A DATA-DRIVEN APPROACH TO ADOPTING AND MANAGING AMI 2.0

Make the transition from legacy infrastructure to next-generation systems and unleash the power of utility data with a trusted end-to-end solutions provider.

Honeywell

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ABSTRACT

How has the utility landscape changed in the last decade? Can you picture it? Data is more abundant and accessible; cutting-edge technologies support quick, constant, accurate communication and intelligence; and sustainability and efficiency are prioritized across the value chain. What started with a smart meter, communication networks and software is now a connected, evolving, data-driven world of managed resources and strong outcomes.

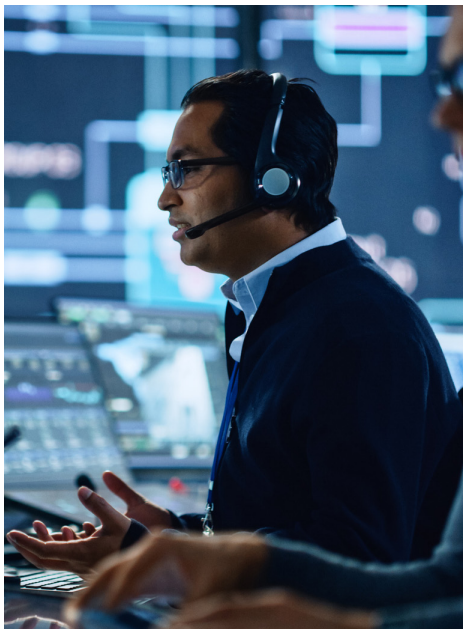
A series of small-, medium- and large-sized changes created the utility industry of the present. The development, introduction and adoption of advanced metering infrastructure (AMI) was one of the biggest changes and is often considered the most important.

AMI is an integrated system of smart meters, communications networks and data management systems that enables two-way communications between utilities and customers.[1] This system consists of basic meter reading, improved data handling and interoperability with other utility operations for better measuring, monitoring and managing of power and resources.

Or at least it used to. Because of technological advances, digitalization and exciting innovation, AMI isn't serving its purposes as well as it once did. The first wave of smart meters lacks the speed, accuracy and power that newer versions have. Other infrastructure is aging, too, meaning it's less compatible with recently deployed solutions. Instead of trying (and ultimately failing) to keep pace with the rate at which transformation occurs by making upgrades here and there, utilities must rethink their entire AMI system(s).

Thankfully, AMI 2.0 is here at the perfect time. AMI 2.0 is the *next generation of metering infrastructure* available to utilities. The main difference between iterations is that AMI 2.0 is built for today's grid. With intentional, automated, energy-saving functions, it's built to help meet today's goals of sustainability and efficiency. With better measurement, monitoring and management capabilities, it's built to help us organize, learn from and act on copious amounts of valuable data.

In the words below, we'll discuss how AMI 2.0 works, explain what this transformation means for utilities and utility customers, identify various approaches to this transformation and what it means for different parts of the utility value chain. This includes key topics such as intelligence, cybersecurity, sustainability, distributed energy resource management and edge computing. Then, we'll explain how and why utilities should make the biggest change of all — adopting AMI 2.0.



INTRODUCTION

From the development and deployment of the very first smart meter to now, many of our world's technologies have been reimagined, redesigned and reintroduced. After all, innovations and advancements in the utility industry are how we make the world a smarter, safer, better place. They're how we push limits, achieve goals and set new standards. And right now, nothing is innovating, setting new standards or promising positive operational outcomes faster than AMI 2.0.

When smart meters were widely adopted in the late 2000s and early 2010s, and AMI 1.0 gained traction, utilities entered a new era of productivity, efficiency and accuracy. It was the first time utilities could truly measure, monitor and manage energy consumption data. But that was more than a decade ago. The cutting-edge capabilities experienced then — communication between utilities and meters, remote data capture at regular intervals, greater visibility into utility operations — are obsolete now when we consider how they can be performed with today's technologies. Moreover, smart meters typically have a 15- to 20-year lifespan, meaning most will need to be replaced soon.

The same can be said for other essential components that make up AMI 1.0; mesh networks, communication modules and software all become outdated as technological and digital progress occur. For example, many mesh networks are being supplanted by faster, more secure cellular networks. When this happens, existing meters and devices may no longer possess the intelligence or compatibility needed to work effectively. And while updates can be made to legacy infrastructure, they're less practical (and less cost-effective) as time passes.

Though it was once fully operational and innovative, AMI 1.0 is limited. Its basic meter-reading and communication functions no longer perform how utilities need them to in a landscape dominated by data, change and efficiency. To move forward with measurable success, utilities need more advanced, robust and secure infrastructure. *They need AMI 2.0.*

OUT WITH THE OLD, IN WITH NEXT-GENERATION

Think about the first smartphone. With mobile calls, faxes and emails in one's hand, the smartphone unequivocally changed how individuals communicated. Now, think about the developments since then. Smartphones have evolved in size, shape, capacity and function. Each year, providers release new smartphones with better processing power, more data storage, an upgraded camera and smarter features. Messaging and calling only begin to describe what smartphones can do. Accessories also change. 1G networks have been replaced by 5G. Clunky, wired headphones morphed into sleek, wireless, in-ear devices. Applications receive frequent software updates. Fast-charging solutions are available for homes and cars.

The first smartphone and its once-groundbreaking capabilities aren't compatible with the technologies or lifestyles of today. So, the first generation of smart meters and other infrastructure shouldn't be expected to operate successfully in the current utility landscape.

WHAT IS AMI 2.0?

Once a mere thought, an idea of what the future of utilities might look like, AMI 2.0 refers to the system of current, advanced solutions that help utilities make the world smarter, safer and stronger. The next step in the utility transformation, AMI 2.0 is still in the process of being explained, understood and adopted. We're here to help.

Recall the definition of advanced metering infrastructure in the introduction above: AMI is an integrated system of smart meters, communications networks and data management systems that enables two-way communications between utilities and customers. While this definition was created to describe AMI 1.0, it still works for AMI 2.0, with each next-gen component more elevated and enhanced than its first-gen counterpart.

In addition to technologies becoming more sophisticated and capable, enhancements and upgrades have been made to utility solutions based on current industry priorities and goals. The list is long, but toward the top are embracing digitalization, improving communication between utilities and customers for a seamless customer experience, maximizing sustainability and upgrading cybersecurity.

Here's a simplified workflow of AMI 2.0's process, along with the purpose of each component and how it works to help utilities achieve the goals outlined above:

AN AMI'S NETWORK FACILITATES COMMUNICATION BETWEEN SOFTWARE, PLATFORMS AND DEVICES FOR THE QUICK, SECURE COLLECTION, TRANSMISSION AND ANALYSIS OF GATHERED DATA, ETC. THE NETWORK INCLUDES COMMUNICATION PROTOCOLS, GATEWAYS AND MORE.



SMART METERS

These intelligent devices capture various data metrics, including consumption information, time of use, customer insights— i.e., how and when a household or business uses a certain resource. Once data is collected, it's sent to the head-end system and beyond for storage, action and change.

HEAD-END SYSTEM METER DATA COLLECTION (MDC)

The central management device for smart meters in a network, the head-end system speaks to smart meters, collects all captured data from the meters and preliminarily processes the data before sending it to the meter data management solution. This device also helps facilitate remote operations and data aggregation.

METER DATA MANAGEMENT (MDM)

Historical and real-time data are thoroughly processed, organized and analyzed. Actionable insights are extracted from the data and delivered to utilities to aid in decision making and operational optimization. Here, utilities can gain complete visibility of assets and operations to stay steps ahead of outages or other threats to their infrastructure.

CUSTOMER DATA INTERFACE

Utilities transmit data to customers to make them more informed and encourage modifications to current consumption and usage habits. Customers — industrial, commercial and residential — can see their data via customer portals and access channels. Common customer portals include billing data and real-time feedback — with the right protocols to keep both secure.



Take **cybersecurity**, for example. The digitalization of utility operations, the abundance of data and the reliance on data mean utilities are obligated to protect it. Keeping utility and consumer data confidential, however, is complicated as it travels along the workflow, especially when cyber threats are a growing challenge. Fortunately, AMI 2.0 smart meters are typically engineered with layers of protection, like external tamperproof features and internal data encryption. The head-end systems to which the data travels and the networks that facilitate data communications are also secure, just as data management systems usually have threat-detection capabilities to keep all data protected.

Or consider **sustainability.** Smart meters do their part to maximize sustainability by measuring how much of a resource is used and identifying the time at which it's most frequently consumed. Some can even identify improper distribution, which almost always connotes a leak (meaning a valuable resource is wasted) or other concerns that must be swiftly rectified. The speed at which AMI 2.0 networks and head-end systems operate means critical data can travel to data management platforms faster, enabling an expeditious response from utilities if something needs to be repaired. Consumption data and analysis can also be used by utilities and customers alike to change usage habits. This further supports sustainability efforts by taking some strain off of the grid and slowing the rate at which consumption occurs.

Each component of advanced metering infrastructure, whether it's measuring, monitoring or managing data, plays an integral role in meeting the goals of today's ever-changing landscape. With progressive digital capabilities and forward-thinking functionalities, AMI 2.0 proactively works against obsolescence and the restraints and limitations of legacy infrastructure.

PROMISES OF AMI 2.0

The steady adoption of AMI 2.0 solutions and the subsequent transition from outdated systems to those on the cutting edge are accompanied by promises of enhanced operability and improved communication at all levels.

It's the perfect time for utilities to pursue excellence and advances. Each new technology, software and hardware offering that makes up AMI 2.0 seeks to improve utility operations by strengthening, securing and optimizing entire processes. As more utilities turn to the next generation of advanced metering infrastructure for this strength, security and optimization, they'll be some of the first to experience highly anticipated developments.

Remaining aware of what AMI 2.0 can do — and leveraging its benefits — are how utilities can confidently control their own transformations.

HERE'S A SNAPSHOT OF WHAT AMI 2.0 PROMISES UTILITIES:

- **Compatibility With a Variety of Operations:** AMI 1.0 was traditionally thought of as a system for electric utilities. That's because smart meters were commonly used to record electricity consumption data and voltage information. But now, with developments across electric, gas and water infrastructure, one distinction between AMI 1.0 and AMI 2.0 is how it can be used throughout water and gas networks. Smart gas and water meters are more advanced than ever; they capture flow rate, velocity and pressure, can be remotely controlled and can detect leaks. And, when connected to the right data management platform, the data can accurately and quickly inform utilities, which helps stop issues before they start.
- **Edge Computing:** Smart meters represent edge computing— the monitoring, measuring and managing of data in real time behind the meter. This recently popularized concept occurs at the site of an activity, collecting and streaming data from equipment, machines, devices, sensors, etc. Instead of sending everything to a physical or cloud-based storage system, edge computing creates smart, intuitive networks that can react quickly to real-time, on-site data and make decisions. Such reactions include shutting down equipment for safety reasons, identifying in advance a part's end of life to avoid downtime, taking some kind of corrective action autonomously or providing personnel with instructions and information that will help them solve a problem. When individual devices can analyze their own data, the analysis workload is distributed, and the chance of data breaches decreases. Edge computing is an option for utilities who need to operate this way or those who don't want to continuously rely on a head-end system.[2]
- **Better Management of Distributed Energy Resources (DERs):** Distributed Energy Resources (DERs) — small-scale electricity supply or demand resources that are interconnected to the electric grid like solar panels, wind turbines, battery energy storage systems — are critical to modern energy grids because they offer sustainable, alternative, renewable sources of power and thus, help balance strain on the grid. An AMI system with smart meters helps manage DERs. This is because the advanced communication abilities of smart meters enable real-time data collection on energy generation. Once collected, data can be further used throughout the system to monitor the performance and output of demand energy resources, ensuring their resources are implemented in the right place at the right time. Managing supply and demand with data helps improve the strength and security of our grid.[3]

ANOTHER THING TO NOTE: AMI 2.0 ISN'T UNIFORM

Depending on utilities' priorities, they can pick and choose the advanced metering infrastructure solutions that *work for them.* Some may lean toward smart meters with the intelligence to manage distributed energy resources or choose to adopt networking infrastructure that's expansive and impenetrable. Others may opt for edge computing, investing in devices that can quickly integrate that capability into existing processes. This flexibility of use puts power and control in utilities' hands, thus enabling change to occur how, when and where utilities need it.

AMI 2.0, DERS AND RENEWABLE ENERGY HELP BALANCE OUR GRID

Because AMI 2.0 is an integrated, complete, advanced system of solutions that gives utilities control of resources and enterprise operations, utilities subsequently (and automatically) have an opportunity (and responsibility) to shape, strengthen and balance the backdrop against which they perform, now and in the future.

The grid — an ecosystem of interconnected assets, infrastructure, manufacturers, service providers and more — enables the generation, transmission and distribution of water, gas and electricity while striking the fragile balance between supply and demand for these precious resources.[4]

Resiliency and stability are necessary for our grid to keep up with future changes, but until now, they have remained largely out of reach due to grid fragmentation, strain and obsolescence. Together, AMI 2.0 and DERs help address these current grid challenges, re-injecting strength and reliability with targeted approaches that use emerging technologies and evolving solutions.

Let's expand on electric vehicles (EVs). EVs, emerging and fast-growing products, are distributed energy resources because their batteries can provide a range of grid services, including demand response, voltage regulation and distribution-level activities.[5]

Using data from AMI 2.0 to identify how, when and where charging of EV batteries is optimized, and then integrating optimized charging into the grid for power that can be readily accessed and managed in times of need, helps utilities slowly but surely create a more reliable, predictable backdrop for more reliable, predictable performance.

By anticipating the load required to charge EV batteries and planning for it instead of taking a reactionary approach, utilities can:

- Supply ancillary services to the grid
- Avoid new investments in grid infrastructure (optimizing existing assets)
- Enable greater integration of wind, solar and various other renewable sources, which can help decarbonize the grid and thus work toward overarching, ever-present goals
- Improve energy security[5]

Renewable energy sources also help alleviate grid strain and promote stabilization. While fossil fuels currently provide most of our power, they have become increasingly unreliable, even causing outages and grid failures during extreme weather events.[6] The implementation of renewables (also called green energy sources) can help when outages and failures occur because they, like EV batteries, can be stored, requested and dispatched on demand. With AMI 2.0, alternative, at-the-ready energy can be tracked in real time and adjusted to meet market needs, putting reliable power in the hands of those who need it at optimal times.

Utilizing DERs and renewable energy sources to their full potential with AMI 2.0 can help achieve grid decarbonization, stability, resiliency and reliability goals. It also helps utilities develop their approaches to AMI 2.0, which will shape how this integrated solution should be implemented, used and managed today, tomorrow and beyond.



APPROACHES TO AMI 2.0

Because advanced metering infrastructure is a system with many moving parts instead of one all-or-nothing solution, utilities are left to determine how they should adopt AMI 2.0 and which component should be at the center. Although market saturation and seemingly endless system options complicate decisions, there are two approaches that dominate the current utility landscape: device-centric and network-centric.

Evaluating current systems and future goals can help utilities discern which component takes precedence in their processes. Questions, too, can help. *Will devices or networks help us work smarter, faster? What's easier to deploy? How will productivity be affected by the integration of one solution versus the other? Which will provide more value to our customers?*

NETWORK-CENTRIC AMI 2.0 MODEL	DEVICE-CENTRIC APPROACH TO AMI 2.0
A network-centric AMI 2.0 model works to improve how devices communicate. Because of networks, smart meters and other hardware can transmit data to various endpoints. But can they do it faster? More securely? Utilities with a need for speed and protection may choose to upgrade their network functionality. Networks also provide connectivity and scalability. This means, if more devices are needed as part of a utility's infrastructure, and if the coverage exists, implementation and deployment are quite simple. However, networks characteristically lack the brains to do anything with the data they collect and transmit.	A device-centric approach to AMI 2.0 focuses on smart meters as they capture, organize and begin to analyze information. AMI 2.0 smart meters have remote reading capabilities, which reduce manual visits and increase the sustainability of operations. Real-time data monitoring is an advantage, too, because it provides utilities with accurate, timely information about what's happening across entire networks. But, with a device-centric approach, utilities are largely restricted in terms of infrastructure scalability, connectivity, security and management. In most instances, an investment in smart meters is a commitment to the same hardware for at least ten years. Keeping the same smart meters (even when regular software upgrades are administered) creates degradation and reliability issues as networks, security protocols and management practices evolve faster than meters can be updated and replaced.

In both approaches to AMI 2.0, a critical element is almost entirely forgotten. While the device-centric and network-centric models acknowledge data, it's done so as an afterthought. Though not an actual piece of infrastructure (smart meters, head-end system, network, data management system and customer engagement portals), data, arguably, is the most important part of AMI.

While the infrastructure makes it possible to capture, organize, store, communicate and analyze data — utilities wouldn't have access to accurate, real-time data without smart meters, networks and data management platforms — better operational performance and customer experiences are only achieved when data is acted upon.

The infrastructure must be in place for actionable insights to even exist. But what happens once it's there, and what happens beyond the advanced metering infrastructure system, matters more. That's why, at Honeywell Smart Energy, we developed a ***data-centric approach*** to AMI 2.0 with solutions that facilitate informed, data-driven actions.

HONEYWELL'S APPROACH TO AMI 2.0

An AMI 2.0 system should ultimately give utilities more value across each part of their operations — productivity, safety, sustainability, security, customer experiences, etc. That's why the new wave of infrastructure for utilities comes with capabilities like remote operability, outage alerting, anomaly and threat detection, demand response program integration and more. The common denominator between each capability? Data, and how it's used.

At Honeywell, we recognize that data is a powerful performance tool. It allows utilities to see trends, forecast what future operations might look like, identify gaps in operations and make better decisions, all in real time. Transitioning to AMI 2.0 with us, an end-to-end solutions provider and leader in the utility industry, means utilities are not only supported by proven, optimal infrastructure, but also that they can take data further than they do now, truly extracting valuable information to enhance operability.

We pioneered and adopted a data-centric approach to AMI 2.0 for two reasons: analytics and decentralization.

- **Analytics:** Data analytics extract insights that help present, prescribe, predict and prevent.
  - **Present** data, opportunities, risks and other important information in digestible formats.
  - **Prescribe** steps of remediation and action if swift changes need to take place based on data analysis.
  - **Predict** operational outcomes and grid strain by analyzing historic data, current information and trends.
  - **Prevent** downtime, device failures and degradation with data analytics that track infrastructure health alongside overall utility performance.
- **Decentralization:** To improve analytics, we work to distribute intelligence across devices that traditionally relied on central servers or single points of congestion. Decentralization results in quicker response times, enhanced data security and greater resilience; if one server, node or communication module fails, others remain functional.



HERE'S WHAT AN AMI 2.0 SYSTEM WORKFLOW LOOKS LIKE FROM END TO END WITH HONEYWELL SOLUTIONS:



SMART METERS

The A4 smart meter has expanded data gathering and enhanced processing power to capture and analyze electric consumption data like voltage, current and use. Its industry-leading memory enables storage of more metrology data over time. And the A4's increased system and communication flexibility provide a range of data collection choices.

HEAD-END SYSTEM

Using an AMI's network, the head-end system speaks to the A4, collects all captured data from the meter and preliminarily processes the data before sending it to Honeywell Forge Performance+ for Utilities. The head-system helps manage, secure and aggregate data from A4 meters across a utility's entire AMI system.

HONEYWELL FORGE PERFORMANCE+ FOR UTILITIES

Measure, monitor and manage the data from the A4 with Honeywell Forge Performance+ for Utilities, a digital platform that helps track an entire utility enterprise and provides detailed visibility of each asset. Data analysis that occurs here helps utilities remain apprised of outages or other threats to their infrastructure; device health; peak loads and grid strain; changes in consumption.

CUSTOMER DATA INTERFACE

Utilities transmit data to customers to make them more informed and encourage modifications to current consumption and usage habits. Customers – industrial, commercial and residential — can see their data via customer portals and access channels. Billing information, real-time consumption data, utility rates and resources on energy-efficiency are typically available to customers.

With the flexibility and control that Honeywell Forge Performance+ for Utilities provides, we created a tier-based **network** system. Here, network servers are tiered based on the role they play within the next-generation advanced metering infrastructure. The three tiers are Model, View and Controller (MVC):

- **Model:** This is the database or single source of trust where all collected data is safely stored and encrypted.
- **View:** This consists of interfaces made available to end users to interact with data (web server, mobile apps, etc.).
- **Controller:** Using common denominators, this tier brings together disparate devices (and, thus, decentralized data) from multiple sources.

The meters, networks, Honeywell Forge Performance+ for Utilities and customer data interfaces create a strong, secure AMI 2.0 system that brings data, productivity and efficiency to utilities. This system also allows for the integration of other solutions that can use the same infrastructure and work to improve sustainability, grid management and resource consumption.

Take demand response programs, for example. Demand response programs help customers manage, monitor and lower their energy use to prevent power surges, outages and blackouts. Using Honeywell Forge Performance+ for Utilities to analyze time- and event-based data from smart meters, utilities can identify when energy demand is highest. Then, they can inform customers how making changes (setting thermostats a few degrees higher during peak A/C hours or choosing to leave the lights off a little longer than normal) creates a sustainable, strain-reducing impact. When customers can see their usage rates through customer interfaces and how they're incentivized for program participation, they're more likely to keep up with demand response practices. One solution that integrates seamlessly with AMI 2.0 is Honeywell DemandSites™, a connected, cost-effective interface that increases real-time data access across assets for optimal energy reduction during peak hours.

CONCLUSION

Utilities find themselves in a landscape that's evolving — and one that's full of opportunities. The transition from AMI 1.0 to AMI 2.0 requires effort, investment and careful consideration. But the short-term and long-term benefits of a next-generation AMI system, including better operability, performance, communication, security and sustainability (for utilities and beyond), far outweigh the initial phases of adoption and eliminate any arguments for keeping legacy systems.

Designed to add value and simplicity, new, improved, advanced infrastructure that collects, organizes, transmits, analyzes, shares and acts on data in real time keeps utilities on the cutting edge. Remaining here, instead of one or two steps behind, makes the difference between meeting goals and falling short of them.

Falling short of goals is non-existent with Honeywell, a proven, trusted solutions provider that supported utilities before the onset of AMI 1.0 over two-and-a-half decades ago and continues to help utilities make the most of their AMI 2.0 journeys, no matter what they look like, no matter what they need.

The transformations that technologies, devices, networks and other advanced metering infrastructure components have undergone in the past decade are promising and essential. Now, utilities can use them to change the world.

Get started today, with Honeywell.

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For more information
https://automation.honeywell.com/us/en/solutions/smart-energy

Honeywell Smart Energy
2101 CityWest Blvd.
Houston, TX 77042

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THE FUTURE IS WHAT WE MAKE IT

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