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Falling out of love with AMI: Why we need a new approach to smart metering

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Smart meters are often seen as an integral part of utilities' infrastructure and modernization efforts given the large and growing need for high-frequency meter data, but advanced metering infrastructure (AMI) deployments have often failed to deliver promised benefits to both utilities and their customers. At a time when utility customers are struggling with the effects of inflation and utilities are increasingly facing the need to decarbonize their systems, increase resiliency, and deepen customer relationships, there's an urgent need to find more cost-effective approaches to collect and use near-real time meter data at scale. The good news is that recent technological developments are creating opportunities to reduce or even eliminate the need for new AMI infrastructure going forward.

For electric and gas utilities, high-frequency meter data is essential to support an informed transition to a low-carbon economy, equitably engage and empower customers at a deeper level, increase system resilience, manage demand, support new rate structures, and improve operations. However, results from a range of studies suggest that many of the promised benefits of AMI have yet to be delivered even after a decade of implementation. For instance, a 2022 analysis from the Mission:data Coalition found that 97% of smart meters fail to provide promised customer benefits, and a 2020 report from the American Council for an Energy Efficient Economy (ACEEE) found that utilities "are largely missing the opportunity to utilize AMI data to improve their energy efficiency and demand response offerings, in part due to regulatory, administrative, and technological barriers." Unsurprisingly, a handful of states have blocked multimillion-dollar smart meter deployments over the past few years, and there is growing regulatory scrutiny of the benefits that AMI deployments actually provide.

While programmatic and regulatory changes could help improve matters, AMI also has fundamental technological limitations that constrain its potential, including:

Cost: AMI deployments often cost several hundred dollars per customer, with large rollouts often costing utilities—and by extension ratepayers—hundreds of millions of dollars in upfront costs (plus additional ongoing maintenance expenses).

Shorter effective useful life (EUL): Because the computation and communication capabilities of AMI meters are largely built-in, utilities typically need to replace meters to gain important new functionality. As a 2020 blog from smart meter vendor Sensus explains, whereas traditional meters had an EUL of at least 20 years, smart meters are unlikely to have a similarly long EUL "not because they won't last that long, but the pace of meter technology is changing so quickly that utilities would miss out on powerful new capabilities... The trend today is for electric smart meters to have a depreciable life of 10-15 years."

Time to deployment: Over full utility service territories, AMI deployments can take years to complete. Particularly given the feature-driven reduction in AMI meter EULs, utilities may end up in near-constant technology update and deployment cycles with associated rate increases for customers.

Delays in data sharing: AMI meters often have constrained bandwidth in the mesh networks they use to communicate with each other and the backhaul system to get data to the utility. In practice, that means that even if meters are technically capable of collecting near-real-time data, the most frequent data many utilities (and utility customers) are able to access is the previous day's 15-minute data. Although many AMI meters have built-in Zigbee or Wi-Fi communications capabilities that should theoretically be able to share data more frequently with customers (but not necessarily utilities), these are almost always turned off in practice due to interoperability challenges, ongoing service fees, or other utility concerns.

Focus on a single resource: A single AMI meter is only able to share consumption of electricity, gas, or water, so to get more frequent data on all of these resources requires three separate meter retrofits, increasing overall expense and complexity. Particularly as dual-fuel utilities explore potential pathways for deep decarbonization, and as stakeholders try to better understand issues at the convergence of multiple resources (such as the water-energy nexus), consistent, high-quality data in all these areas is essential.

Meter vendors claim that a second wave of smart meter deployments (often referred to as AMI 2.0) will help improve outcomes due to upgraded technology, but the focus on so-called "grid-edge" computing could actually further complicate matters. Instead of addressing the limited bandwidth of the network and data backhaul systems, vendors have instead focused on making meters perform increasingly extensive computations within the devices themselves. With more complex meters housing even more technology inside—and as utility data needs continue to evolve—utilities will face growing pressure to replace meters more often and expand their focus on maintenance. While that may be great news for smart meter vendors, it is likely to increase rates for utility customers and divert utility funds from projects that could otherwise support increased system resiliency, decarbonization, and modernization.

To date, utilities wanting access to more-frequent, granular meter data have largely been forced into deploying AMI networks due to a lack of viable alternatives. Now, Colorado-based Copper Labs thinks it has a better approach. By developing custom hardware and sophisticated new signal-processing capabilities, Copper can uniquely access near-real-time data remotely from existing AMI and drive-by (also called automated meter reading, or AMR) meters, without requiring retrofits to the meter itself. With improved data backhaul using existing high-speed networks, the system can share data with utilities and customers in near-real-time (down to 30-second intervals) while data analysis and computation take place in the cloud. This approach allows meters to simply be data-collection devices, increasing their useful lives by reducing complexity—regardless of how the data is ultimately used. Because this approach leverages existing meters—and since Copper's new detector hardware can remotely detect signals from hundreds of meters at once—it can be rolled out at scale much more quickly and at a far lower cost than new meter deployments, and it can support electric, gas, and water utilities alike.

Copper Labs' neighborhood-level detector can remotely access data from hundreds of existing meters at once. Image courtesy Chris Choi.

To help avoid the challenges that utilities have traditionally faced in making AMI data more directly actionable, Copper built a web portal for utilities that displays real-time geographical consumption data and enables segmented customer messaging, behavioral load management, and system planning. For utility customers, Copper offers a mobile app designed to engage and educate with relevant and timely insights—including mid-cycle high bill alerts, leak detection, information on time-of-use (and other) rates, real-time carbon intensity, and utility efficiency programs that could help meet their needs. And for sophisticated utilities that would like to develop their own solutions, Copper also provides data directly through a set of API libraries.

In a time of unprecedented change for utilities, high-resolution data is essential. By making the most of existing meters, reducing the need for costly and time-intensive AMI 2.0 deployments, and streamlining the generation of actionable insights from near-real-time data, Copper is providing a compelling alternative to new meter hardware. Utilities and regulators may be falling out of love with AMI, but new, more modern alternatives are finally on the horizon.