STATE OF CONNECTICUT PUBLIC UTILITIES REGULATORY AUTHORITY

PURA INVESTIGATION INTO DISTRIBUTION SYSTEM PLANNING OF THE ELECTRIC DISTRIBUTION COMPANIES – AMI

Docket No. 17-12-03RE02

July 31, 2020

UTILIDATA, INC.

PROPOSALFOR PROGRAM DESIGN

I. Introduction

Utilidata is grateful for this opportunity to submit a proposal for program design in response to the Public Utility Regulatory Authority's (Authority) *Notice of Requests for Program Design and Proposals for Advanced Metering Infrastructure (AMI).* This proposal builds upon the Utilidata's Preliminary Comments filed with the Authority on June 5th, which provide an overview on the tremendous potential of AMI, and the importance of requiring capabilities and outcomes that go beyond traditional AMI use cases. We provide some additional detail here, and look forward to continuing to work with utilities and other stakeholders in Connecticut.

Our proposal describes a business plan for AMI focused on what we believe is the most important component of a next generation AMI deployment: utilizing software to maximize the customer and operational value of smart meters. Executed correctly, AMI is an essential computational and communications platform to manage the modern electric grid. However, to fully realize that value, meters must be equipped with a grid-edge operating system that can unlock the unique potential of AMI to serve as a planning and operational tool for the grid , not just as a billing and customer engagement device.

Realizing the potential of AMI is important not just for driving more customer and grid value in the near term, but it is essential to operate a grid with growing wholesale renewables and distributed energy resources (DERs). Safe, reliable, and affordable DER integration at scale will

require *real-time* grid management based on information from the grid-edge – the interface between customers and the utility. Unless the Authority specifically requires an expanded set of AMI capabilities, utilities will likely procure a system incapable of providing the benefits described in this proposal and will instead need to procure separate, more costly, and less effective assets and software platforms to manage the evolving grid. Accordingly, Utilidata recommends that the Authority establish minimum AMI system capabilities that exceed those described in conventional AMI proposals to provide additional value to Connecticut customers over the life of the AMI assets.

II. **Business Plan**

Since 2005, the vast majority of AMI proposals have primarily relied upon proposed benefits of reduced meter-reading costs, enhanced outage detection, and shifting demand via time-of-use (TOU) rates to justify the costs of deployment.[1] Although the value of these benefits is often significant and may satisfy a benefit-cost-analysis, it does not capture the full potential of an AMI deployment. Recent advances in on-meter computing potential, software programming, and data analytics have enabled essential new value streams for AMI.

Within the service territories of both Eversource and United Illuminating, the distribution grid is becoming more dynamic with additional penetration of DERs. Moreover, the rapid scaling of wholesale renewables will require engaging flexible demand, starting with TOU rates and quickly evolving to much more dynamic load control. This dynamism poses new challenges and opportunities for the electric grid and the utilities, much of which will be managed at the edge of the system, where supply meets demand, and where the grid meets customers and their DERs. For example, increased penetration of intermittent rooftop solar generation and electric

[1] U.S. Department of Energy, AMI in Review. 2020.

vehicle charging will change the time and peak capacity of electric demand on distribution feeders. Similarly, the growing number of connected home-thermostats and storage will increase opportunities for real-time flexibility.

AMI is uniquely situated to be the foundational platform for managing this emerging complexity and for driving more value for customers. Traditionally, utilities relied upon annual forecasts of peak demand to ensure that each element of its distribution system was sufficient. Conventional AMI proposals improve upon this approach to increase customer engagement and to provide utilities with data that identifies hourly trends at the distribution feeder level and presents opportunities for targeted energy efficiency and demand response. However, this conventional utilization of AMI depends on a centralized grid management of grid edge assets, often called a Distributed Energy Resource Management System (DERMS). This centralized data management system inherently limits its ability to analyze the billions of data points created by an AMI deployment. Under this approach, AMI data is stored centrally, analyzed periodically, and insights and recommendations are reviewed through utility investment decision and engineering processes. In contrast, distributed, on-meter data processing enables far more granular, accurate, and real-time planning and operational insights, which are impossible with a centralized system, particularly one with limited communications bandwidth to transfer data.

AMI can address the emerging business needs of a more dynamic electric grid, but only when it includes a grid-edge operating system with on-meter computing and meter-to-meter communications in the following areas:

1. **Grid planning and reliability modeling:** AMI with a grid-edge operating system allows visibility and control to the very edge of the distribution system. Real-time grid-edge data enables the creation of a "digital twin," or a fully data-driven power flow model to the edge of the system, allowing much more precise topographical and temporal distribution system planning. Planning based only on probabilistic forecasts using physical models that stop at the end of the primary and do not reach the secondary system will quickly become insufficient for a dynamic grid with meaningful penetration of electric vehicles and other DERs.
2. **Interconnection and hosting capacity:** AMI with a grid-edge operating system provides real-time system visibility and controls that can greatly increase the distribution system's hosting capacity and reduce the complexity and length of interconnection studies, reducing the cost and timeline for renewable energy interconnection.
3. **Voltage and usage data:** AMI with a grid-edge operating system can provide real-time, distributed voltage control to improve system efficiency and support increasing amounts of DERs.
4. **Distribution system operations:** AMI with a grid-edge operating system can provide the visibility and control needed to make distribution system operations more precise and efficient, and therefore less costly to consumers.
5. **Resiliency:** AMI with a grid-edge operating system can predict and identify voltage anomalies in the distribution system and highlight them as areas for maintenance. At the same time, the location of the meter, on-the-meter computation and communication with the grid and behind-the-meter devices can enable local power flow resiliency, including greatly expanded islanding capabilities.

6. **DER optimization and management:** AMI with a grid-edge operating system can act as a real-time management system of a DER-heavy distribution grid, reducing wear and tear on the system and replacing hundreds of millions of dollars of investments, while enabling DERs to respond to dynamic rate signals and provide valuable services such as fast frequency response, and wholesale and retail-level demand response.

To achieve the full potential of AMI in these areas the Authority must specify that it requires an AMI procurement to include certain capabilities, including:

1. **Real-time data insights:** Real-time, on-meter calculations are essential for transforming billions of data points into actionable grid edge insights. Such grid-edge calculations are also critical for enabling market operations for DERs. The AMI provider should be required to demonstrate the ability to conduct real-time, on-meter processing of voltage and power quality data. Insights derived from this capability should be used to achieve a minimum incremental customer savings from voltage optimization over existing programs in the range of 1% of total energy, increasing to 2% as utilities gain experience leveraging AMI data for system optimization.
2. **System visibility to the grid-edge:** AMI should enable real-time power flow mapping all the way to the meter. Utilities must develop plans to use this system visibility to improve grid planning, operations and interconnection requests, and the system modeling must meet the following minimum standards:
    a) Mapping meters to feeders, meters to phase, and meters to secondary transformers with >95% accuracy, and updating that mapping in real-time based on grid operating conditions;

b) Forecasting demand and voltage at primary and secondary nodes, and each meter, with >95% accuracy;

c) Monitoring power quality, frequency and other grid conditions based on real-time signal processing with >95% accuracy.

3. **Price signaling:** AMI should be able to translate TOU rates and other locational operational values into simplified signals that can be locally communicated to devices in the home, service providers and/or customers. The AMI provider should be required to demonstrate that its AMI has these capabilities, and utilities must develop programs to utilize these capabilities.
4. **Local optimization:** AMI should be deployed with distributed algorithms that can identify the value of various loads, storage and generation behind-the-meter, and leverage meter-to-meter communication to determine local needs and optimize power flow in service of lowest-cost grid operations and maintaining service during a system outage. The AMI provider should be required to submit a plan to leverage these local optimization capabilities to: a) decrease the cost and increase the value of DER integration, including mechanisms to aggregate DER to provide distribution-level and wholesale market services, and b) enhance system resilience, working collaboratively with hospitals and other critical infrastructure owners.
5. **Anomaly detection**: AMI should enable the detection of anomalies on the distribution system to prevent power outages, fire hazards or security breaches. This could include the analysis of high-resolution waveform data at the meter, combined with comparisons of measurements across meters and other circuit elements, to yield identification and triangulation of short-circuit, open-circuit, and high-impedance faults. The AMI provider

must develop pilot projects to leverage these capabilities to reduce outage rates, with plans to scale such projects where appropriate.

In this proposal, we have not provided detailed benefit and cost calculations. As a third party, it is challenging to quantify utility benefits with specificity, and it is competitively disadvantageous to reveal specific product pricing. However, there are ample publicly available analyses documenting the large benefits of the categories listed above, which will only grow as the grid continues to evolve. Moreover, the cost of on-meter operational software is a small fraction of the overall cost of an AMI deployment, but will enable the majority of its benefits moving forward. As the Authority continues to examine AMI and pursues related dockets on grid modernization, and utilities begin to share more detailed cost-benefit proposals, Utilidata welcomes the opportunity to more deeply engage in a quantification of costs and benefits.

III. Required data and data analytical tools needed to deliver operational efficiencies,

All of the capabilities and outcomes described above can be delivered by on-meter software that processes data captured by most modern smart meters. Extracting maximum system value from meter-based insights often requires combining those insights with other grid data the utility captures.

By way of example, Utilidata's technology processes data throughout the electric grid including substation equipment, feeder devices and grid edge assets to deliver holistic grid outcomes. Specifically, with AMI, Utilidata's software can leverage various AMI data configurations to generate unique power flow and operational insights at the grid edge. These data types can range from hourly metrology data found within standard ANSI C12.19 tables, to sub-second data processed in real time. Regardless of the system in place,

Utilidata's technology is meter-data agnostic and proven to deliver enhanced system visibility, forecasting and optimization capabilities with AMI data. Utilidata's software has patented signal processing techniques that seamlessly integrate AMI data with existing primary grid data to help bridge the gap between siloed systems such as an AMI MDMS and a SCADA or ADMS. In addition, Utilidata's software can apply patented machine learning algorithms to establish real time electrical behaviors throughout the distribution grid. This data driven approach enables any AMI system to automatically map meter topology while providing accurate forecasting capabilities for use cases such as DER hosting capacity analysis and real time grid control.

IV. Data Management

As described above, the modern grid will require more granular energy data from the grid-edge, including the grid conditions for circuits and their respective nodes, customer loads and corresponding behind the meter solutions. Such data was not required for traditional system planning and operations but is critical to manage increased wholesale renewables and DERs and broader electrification at scale. A grid-edge operating system will ingest and analyze the massive amounts of data produced by advanced meters. In multiple jurisdictions, questions of grid-edge data capture, access and security are addressed in separate proceedings from initial AMI approval, but because modern grid planning and operations will require processing information *at the meter*, these issues must also be addressed in AMI proceedings. Centrally processing data increases data latency and strains communications bandwidth to the point that much of the meter data cannot be effectively utilized. Regulators should require in the initial AMI approval that utilities leverage real-time AMI data to optimize planning and operations. Without such requirements in an AMI proceeding, which will dictate how AMI will be procured, deployed and

utilized, other proceedings to establish address DER interconnection challenges, establish data-sharing frameworks or animate DER markets will be greatly undermined by a lack of grid-edge data processing capabilities.

The capabilities for AMI described in this proposal are largely agnostic to the particular data access and management framework that the Authority may establish. Whether as a provider of AMI services or as a sub-contractor to a utility, Utilidata would expect to operate with access to the same data that a utility routinely manages under the data access and security protocols established by the Authority. In its capacity as a volt/VAR optimization solution provider, Utilidata currently has supervisory control over hundreds of distribution circuits across the country, and as such operates with the highest levels of data security.

V. Enhancement of Related State Programs and Strategies

Inclusion of the capabilities of a grid-edge operating system described in this proposal will have a significant beneficial impact on each of three major areas of the future electric grid: energy efficiency, demand reduction, and renewable energy deployment and utilization. To cite a few examples:

1. For energy efficiency, a grid edge operating system will enable much more effective program targeting and voltage optimization that can drive 3-5% efficiency;
2. For demand response, a grid-edge operating system can enable more effective TOU rate deployment by locally communicating customer rates and inform and automate decisions about when demand response resources can provide valuable contributions to the distribution grid;

3. For renewable energy deployment and utilization, a grid-edge operating system can enable demand flexibility that is essential for renewable integration at scale and help make DERs more readily visible and controllable as a wholesale resource.

VI. **Allocation of Benefits**

The lack of tangible customer benefits delivered by AMI is one of the greatest missed opportunities of the first wave of AMI investment. The benefits customers received were primarily modest operational savings that partially flowed back to them, improved utility performance during outages, and the availability of TOU rates, which only provide benefits to a small subset of customers.

Beyond these basic use cases, utilities promised much broader customer benefits, but little of that promise was realized. Moreover, the paradigm for those enhanced customer benefits focused on greater data availability and engagement with the utility. We believe the full potential of AMI's customer value will be realized only if regulators require operational capabilities that are aimed at outcomes customers clearly want: lowering bills without requiring great effort from consumers; making DERs cheaper and easier to buy; and keeping the lights on. As described above, AMI deployed with a grid-edge operating system is squarely aimed that exactly those outcomes, including large systemic cost reductions, such as doubling historic voltage optimization, which are passed directly to consumers without any engagement or out-of-pocket spending on their part.

Using this new paradigm, the traditional distinction between operational and customer benefits begins to blur. The modern electric grid holds great potential for customers to realize the benefits of a system that is cleaner, cheaper, *and* more resilient and reliable. Fully-enabled AMI is an essential platform for delivering those benefits to customers.

VII. Interaction with Other Grid Modernization Dockets

When deployed with a grid-edge operating system, AMI can have significant beneficial impact on topics addressed in several of the Authority's related sub-dockets. The Authority's emerging goals in these other areas of grid modernization should also inform its consideration of what Connecticut wants its AMI program to be able to do. AMI approval should be conditioned on the capabilities described here that can achieve the goals in these other proceedings. By requiring key operational capabilities as part of AMI approval, the Authority will give itself flexibility to achieve more in the related sub-dockets of the grid modernization proceeding, fleshing out regulatory mechanisms for guaranteeing results in each of those proceedings, including:

- Electric Storage (17-12-03RE03)
- Zero Emission Vehicles (17-12-03RE04)
- Interconnection Standards and Practices (17-12-03RE06)
- Non-Wires Alternatives (17-12-03RE07)
- Resilience and Reliability Standards and Programs (17-12-03RE08)
- Distributed Energy Resource Analysis and Program Reviews (17-12-RE09)

The Authority and other stakeholders have ambitious goals to advance in each of these dockets. There is the likelihood that achieving these goals in an uncoordinated manner will result in the need for significant and costly distribution system upgrades. Accordingly, the benefits of AMI in general, and the addition of a grid-edge operating system in particular, should be evaluated within the broader context of these additional dockets, not just in terms of AMI deployment.

Simply put, including a grid-edge operating system will marginally increase the cost of an AMI system, but will avoid significantly more costs as the state attains its decarbonization goals.

Executed correctly, AMI could provide the technical foundation for an efficient, optimized grid-edge that drives meaningful value for customers; executed incorrectly, AMI will quickly be a stranded asset. The point of initial approval is critical because that is when regulators and the utility define what AMI is expected to do, which then influences a wide range of technical and commercial decisions. Approval of AMI expenditures should be conditioned on compliance filings that demonstrate achievement of the outcomes described in this business case. Without specifying these capabilities, a conventional AMI procurement runs the risk of repeating the experience of many jurisdictions and yielding an underutilized and inherently limited, expensive billing machine. The opportunity for AMI is much greater, and Utilidata welcomes the opportunity to continue to partner with the Authority and all stakeholders to realize this vision for Connecticut.