



Meter Testing 101



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Abstract

- As many utilities have elected to deploy advanced metering systems and millions of new solid-state, microprocessor based end-points with communications under glass, a dramatic shift has begun regarding where metering resources are being deployed and what they are doing.
- This presentation will highlight the new value proposition for metering personnel at their respective utility companies in a post-AMI World.
- Examples of issues which have arisen or been identified over the course of various deployments and in the immediate aftermath of an AMI deployment.



Pre-AMI Meter Operations

Common Features and Common Sources of Concern



- Fewer meter techs in the field and in the shop than there were 25 years ago
- Fewer Field checks and site verifications due to lack of personnel, lack of experience and lack of expertise
- More features under glass in the meters even before AMI deployed
- Significantly more features under glass in every AMR and AMI system being considered or being deployed
- Metering losses starting to be identified “by accident” as opposed to being “by design”.

The Pendulum Starts to Move

- Meter Operations. Prior to deployment many larger utilities take an attitude of “this is only metering – how hard can that be?”. Over the course of deployment Meter Operations gains a stature and a respect from the rest of the organization that was not previously accorded them – even if this is only begrudging respect.
- New tests for AMI meters (e.g. communication, disconnect) are identified
- The complexity and issues around high revenue metering are at least acknowledged by the rest of the organization
- Tests which have not been performed in years are suddenly back in vogue



The New Realities

- Electro-Mechanical Meters typically lasted 30 years and more. Electronic AMI meters are typically envisioned to have a life span of fifteen years and given the pace of technology advances in metering are not expected to last much longer than this.
- This means entire systems are envisioned to be exchanged every fifteen years or so. In the interim the meter population and communication network inherent in the infrastructure for each utility must be maintained.
- Meter communication and meter data management are becoming as important to metering operations as meter accuracy.
- Firmware upgrades, firmware stability and cyber security are becoming increasingly important to metering departments



Expected & Unexpected Trends at the End of Deployment

Expected:

- The AMI deployment team will declare victory at some point and move on. Clean-up will be left for the meter service department
- Change Management continues to be a tremendous challenge for every vendor through every deployment
- Meter Acceptance testing including far more than accuracy testing for every deployment
- Firmware upgrades must be checked and tested before mass deployment

Unexpected:

- Not all forms are available by the end of deployment and must be installed as part of normal operations by the meter service department
- Meter Certification Testing never slowed down over the course of any of the deployments



Why do AMI meters fail?

Looking back at various deployments – what are the chief causes to reject meter shipments?

Meter functional test failures including but not limited to;

- Incorrect firmware
- Bad settings
- Alarms and errors that do not clear
- Communication test failures
- Bad tables
- Failed disconnect switches



Lessons for the Future?

- Are these infant mortality issues or are these issues to be concerned about going forward?
- What was NEVER the reason for rejecting a shipment – meter accuracy.
- Which are the most difficult meters for every deployment – the transformer rated meters. Often these forms are not available until very late in the deployment and sometimes not until the deployment has officially ended.



Commercial and Industrial Metering Challenges

- Most AMI deployments utilize third party contractors to handle the residential and some self contained non-2S services. The balance are typically handled by the meter service department of the utility.
- No AMI deployment has used the AMI communication network to handle the communication with the largest customer meters. The risk from even a short term interruption of communication or loss of data far outweighs to benefit of meters which are already being communicated with daily or even several times a day.
- As these services are evaluated for new metering technology issues are being found at some accounts. These issues represent revenue losses due to inappropriate metering schemes or partially failed metering components (e.g. transformers, electronic components).

How are these new realities starting to affect metering operations?

- Metering is becoming more about IT. Some metering departments have been reorganized after AMI as part of the IT department.
- Metering emphasis will shift strongly toward C&I customers and further and further away from residential meters
- Metering resources are being refocused on C&I accounts.
- There are fewer levels of meter tech. Every meter tech needs to be at the higher level as there is not enough lower level work to warrant full time employees
- Utility commissions are being less forgiving of allowing rate relief for project over runs and metering inaccuracies

New or expanded roles for metering departments of all sizes

- Responsible for either reviewing ANSI Tests or even performing some of these ANSI Tests
- Perform Meter Functionality testing on new and returned AMI meters
- Register and communication module energy measurement comparison
- Disconnect/Reconnect Functionality
- Outage Performance
- Meter Communications Performance
- Consumer safety and combating real and perceived issues
- Near continuous research into the “next” technology and the next deployment



Shop Testing

- Accuracy testing
- Meter Communications Performance
- Software and firmware verification
- Setting verification
- Functional testing
- Disconnect/reconnect Functionality and as left setting



Field Testing



- Accuracy Testing
- Meter Communications Performance
- Software & Firmware Verification
- Setting Verification
- Functional Testing
- Disconnect/Reconnect Functionality and as left setting
- Tamper Verification
- Site Audits appropriate to the type of meter

RMA's, Root Cause Analysis and In Service Testing

No one knows the actual life of their AMI meter. To do this we must learn as much as we can from the failures and the performance of the meters we have deployed.

Opportunities to Learn:

- Meters returned from the field as bad or flagged on incoming inspection. These RMA's need to be tracked not only for warranty purposes but more importantly to understand the root cause of the issues.
- In Service Test programs need to be utilized to understand the overall performance of AMI meters and as failures are identified these meters need to be dissected and the failure mode understood. If necessary, once the failure mode is understood the meter population may need to also be dissected to identify sub-groups of meter that may be similarly affected. This could be a group of meters...
 - from the same shipment.
 - that were deployed in the same geographic area.
 - that saw the same type of usage or environment.



Post-Deployment Needs



- Once deployment is complete the certification and acceptance testing does not stop.
- Everyone understands the importance of acceptance testing, but future generations of a smart meter also require certification testing.
- New software and firmware needs to be tested and compared against the performance of older generations.
- New hardware must be tested and compared to older generations.
- Firmware upgrades need to be checked
- New head end systems or IT protocols need to be tested against a large group of meters before going live.

Real Life Examples of Change Management in Action

- Issues in the system not the components – what is the definition of a meter and when did the meter change?
 - Meter and communication device interface
- Feature Creep – every manufacturer wants to differentiate themselves – sometimes this works in unanticipated ways
 - Recovery from power outages
 - Short and long demand periods
- But we only changed....lessons we should have learned from Microsoft
 - Over the air upgrades
- Thank Goodness for test plans – right?
 - Half closed disconnect devices
 - Disconnect devices of unknown state
 - Meters with incorrect firmware



Summary

- The focus is on far more than accuracy
- The meter man of the future knows not only metering but they are communication experts and are involved with handling, reporting and analyzing far more customer and system data
- There are fewer “routine jobs” in the field and many of the standard tasks are no longer required. This will lead to fewer classifications of meter techs going forward and the need for a more highly trained tech.
- Each Utility must take a far more active role as part of checking, certifying, and rechecking the functionality of their meters.
- Metering will be in a near constant cycle of looking for the next technology, evaluating those technologies, planning for deploying these technologies, and cleaning up the aftermath of the deployment of these technologies.



Questions and Discussion



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This presentation can also be found under Meter Conferences and Schools on the TESCO web site:

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