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LEVERAGING COMPETITIVE MARKETS TO UNLOCK THE TRUE VALUE OF AMI

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CONTENTS

EXECUTIVE SUMMARY

The electric utility sector is undergoing a digital transformation, which includes the creation of a sophisticated data management and communications network that has the potential to significantly lower consumers' energy costs and create environmental benefits. This data management and communications network is known as Automated Meter Infrastructure (AMI) and includes two-way meters capable of sending and receiving data, a communications network and a data management system that can store and analyze data.

Since 2011, U.S. utilities have spent an estimated $15 billion on AMI investments, which have primarily been used to streamline utility operations and reduce operating costs.[1] However, the ability of AMI to provide near real-time consumption data and two-way communications, can also be used to reduce energy consumption, generate savings for consumers, increase reliability and improve the experience of customers.

As other industries have demonstrated, competition drives innovation, simplification and real-time information access, which results in a better overall customer experience. A similar opportunity now exists in competitive energy markets, where AMI can be used to help consumers better understand the key drivers of their electricity costs and choose competitive rate plans that best match their usage patterns, including rate plans that incorporate savings associated with altering their energy consumption. AMI can support these innovations by permitting billing to be based on actual residential customer usage data, making near real-time, revenue-grade customer data available to retail suppliers and permitting supplier consolidated billing (SCB).

To estimate the savings potential that AMI-enabled services could create for existing residential customers on competitive supply, we considered the results of a large survey of existing time varying rates (TVR).[2] Applying the median savings observed in that survey confirms that residential consumers currently on competitive supply could save approximately $250 million per year under AMI-enabled TVR.[3]

Note: The views expressed in this paper are those of the author and do not necessarily reflect the views of his employer.

1. Office of Electricity Delivery & Energy Reliability, "Smart Grid Investment Grant Program Final Report, December 2016," U.S. Dept. of Energy, Dec. 15, 2016. https://www.smartgrid.gov/document/us_doe_office_electricity_delivery_and_energy_reliability_sgig_final_report.html.

2. Gold et al., "Leveraging Advanced Metering Infrastructure to Save Energy: Report U2001," American Council for an Energy-Efficient Economy, Jan. 27, 2020. https://www.aceee.org/sites/default/files/publications/researchreports/u2001.pdf.

3. Ibid

Achieving this level of savings will require regulatory commission actions that ensure competitive market participants have greater access to new and existing AMI investments so that they are able to create additional benefits for consumers and advance specific policy objectives.

INTRODUCTION

Competitive wholesale power generation markets were created to enhance the overall efficiency of the power markets while retail electric markets were created to allow consumers to make individual energy purchasing decisions consistent with their own preferences. The benefits of both wholesale and retail competition have been realized by many large commercial and industrial (LCI) customers in competitive markets as these consumers can now pursue procurement strategies that allow for better control of electricity costs. These benefits have been made possible, in part, by greater access to consumption, cost and market data and innovative products offered by competitive retail suppliers. LCI customers work with their suppliers to analyze historical, hourly consumption data to determine key cost drivers and develop strategies to better manage energy costs. These customers are then able to implement procurement strategies and undertake investments that allow them to respond to real-time energy market prices.

Due to certain state electricity market constraints, technological limitations and limited access to customer consumption data in near real-time, the applications of such load management and cost control strategies are far more limited for residential consumers. However, by 2021 it is anticipated that 85 percent of all U.S. electricity accounts served by investor-owned utilities will be read through Automated Meter Infrastructure (AMI), which will allow residential consumer's hourly usage data to be available in near real-time.[4] With this level of data availability, residential consumers could view revenue-grade energy consumption data in near real-time, assign access to this data to third parties and eventually use the AMI-enabled meters to support automated control of in-home devices. This would empower residential consumers to reduce energy consumption and save money.

However, whether this data will be widely available to customers, or accessible by competitive retail suppliers to improve the customer experience remains an open question. As a practical matter, supplier consolidate billing (SCB)—whereby retail energy suppliers directly mange and render customer bills—is essential to permit customer-centric products and enhance the relationship between retail providers and consumers.

4. Adam Cooper and Mike Shuster, "Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2019 Update)," The Edison Foundation Institute for Electric Innovation. December 2019. https://www.edisonfoundation.net/-/media/Files/IEI/publications/IEI_Smart-Meter-Report_2019_FINAL.ashx.

UNLOCKING THE VALUE OF EXISTING AIM INVESTMENTS

AMI systems have three main components: advanced meters, a communication network and a data management system. Together these components form the AMI platform that enables two-way communication between the customer meter and data systems managed by the utility. AMI systems may also include non-meter sensors that provide additional data to enhance the performance of the distribution system (e.g., reduced line losses and outages) and inform future investment. Under AMI, each meter has its own IP address which allows the utility to record consumption data in real-time and control meter functionality. In addition, AMI systems have been used to communicate and control the energy consumption of in-home appliances. This granular level of data capture and account control could be used by various third-party entities to offer new products and services to consumers. Ultimately, the AMI system allows for a modernized smart grid that is more efficient, clean and resilient.

AMI-enabled Services

Utilities have primarily used AMI capabilities to streamline utility operations and reduce utility operating costs through the following activities:

- Automating the collection of electricity consumption data
- Performing remote account connections and disconnections
- Detecting meter tampering
- Identifying and isolating outages
- Monitoring voltage[5]

While these services are valuable, AMI systems have the potential to create far greater value by reducing energy consumption, improving grid resiliency and supporting new products and services for customers. A recent review of AMI implementations across the United States has found that there are significant, untapped opportunities to utilize AMI data to improve energy efficiency and demand response outcomes. If these opportunities were to be pursued, AMI investments would:

- Permit two-way communication between smart meters and home area networks (HAN) to support the creation of new competitive retail service offerings that allow for a shifting of loads to reduce overall and peak demands.

5. Gold et al. https://www.aceee.org/sites/default/files/publications/researchreports/u2001.pdf.

- Generate customer bills based on actual hourly usage and not a standard utility load profile.
- Allow residential customers to manage real-time energy consumption with simple notifications regarding pre-established consumption thresholds—similar to how credit card companies provide customer notifications of large or suspicious transactions in real-time—and more advanced, automated, in-home energy management.
- Enhance the flexibility of wholesale power markets to respond to price spikes.
- Enhance competitive retail energy markets for the benefit of consumers.[6]

To achieve these objectives, regulators must ensure that utility AMI systems provide the following functionality:

- Allow customers and suppliers to seamlessly access meter data in near real-time
- Allow customers to designate their competitive supplier or other third party as an authorized agent to obtain access to usage data in near real-time
- Use actual customer usage data for billing so that suppliers can offer TVR programs
- Provide usage data in at least hourly resolution that is of sufficient quality for billing and at watt-level precision

The type of real-time data access described above is considered core functionality in other service industries. For example, credit card spending details and cell phone usage can be viewed in real-time through a company portal, and wealth management account platforms often provide functionality that allows customers to share investment data with third-party advisors. These service enhancements have raised the expectations of consumers regarding their access to data.

AMI Policy Objectives

Given the critical role AMI plays in enabling an overall modernized grid, the National Association of Regulatory Utility Commissioners (NARUC) has developed a set of smart grid principles that address the critical components that regulators should consider when evaluating AMI investments.[7] These principles recommend AMI systems incorporate a number of components, including:

- The ability for third parties to enhance the benefits that arise from AMI/smart grid programs, particularly when these third parties can provide new information, pricing and service options; facilitate microgrids; distribute generation and storage; or provide energy management or other smart grid systems and technologies
- Interaction between AMI systems and smart appliances that can automatically optimize electricity usage, implement consumer preferences and provide opportunities to reduce power system costs
- Consumer access to their own energy usage data and the ability to authorize third-party access to the data
- Adherence to interoperability standards
- Access to dynamic rate structures; energy usage information and comparisons; in-home devices and web-based portals that can help consumers understand their energy usage, empower them to make informed choices and encourage consumers to shift their usage to lower cost periods of time[8]

Taken together, these principles demonstrate that regulators from across the United States understand these investments must support competitive innovation to realize the full benefit of AMI technology. Further, there must be tools that can help reduce consumer costs, consumers must have access to their data and competitive third parties must play an important role in expanding the benefits of AMI investments. In particular, given that many of the services articulated by the NARUC principles relate to behind-the-meter services, it is anticipated that such services would be the purview of competitive entities.[9]

As shown in several recent rejections of utility AMI plans, AMI investment requests must provide greater consumer benefits in the form of energy consumption reductions as opposed to simply streamlining utility functions.[10] To ensure greater customer benefits, regulators should mandate that utilities provide the data access required to facilitate customer savings programs offered by third parties.

AMI Investment and Penetration Rates

Electric utilities have been strong advocates of AMI, and since 2011 they have invested more than $15 billion in AMI

6. Ibid.

7. "Resolution on Smart Grid Principles," The National Association of State Utility Consumer Advocates, July 20, 2011. https://pubs.naruc.org/pub.cfm?id=53985C3E-2354-D714-51A8-281C62A21700.

8. Ibid.

9. Ibid.

10. The Kentucky Public Service Commission, *Order in the Matter of Electronic Joint Application of Louisville Gas and Electric Company and Kentucky Utilities Company for a Certificate of Public Convenience and Necessity for Full Development of Advanced Metering Systems*, Case No.2018-00005, Aug. 30, 2018. https://psc.ky.gov/pscscf/2018%20Cases/2018-00005//20180830_PSC_ORDER.pdf.

capabilities.[11] With this investment, it is now estimated that by 2021 more than 107 million AMI-enabled electric meters will be installed by utilities across the United States.[12] At this level of penetration and with the correct regulatory policies in place, approximately 85 percent of U.S. households served by investor-owned utilities should be able to access their consumption data in near real-time. Such a deployment of AMI, creates the potential for widespread availability of expanded service offerings by competitive retail suppliers and third parties, including smart home energy management, load control, usage alerts, outage notifications and time-varying pricing.

Projected and Realized Benefits of AMI Investments

A review of several large AMI case studies conducted by the American Council for an Energy-Efficient Economy (ACEEE) shows a wide range of utility operating and maintenance (O&M) savings depending on the attributes of the utility (i.e., rural versus urban), level of AMI deployments and existence of prior automated meter reading (AMR) systems. This review found O&M savings of approximately $10 per customer per year with additional savings generated by AMI implementations that included energy efficiency components.[13] The ACEEE provides the following savings ranges based on numerous studies:

- Near real-time and behavioral feedback: 1 to 8 percent
- Pricing with time-varying rates: 1 to 7 percent
- Conservation voltage reduction: 1 to 4 percent[14]

While these savings ranges are notable, the ACEEE survey also identifies numerous cases in which AMI could achieve additional, meaningful energy efficiency and demand response savings under enhanced regulatory requirements.

Benefits of New AMI-Driven Services

A large survey of TVR studies—including a combination of static time-of-use (TOU) rates and more variable rates linked to wholesale power prices, such as critical peak pricing—confirmed a median peak demand reduction of 16 percent and a median overall energy reduction of 1.3 percent.[15] Generally, more dynamic programs are more effective in reducing peak demands and overall consumption, with critical peak pricing programs generating a median reduction in energy consumption of 2.6 percent and peak demand reductions of 23 percent.[16] If these types of programs could be implemented by just the competitive retail providers in the competitive markets, significant energy savings could be generated for consumers.

To estimate the energy savings that could be achieved if AMI-based dynamic pricing was available in competitive markets, the median TVR savings values were applied to residential loads served by competitive suppliers in the existing competitive markets. As of 2019, total residential energy consumption supplied by retail suppliers was 182 terawatt-hours (TWh) with an estimated peak demand of 52 gigawatts (GW) for which customers paid a total of $18.8 billion per year.[17] If all existing customers on competitive supply were able to participate in a TVR program, these customers could be expected to save approximately $250 million per year and reduce total peak demand by 8 GW.[18] These savings exclude any environmental benefits resulting from such reductions in peak demand.

These savings would be pursued by competitive suppliers and other third parties through mechanisms that adjust residential energy consumption based on customer-specified parameters, using a combination of in-home displays, smart phone apps, programmable communicating thermostats and smart appliances. In addition to immediate reductions in peak demand and energy consumption, true consumer responsiveness—as it is better understood—will become a key input in long-term resource planning, which will result in an overall increase in system utilization and a corresponding reduction in utility investment.

Not only can AMI investments create new savings streams, access to AMI data has the potential to lower the existing cost of competitive supply. One of the key lessons of retail competition is that the cost to serve LCI customers can vary significantly, even for customers on the same or similar utility distribution rates. As such, competitive retail suppliers bill LCI customers based on actual interval usage data and typically require actual hourly consumption data when generating offers. This is not the case with residential consumers. Instead, in many markets residential customer usage and

11. Cooper and Shuster. https://www.edisonfoundation.net/-/media/Files/IEI/publications/IEI_Smart-Meter-Report_2019_FINAL.ashx.

12. Ibid.

13. Office of Electricity Delivery and Energy Reliability, *Advanced Metering Infrastructure and Customer Systems: Results from the Smart Grid Investment Grant Program*, U.S. Dept. of Energy, September 2016, pp. 30, 33. https://www.energy.gov/sites/prod/files/2016/12/f34/AMI%20Summary%20Report_09-26-16.pdf.

14. Gold et al. https://www.aceee.org/sites/default/files/publications/researchreports/u2001.pdf.

15. Ibid.

16. Ibid.

17. "Annual Electric Power Industry Report, Form EIA-861 detailed data files," U.S. Energy Information Administration, July 30, 2020. https://www.eia.gov/electricity/data/eia861.

18. Ibid.

costs are still based on standardized class average load profiles and not actual customer data.

A better approach—that is currently being pursued in competitive markets such as Pennsylvania and Maryland—provides competitive suppliers with their residential customer's actual hourly usage which is then used for both customer billing and wholesale settlement.[19] In these states, competitive suppliers can now consider the specific usage pattern of a customer and provide customized energy offers which reflect lower costs associated with lower consumption during high-priced periods. In addition, using customer's actual consumption to settle with the regional transmission organization (RTO)—wherein the RTO bills the supplier for actual customer usage and not a quantity based on class average load profiles—reduces the cost of serving residential load which lowers customer costs.

To provide the same functionality being pursued in Pennsylvania and Maryland in all competitive states, regulatory commissions should require that both new and existing AMI implementations have the capability to provide retail suppliers with revenue-grade customer usage data on at least a daily basis.

Ability to Enhance System Flexibility and Resiliency

While older, baseload fossil generation has declined, the decrease in wind and solar generation costs has led to a significant increase in the installed capacity of these types of generation resources. These trends have resulted in a change in the generation mix in most regions of the country and created an increased need for flexible generation resources that can be called on when renewable power generation output unexpectedly declines.[20] The need for flexible resources is also increasing due to the growing incidence of extreme weather events which make both load and generation forecasts more uncertain. If left unchecked these trends may produce unintended consequences including higher emission from fast start-up fossil power plants, greater incidence of price spikes and a decline in reliability.[21]

To address this situation, RTOs across the United States are seeking to enhance price signals for flexible resources so that generators will be incentivized to provide additional flexibility to the system. At the same time, RTOs are seeking ways in which consumers can reduce consumption when generation output unexpectedly declines. Many LCI customers participate in demand response programs offered by RTO's and with proper AMI data and automation, residential customers could be aggregated and participate in similar programs.

AMI systems can enable the aggregation of usage data in real-time and interface with behind-the-meter resources to increase the overall flexibility of the grid. This capability should be made available to competitive suppliers so that they may aggregate customers willing to provide such flexibility. Real-time access to data improves load forecasting precision and also allows RTOs to gain a better understanding of load variability patterns. These insights can be applied to both day-ahead load forecasting and longer-term needs, including the scheduling of maintenance outages.

In conjunction with third parties such as competitive retail electric suppliers, The Midcontinent Independent System Operator (MISO)—through its Resource Availability and Need (RAN) process—is attempting to address the need for greater flexibility through a number of recommendations which can be achieved through utility AMI.[22] These recommendations include expanding the availability of Load Modifying Resources (LMRs)—which include behind-the-meter-generation and demand response—and altering MISO's demand response protocols so that LMRs would be dispatched prior to other emergency response measures, (e.g., requesting fossil generation resources to generate above their normal limits).[23]

> The need for price responsive demand was recently made abundantly clear in California. On Sept. 3, 2020, the California Independent System Operator (CAISO) issued a statewide call for voluntary electricity conservation.[24] The CAISO asked for residents to raise their air conditioning thermostats set points, defer use of major appliances, and take other actions to reduce and shift consumption to avoid rolling blackouts. Had the AMI systems in California been configured to provide residential consumers price signals, the system could have been used to communicate these emergency system conditions, allowing conservation efforts to occur through either manual actions or automated smart devices controls.

19. See, e.g., "Consolidated Case View," Pennsylvania Public Utility Commission, Oct. 24, 2013. http://www.puc.state.pa.us/about_puc/consolidated_case_view.aspx?Docket=P-2013-2389572.

20. "Resource Availability and Need: Issues Statement Whitepaper," MISO, March 30, 2018. https://cdn.misoenergy.org/20180405%20RSC%20Item%2007%20RAN%20Issues%20Statement%20White%20Paper164746.pdf.

21. Ibid

22. "Free Weekends Electricity," Direct Energy, last accessed Oct. 8, 2020. https://www.directenergy.com/free-weekends-electricity-12#plan-grid.

23. "Resource Availability and Need." https://cdn.misoenergy.org/20180405%20RSC%20Item%2007%20RAN%20Issues%20Statement%20White%20Paper164746.pdf.

24. California Independent System Operator, "Flex Alert Issued for Holiday Weekend, Calling for Energy Conservation," Press Release, Sept. 3, 2020. http://www.caiso.com/Documents/FlexAlertIssued-WeekendCalling-EnergyConservation.pdf.

Further, the MISO also seeks to improve the visibility of LMRs through enhanced metering and real-time tools.[25] Actual metering in real-time, when integrated into the tools used by the MISO operations, could allow for better awareness and more precise deployment of LMRs. Additionally, greater understanding of the operating characteristics of emergency-only resources could allow for increased operator awareness and visibility.

Today, the actual performance of LMRs is not reported in real-time and this delay reduces the benefit of these resources during emergency conditions. The MISO currently uses the MISO Communication System (MCS) to gain insights into LMR availability and to assist with their deployment. However, the MISO reports:

> [T]he current implementation in MCS is not user friendly for MISO staff or Market Participants, who must update their values manually. Actual metering or enhancements to the MCS could enable automation of updates to LMR availability without causing undue burden on Market Participants.[26]

To ensure that AMI investments are being used to support RTO needs for resiliency, state regulatory commissions should require that current and future AMI implementation proposals specifically address the needs of the applicable RTO.

Streamlined Customer Switching

In competitive retail electricity markets, the process under which a customer initiates or ends supplier service is often known as enrollments and drops, respectively. At the start of competition nearly twenty years ago, enrollments and drops could occur only on a designated meter read cycle date, so that monthly usage could be accounted for and assigned to the appropriate supplier. This was a cumbersome process for utilities, energy suppliers and customers as it was often unclear on exactly what date a customer's meter would be read and, therefore who was responsible for serving the meter on a given day.

With the widespread availability of AMI, the requirement to switch suppliers on a given meter read date each month should no longer apply. In fact, since meter reads occur in near real-time, a new meter read cycle can be initiated each day. Continued adherence to fixed, monthly enrollment and drop dates creates needless complexity and constrains the ability of consumers to choose and switch suppliers. Already, some states such as Pennsylvania and Maryland allow supplier changes to occur with a three-day notice facilitated by AMI and customers in Texas can have a switch initiated in one day.[27] Further, AMI also facilitates greater flexibility for consumers by allowing a customer to maintain their current contract with a competitive supplier upon a move to a new home within the utility's service territory.

AMI Best Practices to Foster Innovation

The ways LCI customers leverage real-time usage data provides a compelling roadmap for those who seek to maximize the benefits derived from AMI investments. These customers use energy consumption data and insights to reduce energy costs. To maximize the benefits from AMI for all customers, state regulators should:

- Implement time-of-use default service rates in states with utility-provided default service to provide correct price signals and opportunities for customer cost savings.
- Permit customers and suppliers to access revenue-grade usage data in near real-time, at watt-level precision.
- Permit customers to grant third-party access to their revenue-grade usage data in real-time, at watt-level precision.
- Settle all supplier load based on actual customer interval usage data.

THE IMPORTANT ROLE OF SUPPLIER CONSOLIDATED BILLING

Many LCI customers are billed directly by their supplier which allows these customers to use real-time energy data to better manage their energy costs, bundle energy with efficiency services and maintain a direct billing relationship with their competitive energy supplier. Similarly, residential consumers could also benefit from a direct billing relationship with their competitive supplier which requires that customers served by a competitive energy supply be billed through SCB.

Customer Relationships as Key Differentiators

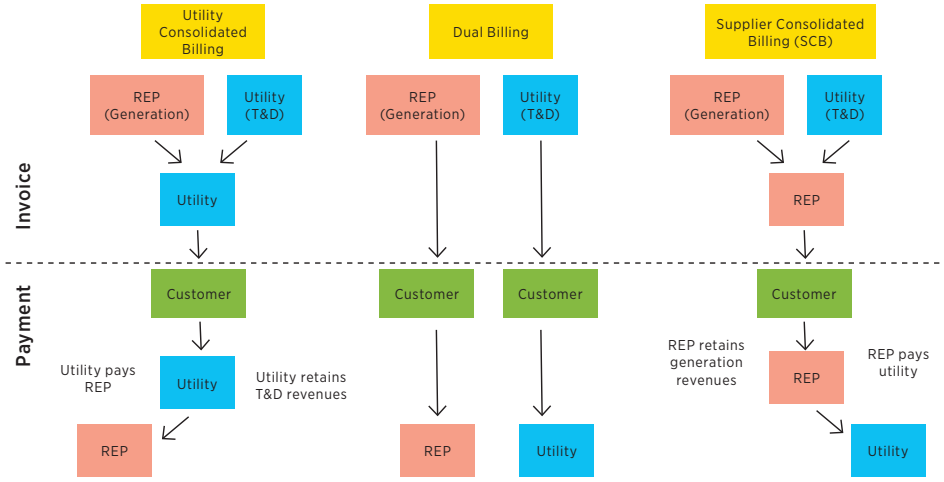
Digitization has allowed companies across many industries to enhance their customer relationships by providing better

25. Ibid.

26. "Resource Availability and Need (RAN) (IR025)," MISO, June 16, 2020. https://www.misoenergy.org/stakeholder-engagement/issue-tracking/resource-availability-and-need-ran.

27. "Chapter 25: Substantive Rules Applicable to Electric Service Providers," *Electric Substantive Rules*, Public Utility Commission of Texas, March 8, 2017. http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.474/25.474.pdf.

FIGURE I: ELECTRICITY BILLING IN COMPETITIVE MARKETS



customer service, more customized offers and new ways to engage with products and services. These deeper relationships form the basis of the firm's reputation and ultimately its brand.

In competitive energy markets, when companies have the ability to develop long-term, direct relationships with customers, the competitor has a strong incentive to ensure a positive reputation among customers and regulators. Regulatory actions that limit product choices and the ability to build such long-term, direct relationships with customers, reduce the relative value of the company's brand and thus lower investments in innovation and other areas of operational excellence. Thus, competitive energy market rules that restrict the ability of suppliers to cultivate their brand reduce service quality and can lead to lower overall customer satisfaction.

Energy Consumers Benefit from a Direct Relationship with Their Energy Supplier

In competitive energy markets, there are three ways in which customers are billed for their energy consumption and use of the distribution system: utility consolidated billing (UCB), supplier consolidated billing, or with separate or "dual" bills—one from the retailer and one from the supplier. These three billing models are shown in Figure 1 above.

Each of these arrangements has important impacts on customers and overall market design. In all competitive retail energy markets—except the Texas power market and the Georgia gas market—residential competitive energy services are billed along with regulated utility services. This lack of a direct billing relationship between the supplier and the customer limits the suppliers' ability to communicate with their customers, convey the value of various service offerings and cultivate a long-term relationship. Under these billing arrangements, the competitive supplier's services are reduced to a line item on a bill that may occupy no more space than a charge for sales taxes. Thus, the entity that the customer competitively chose for service is relegated to a minor line item on their bill. Under such a circumstance, it is not surprising that retail energy customers may not recall the name of the competitive retail supplier they selected.

Furthermore, under UCB the customer neither receives a bill from the supplier, nor is responsible for paying the supplier directly. With little ability to cultivate a long-term relationship with their customers and no responsibility for direct collections (due to purchase of receivables), retailers tend to invest less in innovation, the difference between excellent and poorly performing retailers is muted and the overall pace of competitive exit slows (i.e., weaker competitors can remain in the market for a longer period of time). These outcomes are all counter to the stated intent of regulatory commissions and within the control of state commissions to address.

A far better approach is to require that retailers bill residential consumers under SCB and collect directly from their customers for both supply and distribution services. In this way, suppliers must cultivate a strong relationship with customers and the retailer's investors will have a far greater incentive to protect their corporate reputation and brand. This market structure will also allow suppliers to offer and bill for additional products and services made possible by AMI. For example, the Texas market, has mandated SCB since its inception and several other states currently have efforts underway to evaluate SCB, including Maryland which now

allows optional SCB.[28] While SCB at the start of competition was difficult given the lack of AMI systems that could provide usage to suppliers in real-time, today, such systems can provide revenue-grade data. As AMI is expanded, suppliers' products continue to evolve and the need for SCB will only increase.

Further, SCB in Texas has enabled some extremely innovative time-of-use products. For example, one supplier now offers a time-varying rate which includes periods of time during which energy and delivery services are both free. Such an offer is not practical without SCB. Other offers that are enabled or enhanced by SCB include products such as pre-pay, flat bill, peak rewards, home warranties and home security.

CONCLUSION

As we approach full AMI deployment in the United States, we have a unique opportunity to foster a series of innovations that will generate significant cost savings and environmental benefits for consumers. These direct savings in the competitive markets alone could top $250 million per year for residential consumers and we could realize far greater savings from deferred utility investment and the environmental benefits of reductions in demand peaks.[29] In addition, we have the ability to offer energy consumers a better overall customer experience. To achieve these goals, specific regulatory changes are needed. In this regard, regulators play a critical role in accelerating the pace of innovation and cultivating competitive markets for the benefit of all energy consumers.

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28. "Order No. 89116," *In the Matter of the Petition of NRG Energy, INC., Interstate Gas Supply, Inc., Just Energy Group, Inc., Direct Energy Services, LLC and Engine Resources LLC for Implementation of Supplier Consolidated Billing for Electricity and Natural Gas in Maryland*, Public Service Commission of Maryland, May 7, 2019. https://www.psc.state.md.us/wp-content/uploads/Order-No.-89116-Case-No.-9461-Order-Authorizing-Supplier-Consolidated-Billing.pdf.

29. Gold et al. https://www.aceee.org/sites/default/files/publications/researchreports/u2001.pdf.