Utilities | the way we see it

AMI information
for improved outage management

People matter, results count.

Challenges for Utilities' Distribution Operations

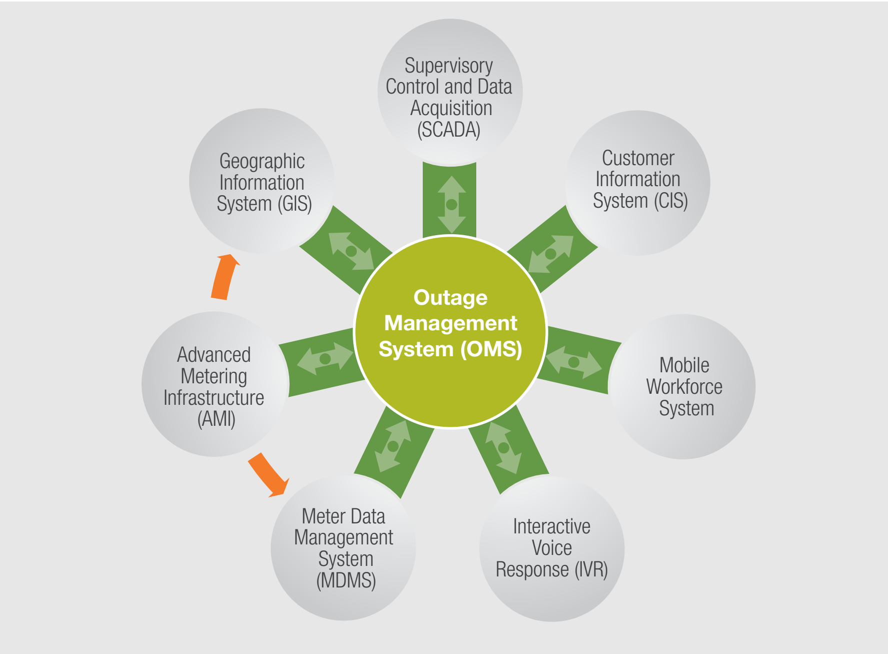
Despite advances by the utility industry to protect and harden the electrical grid, unplanned outages are commonly regarded as business as usual for the utility company.

Electrical grids are subject to failure that can cause unplanned power interruptions for utility customers. Some of the causes for these interruptions include exposure to extreme weather and natural events, equipment damage due to motor vehicle accidents, equipment malfunction or deterioration and electrical contact with excavation equipment, wildlife and vegetation. Despite advances by the utility industry to protect and harden the electrical grid, most of these causes are difficult to control and as a result, unplanned outages are commonly regarded as business as usual for the utility company. Over the last decade there has been significant improvement made to outage management systems (OMS) where utilities have replaced or upgraded legacy systems with advanced GIS-based systems. This has enabled many new business processes which provide for a complete set of network management functions that not only supports outage management processes, but also enterprise outage and asset management solutions. But OMS solutions today still face many challenges based on limited capabilities including:

- A customer calling the utilities to report an outage is still the main input for OMS solutions.
- Outage call handling/interactive voice response (IVR) is not intelligent enough to filter actual outage calls from all customer calls accurately as utilities data shows that 30% of the single customer calls are not classified as outages.
- OMS has limited intelligence to detect and verify nested outages which can go unnoticed for several hours during severe storms.
- Crews that are dispatched to the incorrect location or return trips for nested outages have cost implications.
- Limited capability for dispatchers to have greater visibility of system conditions.

Real-time Operations Leveraging AMI technology

OMS systems are required to integrate and link varied operational systems such as Advanced Metering Infrastructure (AMI), geographical information systems (GIS), customer information systems (CIS), IVR systems and mobile data systems to provide near real-time, dynamic data from the field. The AMI network extends to the ends of a utility network at the customer premise. As a result, it can provide remote monitoring of the end nodes of the delivery points. This capability can be used not only to pinpoint outages but also to verify power restoration, enabling utilities to proactively identify customers whose power has yet to be restored. Outages reported by other systems such as SCADA (Supervisory Control and Data Acquisition) and DMS (Distribution Management System), or by the customer directly, can then be explored to verify the outage and determine the extent of the outage. Because AMI systems improve the processes for identifying the location of outages accurately, the effective dispatch of appropriate personnel and equipment can reduce labor and truck roll costs.



(Figure. 1)

Smart meters are designed to send an alert when they experience a sustained interruption of electrical supply or an "outage". This alert is often referred to as a "last gasp" because it is actuated by a capacitor in the meter for a short period of time after the outage occurs and before the meter loses its capability to communicate due to the loss of electrical supply. Depending on the functional design, communication network components like repeaters and collectors may also send a last gasp alert. The last gasp is sent to the Head End System (HES) and ultimately to the OMS. Solution best practices involve an analysis, assessment and validation of the alert in an operational data store prior to processing by OMS in order to only present the alerts that will add value to the outage management processes. Overloading the OMS with ineffectual and redundant data slows down the OMS prediction engine. The goal is to provide the OMS with new outage data that has not been previously reported by a customer or by an upstream SCADA event that has interrupted supply to the distribution system. New outage information also assists in predicting the exact fault location of a "known" outage. As a result, during storms or large feeder outages, most of the meter last gasps are filtered off unless they meet pre-configured criteria that will improve outage management processing.

As valuable as the last gasp is to provide real time outage notification for the utility, the ability to "ping" the meter to confirm power status can be even greater. Pinging a meter or communications network device simply means that utility personnel such as dispatchers and customer service representatives (CSRs) can send a query across the AMI communication network to confirm the power status of the device. Understanding that the meter or device has power supply provides the utility with information for effective decision making that results in significant OPEX savings by eliminating or reducing crew travel time, as previously mentioned.

AMI technology capabilities integrated with OMS allows network operator to:

Ability to ping any device or meter at any time

- Ability to ping a meter and verify a no-power call
- Ability to evaluate meter points on the entire circuit or feeder
- Provide the network operator with prediction validation
- Provide additional information for locating the faulted device
- Provide outage restoration verification
- Determine location of nested outages

Key Benefits of Integrating AMI with OMS

Improved device prediction accuracy by using meters to verify outages in a timely manner.

This leads to **improved customer satisfaction**.

Key benefits achieved by leveraging AMI include but are not limited to the following use cases:

- Improved device prediction accuracy by using meters to verify outages in a timely manner. Ideally, the OMS will identify and validate an outage before the first customer calls to report the outage. The IVR should notify the customer that the utility is aware of the outage and responding. This leads to improved customer satisfaction.
- Improved crew management and utilization by reducing the crew effort required to return, repair and restore nested outages by pinging meters to validate power restoration of all customers affected.
- Improved outage detection and management process where outage can be verified even without customer intervention.
- AMI information and technology can improve customer outage call handling processes that result in reduced labour costs for CSRs. When OMS is made aware of an outage reported by smart meters, the IVR at the customer contact center should inform the customer that the utility is already aware of the customer outage, provide an auto-ETR and in most cases the customer will hang up unless the customers wants to provide damage or causal information. This reduces the requirement for a CSR to answer customer calls that do not add value to the outage management process. Also, if the CSR has the ability to ping a meter to confirm power on at the utility side of the meter base, they are more informed when dealing with customers who have been disconnected for payment arrears.
- Detection of outages at distribution transformers or other common points of failure can improve response times and reduce restoration costs. This is especially valuable in remote areas where the crew would normally have to spend a significant amount of time patrolling the grid to find the exact fault location.
- Improved accuracy of distribution network reliability statistics by detecting outages in a timely manner.
- Validation of liability claims. Detection and recording of outages allows utilities to know which claims attributed to outages actually correlate to an outage and which do not.

AMI Integration for Advanced Utilities Operations

Today, the utility industry is facing real cost challenges in replacing aging infrastructure, maintaining customer satisfaction, meeting a growing demand for power, improving reliability, and regulatory issues and environmental concerns. This has increased the importance and focus on cost effective and efficient utilization of physical assets. Traditional approaches to maintaining electrical grid infrastructure are based on "preventive" or, in some cases, "reactive" methods. Preventive maintenance approach involves a time-based, periodic maintenance program for all assets with a higher priority placed on critical, higher cost assets. For example, certain assets are inspected every five years, while others are inspected every year, and so on. Under a reactive maintenance approach, assets are inspected and repaired only after they fail. Neither approach fully mitigates the risk that critical assets will fail while in service, in some cases resulting in catastrophic consequences. Predictive planned maintenance helps utility organizations to accurately predict events that cause outages and also to run their assets at peak performance.

This involves the data integration and predictive analytics of the equipment nameplate operating ratings with actual equipment operating data to boost uptime, performance and productivity while lowering maintenance costs and the risk of revenue loss. AMI information for asset management include power quality and load profile data which provides detailed information on how electrical components are performing and which components are at risk. Leveraging predictive analytics using this and other information such as weather data help planning engineers identify over-utilized assets and respond quickly to prevent outages and improve asset life. Predictive analytics can help the utility improve the cost effectiveness of the planning and scheduling of their asset maintenance program through a risk-based approach rather than a time-based approach, prioritize field crew activities on the most critical maintenance components and improve the overall reliability of service.

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This capability provides a number of potential benefits for the utility, including:

- Reducing unplanned outages by predicting failures and replacing overloaded transformers before the onset of the peak-loading season.
- Informed and sound decision making to determine the load growth for any given transformer to decide whether to move a given customer from one transformer to another.
- Improving customer service and avoiding costly emergency/overtime work by replacing a large percentage of unplanned outage work effort with planned maintenance work activity.
- Accurately optimizing capacitor bank size and location based on actual Volt/VAR readings.
- Discovering suspect transformers proactively before they lead to customer voltage complaints.
- Better asset utilization by relocating transformers or rebalancing the customer load on under-utilized and overloaded transformers.
- Choosing the appropriate transformer size when replacing failed transformers.

- Troubleshooting voltage problems by knowing the voltage at each customer access point on the feeder.
- Scheduling maintenance and adjusting load based on accurate indications of conductor, sectionalizer and regulator overload rather than estimates and periodic scheduling.

By leveraging AMI information and the AMI network to authenticate and prioritize potential and real outage events, the utility can realize significant benefits and return on investment in reduced operating costs, capital costs and improved reliability.

Integration of OT/IT Solutions

As Operational Technology (OT) and IT continue to converge and improve information sharing, utilities can expedite new business processes, applications, and data management to drive transformation. The integration of complex event processing and analytics engines into the utility's enterprise architecture that is comprised of IT systems (CIS, EAM, HES and MDMS) and OT systems (OMS, DMS, SCADA and WFM) will enable effective outage management, asset management and workforce management.

Finally, looking forward, the AMI infrastructure will allow for many other future distribution operation management capabilities and improvements. The enablement of AMI and additional data elements allows the utility to deploy additional real-time monitoring, control and management solutions. Distribution Management applications such as:

- Distribution – Automated feeder restoration
- Distribution Power Analysis – Real-time unbalanced load flow
- Volt/Var Optimization - Multi-objective optimization system

Over the last decade, utilities have invested in AMI technologies that provide data to support processes for meter-to-cash, conservation, theft detection, outage management and asset management. By leveraging AMI information and the AMI network to authenticate and prioritize potential and real outage events, the utility can realize significant benefits and return on investment in reduced operating costs, capital costs and improved reliability.

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