TESCO METERING

# AMI 2.0: How to Analyze and Justify Upgrading

SOUTHEASTERN METER SCHOOL

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# Topics we will address

- Definition of and benefits of AMI* 2.0
- Why should we move to AMI 2.0?
- If we should move to AMI 2.0 when should we move?
- If we move to AMI 2.0 what type of timelines should we expect as we move into planning for AMI 2.0 and what are the business case reasons for this move?

*Note: AMI stands for Advanced Metering Infrastructure

# Why Metering Modernization Matters

## The Evolution of Electric Metering

| Era | Technology | Utility Capability |
|---|---|---|
| Pre-1990 | Electromechanical meters | Manual reads |
| 1990–2010 | AMR* | One-way communication, digital, mechanical and hybrid meters |
| 2007–Present | AMI 1.0 | Two-way communication, digital meters only and some data in addition to energy consumption |
| Emerging | AMI 2.0 | Grid edge intelligence and the promise of more data for better and more operationally directed analysis |

**Metering has evolved from energy measurement only → operational intelligence.**

***Note: AMR stands for Automated Meter Reading**

# What AMI 1.0 Delivered

**Capabilities:**

- Two-way meter communication
- Remote reads and billing automation
- Remote connect/disconnect
- Interval consumption data
- Outage detection
- Ability to update the meters firmware and settings over the air
- Ability to bring back real time data from the metering end-point to better detect sources of line loss in the distribution system.  This ability increased as AMI meters evolved and more sensing technology was added.

# Financial Value of AMI 1.0

Typical AMI 1.0 Business Cases showed a 10 year payback and a system life expectancy of 15 to 20 years. Savings included but were not limited to the following big four:

| Benefit | Typical Impact |
|---|---|
| Labor reduction | Meter reading eliminated if there had been no AMR program. For these utilities AMI 1.0 was a slam dunk. Most utilities had some form of AMR system in place. These utilities saw a nominal reduction in the work force required for an AMI vs an AMR system. |
| Truck roll reduction | Remote disconnects and reconnects were the biggest savers of truck rolls, but the data from the meter also prevented some truck rolls and more importantly allows utilities to determine where to send a truck and which truck to send with the right equipment and personnel – eliminating many unnecessary truck rolls. |
| Billing accuracy and system information | Reduced disputes, enhanced user portals, ability to change tariffs on the fly, and outage monitoring |
| Operational visibility | Interval data, outage management and line voltages |

# The Shift Toward AMI 2.0

**What new industry challenges are Utilities seeing and what new meter features are Utilities seeing as they look toward AMI 2.0?**

## Major grid and meter changes:

- Distributed Energy Resources (DER)
- EV charging growth
- Grid reliability pressure
- Cybersecurity requirements
- Data analytics expectations

AMI must now support **grid operations**, not just billing.

But the REAL reason we are looking at AMI 2.0…..

# The Primary Reason for AMI 2.0

## AMI 1.0 systems are aging out!!!!!

And no one wants to rip and replace all of their meters as most utilities did for AMI 1.0.

This was expensive - largest metering related project in the history of every utility, and no one wants to repeat that expense, and no one wants that level of disruption again.

Utilities would prefer a more gradual approach and at some point, a return to pre-AMI 1.0 meter replacement, but at a rate of a complete overhaul every 15 to 20 years (compared to 30 to 40 years for electromechanical). The silver lining for this shorter life span is that improvements in sensing and communications technology that will come as the meter technology continues to evolve.

# Grid Drivers Behind AMI 2.0

## Utilities are facing:

- Data center construction and demands
- Rapid EV load growth
- Solar and distributed generation
- Grid reliability mandates
- Demand response expansion
- Data-driven operations

The market has required Meters to evolve into **distributed grid sensors**.

# What Defines AMI 2.0

AMI 2.0 expands the system from **meter network → grid sensor network**. So, what kinds of things are meter manufacturers offering in today's rapidly changing market?

## Characteristics:

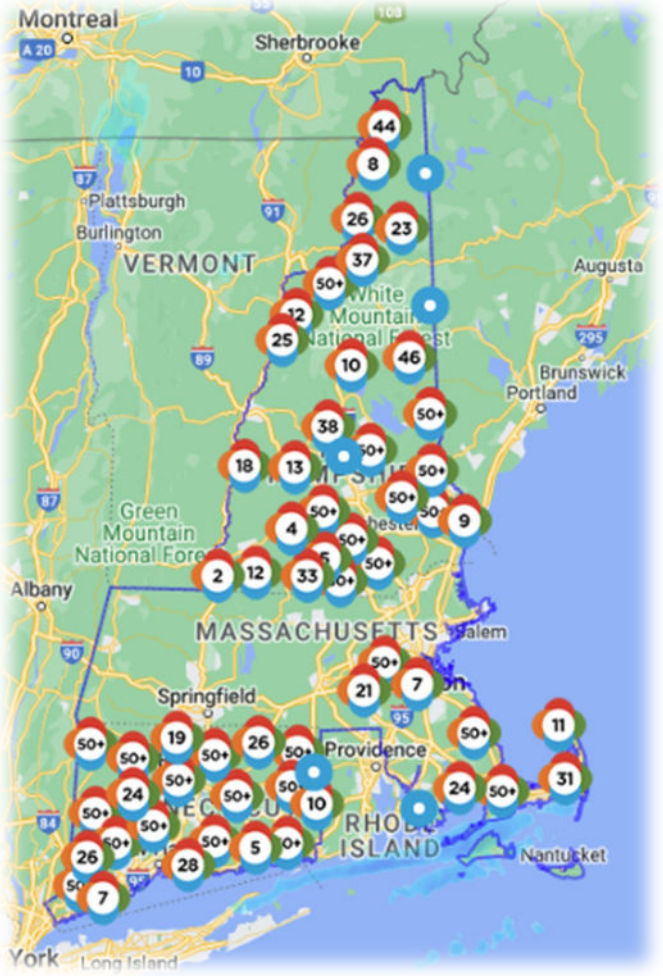
- Higher bandwidth communication
- Edge computing capability
- Improved latency
- Enhanced cybersecurity
- Integration with DER/EV ecosystems

# Operational Advantages of AMI 2.0

## Operational improvements:

- Faster outage detection
- Improved voltage monitoring
- Grid edge analytics
- Better DER visibility
- Faster fault location

Result: **grid resiliency and operational efficiency**



# What are meter manufacturers not offering?

- Interoperability. Meter manufacturers want to tie you to their head end system and their communication system and maintain either exclusive or very dominant control of your meter population. Utilities want the ability to have true interoperability and use any meter on any system. This is a big lift for meter manufacturers, and they feel they have no incentive to make this lift.

- Made in America meters that help to make the metering eco system more cyber secure. Meter Manufacturers are working hard to minimize risks and make their systems as secure as possible. Utilities would like to see more meters manufactured in the United States with US components to limit this potential exposure even more. Once again this is a heavy lift for the meter manufacturers, and they do not believe that the utilities will want to pay the premium required to make this happen.

- Power Quality. AMI 2.0 will become about power quality. This is an area where the meter manufacturers are making strides and this will become a more standard offering over the course of the next ten years.

- Alternative communication methods. In 2007 all of the five major meter manufacturers went with Private RF as this was the most reliable system at the time. Meter Manufacturers want the utilities that invested in this infrastructure for AMI 1.0 to maintain and upgrade this infrastructure. Utilities are less interested in continuing to run and maintain theses aging private RF systems. They would rather use a public or private LTE or their own Fiber network or even Power Line Carrier as both the transformer and the bandwidth issues have been solved at the development level. What do all three of these methods of communication have in common? Utilities can own and operate this infrastructure. And this infrastructure continues to evolve as we want to always improve our cellular communication and our fiber networks. And the copper wires are not going anywhere. This is how we deliver the electricity. Using this system as one of three possible technologies makes a lot more sense in today's world.

- More assistance with Data analytics and tools. This has been a difficult issue. Tools have been provided by meter manufacturers but the overwhelming majority of utilities including many of the very largest have barely scratched the surface of what they can do operationally. Utilities are looking for more of a collaboration with their meter and head end suppliers while the meter manufacturers have been simultaneously tasked with running at three to five times their historical rates and trying to stake their claim to as many users as possible. Utilities are looking for more guidance, training and partnering with the meter manufacturers as they head in to AMI 2.0.

# AMI 1.0 vs AMI 2.0: Functional Capabilities Comparison

| Capability | AMI 1.0 | AMI 2.0 |
|---|---|---|
| Primary function | Billing automation and grid sensing | Billing automation and Grid intelligence |
| Data frequency | Hourly or daily | Near real-time |
| Network capability | Limited bandwidth | High bandwidth |
| DER integration | Limited | Native support |
| Edge computing | None | Enabled |

AMI 2.0 evolves smart metering **from a billing platform into a high-bandwidth grid intelligence network** capable of supporting DER, EV growth, and real-time grid management.

# The AMI Upgrade Decision Question

Key question utilities must answer:

**“Is the value of AMI 2.0 greater than extending the life of AMI 1.0?”**

# This Question is not a legitimate question

## There is no option to “extend” AMI 1.0.

- Meters have evolved and the meters of today are not the same as the meters installed by any utility for AMI 1.0*. As meters fail, they are replaced with these meters and these meters report to the same head end.

- AMI 1.0 meters have an estimated mean time to failure of 18 to 20 years. This means that there should be a plan in place to have somewhere between 60 and 80% of them retired in this time frame.

- The real question is not whether AMI 2.0 should be considered, but how is the utility going to plan for and manage this change out.

*Note: In the United States we are closing in on 90% deployed for AMI 1.0, but even this is misleading as these late adopters could be considered the pioneers for AMI 2.0.

# Possible Implementation Strategies

## AMI 2.0 “deployment” Options:

- Full AMI replacement
- Hybrid AMI deployment
- Phased meter replacement
- Overlay communications network

Each option has different capital and longterm operational implications.

# What is the Utility long range goal?

**A return to operational “normalacy”.**

- Utilities would like to return to a standard annual replacement level that keeps their meter population ever green and continues to add new features and distribution sensor capabilities.

- This can not be done in AMI 2.0 as too many older meters would fail long before this could occur, forcing abnormally high replacement levels and all as an “emergency”. This would be an exceptionally high cost and maximize disruption to the customer and the utility billing system. A lose-lose option.

- A rip and replace option like AMI 1.0 is possible but very expensive in the short term.

- A phased in approach where 60 to 80% of the meters are replaced over 4 to 6 years and then perhaps 10% for the next two years would then result in an “evergreen” level of change out. Several large utilities are now implementing this strategy. The question that still needs to be answered is whether they have waited too long or just long enough. Some have waited until 20 years after AMI 1.0 initial deployment to start on AMI 2.0. They believe their mean time to failure is over 20 years and they will be OK. Others believe that their meter population has a mean time to failure of 18 to 30 years and they are starting at 16 to 18 years after initial AMI 1.0 deployment.

# Financial Justification

## AMI 1.0 Model: Business cases typically included:

| Benefit Category | Example Value |
|---|---|
| Operational efficiency | Fewer outages / faster restoration |
| Grid optimization | Reduced system losses |
| Demand response | Peak load reduction |
| Fewer Truck Rolls | Remote Disconnect/Reconnect was at the top of this list |

# Is Your Utility Ready for AMI 2.0?

## Score Each Category 1 to 5

| Evaluation Factor | 1 (Low Need) | 3 (Moderate Need) | 5 (High Need) |
|---|---|---|---|
| AMI System Age | <10 years | 10-14 years | >14 years |
| DER Penetration | Minimal solar | Growing DER | High DER adoption |
| EV Load Growth | Low EV adoption | Moderate EV growth | Rapid EV adoption |
| Data Needs | Billing only | Operational analytics | Real-time grid management |
| Grid Reliability Pressure | Stable system | Increasing outages | High reliability expectations |

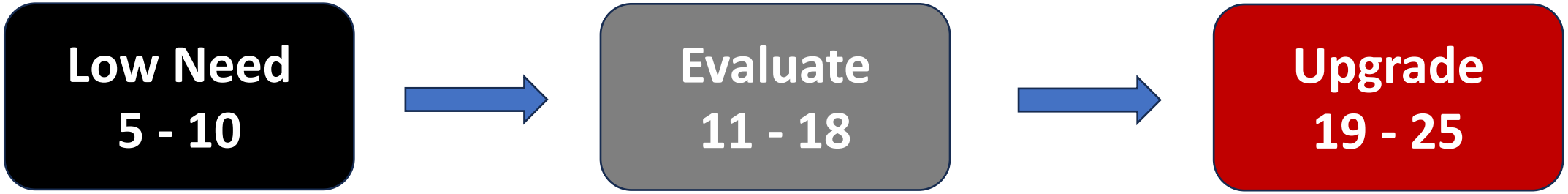
**Key Questions:**

- How old is your AMI system?
- How much DER penetration do you have?
- How quickly is EV adoption growing in your service territory?

# Forget the Scores

You can make a nice case by running a management scoring system. Bottom line is that your meter population is going to age out and once you start climbing that bell curve toward your meter population mean time to failure, you will be too late. Meter change outs will be done on an “emergency” basis generating ill will with the customer and billing nightmares for the utility not to mention a PR headache.

| Total Score | Recommendation |
|---|---|
| 5–10 | Continue operating AMI 1.0 |
| 11–18 | Evaluate targeted upgrades |
| 19–25 | Strong case for AMI 2.0 |



# Establish Total Capital Cost per Endpoint

## Example Utility Economics

| Cost Category | Example |
|---|---|
| Meters | $150–$300 per endpoint |
| Network upgrades | $50–$120 per endpoint |
| IT integration | $10–$40 per endpoint |

**Total Implementation Cost – but this time over a longer period of time**

- Low estimate: $210 per endpoint (100,000 meters = $21,000,000)
- High estimate: $460 per endpoint (100,000 meters - $46,000,000)

# Grid-Level Strategic Benefits

AMI 2.0 business cases can be justified by replacing infrastructure that is moving toward end of life but can often also include some of the **avoided infrastructure costs**, that the new generation of AMI meters can provide.

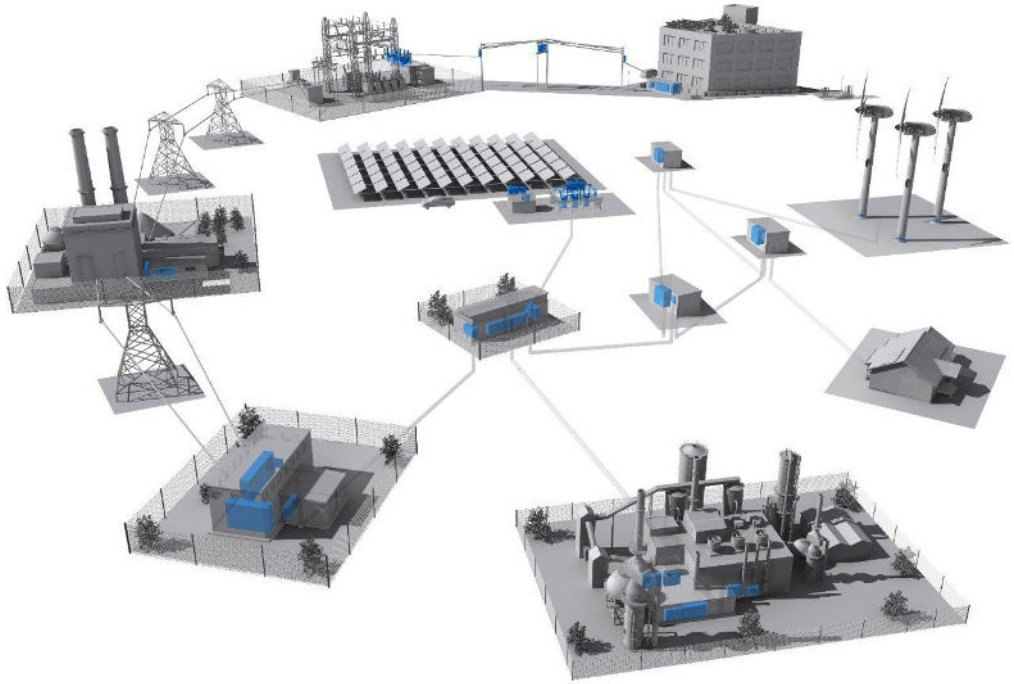
| Benefit | Impact |
|---|---|
| Peak demand reduction | Avoid new generation |
| EV load management | Avoid distribution upgrades |
| Voltage optimization | Reduce energy losses |
| DER monitoring | Prevent grid instability |
| Outage restoration | Reduced SAIDI/SAIFI penalties |

**These benefits can represent up to 50–70% of total program value.**

# Implementation Considerations

## Key planning factors:

- Meter asset life remaining
- Communication infrastructure reuse or a move to multiple communication methods
- IT system integration.  Is there a move to a new interoperable head end and if so, is this worth the investment?
- Cybersecurity upgrades
- Regulatory approval requirements



# Technical Readiness Assessment

## Utilities should evaluate:

- Current AMI network capacity
- Meter firmware limitations
- Communication bandwidth
- Cybersecurity compliance
- Data analytics infrastructure

# Summary

AMI 1.0 was a revolutionary idea that justified itself through operational efficiencies. Truck rolls, starting with disconnect and reconnects yielded large savings and the ability to roll the right truck to site yielded more. Using AMI data, Field resources for residential metering could be minimized, and these resources could be focused on commercial industrial accounts.

The downside of AMI 1.0 was that the life of the meters is half that of the original electromechanical meters; 15 to 20 vs. 30 to 40 years. The silver lining is that over the course of that 15 to 20 years new features have been added to the meter making the meter an energy measurement device that is becoming a super sensor for all sorts of potential operational deficiencies in the distribution system as well as a seamless way for DER's to integrate with the grid.

# Summary (cont.)

AMI 2.0 is an evolution and not a revolution. AMI 2.0 is not a business case as much as a step toward normalacy. There is no need to perform a rip and replace. By handling the replacement of the AMI 1.0 meters over a more extended period utilities can then continue on to what was the historical norm – replacing a percentage of their population each year. If the average life span for any particular utility turns out to be 20.0 years and their growth is 1.0% per year then they can expect to change out 5.0% of their meters every year and add another 1.0%. There is also a typical amount of meters that cycle through the shop due to home renovations, disasters, customer complaints. This may be another 1 to 3%. This utility could plan to be changing out 6 to 7% of their meters each year and installing an additional 1%. This makes planning and budgeting far easier. Engineering and Operations can and should always be looking at the newest and best features bring introduced to see if there is a reason to accelerate the annual exchanges within any one group of meters based on a new feature set.

The value for **AMI 2.0** comes from:

- grid intelligence
- DER management
- EV load control
- reliability improvements
- Avoided infrastructure investment in other areas

And most importantly not allowing your AMI 1.0 meters to age out and begin failing in the field before your replacement plan can be approved, set up and executed.

# Questions and Discussion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