight, which allows for robust communications in many environments. Typically, a collector receives transmissions from multiple meters and passes that information along the network back to the server where it is compiled.—

Collectors are low power devices requiring only about 18 watts of power to operate. They can be powered by a wide range of DC power from 6-60 volts. The low power requirements of this device also allow for the possibility of solar power when wired electrical power is difficult to provide.

Collectors are designed to be mounted outdoors on utility poles or on other premises where they can be elevated so as to have the least possible obstruction to the meter readers. Now available are systems that operate on a licensed 450Mhz channel that greatly increases the distance of the transmission which lessens the number of collectors needed. Improving the overall system and improving aesthetics by reducing the number of antennas throughout the city.

Server:

The server platform runs standard AMI software. The server being the final collection point of the meter reading data, gathers the data sent to it by the collectors over the Wireless Broadband network. Once it receives the readings via the network, it converts and stores these readings in a database. This database serves a dual purpose. It sends the information directly into the existing billing system. But it also can be used to access a greater amount of data that can be used to spot leakage points, handle customer disputes, and provide more information for better management of the utility system.

Summary

Advanced Metering Infrastructure systems provide reliable meter data collection and reporting. It achieves a high accuracy by utilizing the advantages of a fixed wireless system. Thus reducing human involvement to a minimum. This not only eliminates errors, but saves money as well by freeing resources for other purposes. In addition, the system seamlessly integrates into any existing billing system. Thus, additional investments are not necessary, although billing systems can be updated at any time as the need arises.