The Narragansett Electric Company
d/b/a National Grid

Updated Advanced Metering Functionality Business Case

Attachments A through E

Book 2 of 3

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Attachment A
Customer Engagement

Customer Engagement Plan (CEP)

Table of Contents

List of Figures

1. Executive Summary

The Narragansett Electric Company d/b/a National Grid (National Grid or the Company) is pleased to provide this Customer Engagement Plan (CEP or this "Plan") in support of the Updated Advanced Metering Functionality (AMF) Business Case. The Company is seeking approval of full-scale deployment of AMF, also known as smart meter technology, to its electric and gas customers.[1] National Grid is focused on delivering a simplified and enhanced customer experience, making the benefits enabled by smart meters intuitive and the functionality easy to manage. This Plan presents the Company's roadmap for educating, engaging, and empowering customers to maximize these benefits.

Many of the customer benefits lie within the increased granularity and timeliness of the energy usage data that the system will deliver.[2] Access to this information helps tie energy usage directly to the cost of energy, incentivizing customers to change their energy usage by providing them with bill savings and driving step changes in their peak energy reduction, especially when combined with future time-varying rates (TVR).[3] Customers will benefit from:

- Improved access to timely energy usage data;
- Enhanced control over energy management and costs;
- Increased choices on ways to save money throughout their billing cycle;
- Expanded communication on outages and restoration; and
- Greater insights on third-party vendors offering innovative energy solutions.

AMF is also foundational to the Company's Grid Modernization Plan (GMP), which provides an implementation plan and long-term roadmap for grid modernization investments necessary to meet evolving customer expectations and manage the distribution electric grid more granularly by considering a range of customer distributed energy resource (DER)[4] adoption levels through the period ending in 2030. Smart meters enhance these investments by providing increased

[1] The Company is proposing to deploy AMF technology to gas customers over time as their metering is upgraded through the normal course of business.

[2] For electric customer meters, AMF will capture and transmit energy usage data in 15-minute intervals every 30 to 45 minutes, and for gas customer meters, it will capture and transmit energy usage in one-hour intervals every eight hours, as compared to one-month intervals with current AMR technology.

[3] Pursuant to the Amended Settlement Agreement (ASA) approved in Docket No. 4770, the Updated AMF Business Case does not propose a specific time-varying rate (TVR) design; however, it does include "assumptions upon which a proposal to develop time-varying rates will be based." Article II, Section C.16.b.iv. For additional details, please refer to the Updated AMF Business Case, Attachment C: Time-Varying Rates Overview.

[4] DER is defined here as a resource sited close to customers that can provide electricity generation (*e.g.*, solar PV, wind turbine, CHP) or flexible demand (*e.g.*, energy storage, EVs, electric heat pumps).

visibility into grid conditions that support distributed system platform planning functions, DER adoption, and promote the development of a more dynamic, efficient, sustainable and resilient energy network. While this Plan focuses on customer engagement with energy usage through AMF, it is also important that the Company effectively communicate the impact of AMF on the GMP and the importance of the GMP to enabling customer choice.[5]

Development of the Customer Engagement Plan

The Company recognizes that maximizing customer benefits of smart meters requires transparent, thoughtful, and personalized customer engagement. In developing this Plan, the Company utilized:

- Internal learnings from smart meter pilot programs, needs-based customer segmentation insights, surveys, and ongoing customer-focused initiatives;
- External research from the Smart Energy Consumer Collaborative (SECC), U.S. Department of Energy (DOE), customer engagement plans from peer utilities, as well as industry reports; and
- A comprehensive collaborative process with stakeholders from the Rhode Island Power Sector Transformation (PST) Advisory Group and the GMP & AMF Subcommittee.

Figure 1-1 highlights selected learnings from each initiative and their alignment with the CEP. More detail can be found in Section 2: *Development of the Customer Engagement Plan*.

Section	Company Initiative/Activity	Description	Selected Learnings / Alignment with Customer Engagement Plan
2.2	Customer Strategy & Segmentation	Company-wide customer-centric strategic roadmap, including needs-based segmentation surveys of residential and commercial customers	Improved insights on energy decision drivers and desired brand interaction channels will improve personalized customer engagement
2.3	Key Learnings (External)	SECC, DOE, Opower/Oracle, *New York Times*, *Journal of Personality and Social Psychology*, Accenture	Engage customers early, treat customers as partners, personalize engagement, utilize opt-out design, engage Company employees

[5] For additional details, please see the GMP filed concurrently with the Updated AMF Business Case.

Section	Company Initiative/Activity	Description	Selected Learnings / Alignment with Customer Engagement Plan
2.3.1	Worcester Smart Energy Solutions Pilot; Clifton Park Reforming the Energy Vision (REV) Demonstration Project	AMF deployment pilots, including innovative rate structures	Utilize key learnings on energy savings, program design and customer behavior for Plan implementation
2.3.2	Customer Council	Online panel of ~6,100 residential customers, used to tap into customer feedback, needs & expectations on a regular basis	Customers want National Grid to provide personalized recommendations based on energy usage; expressed openness to receiving and accessing energy-related data to help change their behaviors to reduce energy costs
2.3.3	Collaborative Process	PST Advisory Group sessions	Feedback to focus on targeted messaging, including income eligible customers, impact on / opportunities for third party providers, and incorporation of behavioral science
2.4.1	Customer Experience Products	Integrated digital approach, structured around maximizing customer value during “Moments that Matter”	Increased granularity of data from AMF deployment will allow for improved customer experience during Moments that Matter
2.4.2	Customer Energy Management Platform (CEMP)	Integrated hub of energy data, insights, and actions for all customers	The CEMP will provide improved user interface for customers to access and benefit from AMF-enabled energy data once meters are deployed

Figure 1-1: Learnings for Customer Engagement Plan

Customer Engagement Plan

The objective of this Plan is to inform and educate National Grid customers on the benefits of smart meters, to increase customer participation in adopting the new technology, and to empower customers to utilize new insights and services. Using the learnings described above, the Company developed a three-phased approach (awareness, deployment, and empowerment/enablement) for customer education and engagement as summarized in Figure 2-1 and detailed in **Section 3: Customer Engagement Plan**.

In **Phase One** (Awareness), prior to deployment, the Company will build an extensive online collection of informational materials and marketing collateral to support customer communication and engagement activities, educate and train internal Company employees, and begin a territory-wide customer and stakeholder outreach effort to build smart meter awareness, generate interest prior to meter installation, and address customer questions and concerns.

In **Phase Two** (Deployment), the Company plans to build on the broad education initiated in Phase One and narrow the focus of communication toward individual customers in the months leading up to and during smart meter installation, as outlined in its 90-60-30-day communications plan. The Company will engage customers with tactical information that will guide them through the day of meter installation, including the timeline of events, what to expect, and alternate choices available including opting out of meter installation. The Company will also utilize its customer segmentation insights and customer behavior learnings from its AMF pilots to maximize engagement with different customer types.

In **Phase Three** (Empowerment and Enablement), after smart meters are installed, the Company will shift its focus to empowering and enabling customers to take full advantage of their more granular, timely energy usage data. The Company will continue to build out and refine its Customer Energy Management Platform (CEMP), which will be the customers' new touchpoint to access their energy data in Phase Three. The sustaining nature of this phase will focus on helping customers understand how to use this platform, including how to interpret their energy consumption and how to manage their energy usage to reduce energy and costs to effectuate bill savings. In this phase, the Company will also introduce interested customers to third-party vendors who can help supplement customer needs with new and innovative products and services that are incremental to the enhanced customer service offerings enabled by AMF.

Throughout the three phases, the Company will continue to collect customer feedback through additional online surveys, mail surveys, telephone surveys, in-person focus groups, online focus groups, and customer forums as part of its overarching approach to smart meter deployment:

Listen, Test, Learn.[6] It will use these channels to track key metrics on customer awareness of AMF features and benefits, customer satisfaction with meter deployment and billing accuracy, opt-out rates, and customer enablement and empowerment through CEMP functionalities. Please reference Section 7.1 of the Updated AMF Business Case for more detail on how the CEP timeline aligns with overall AMF deployment.

AMF & National Grid's Long-Term Customer Vision

The deployment of smart meters and associated communication network will provide both customers and the Company significantly more granular data at a greater frequency than is available with current AMR technology (15-minute electric data and one-hour gas data vs. monthly intervals, respectively). AMF will establish a two-way communication pathway between the Company and its customers. Likewise, it will establish a grid-edge computing platform, including software applications that are deployable to the meters for both grid- and customer-facing use cases. Once AMF is deployed, the Company will seek to leverage the foundational infrastructure and capabilities to provide new customer solutions where feasible, as described in more detail in **Section 4: AMF & National Grid's Long-Term Customer Vision.** Additionally, the Company is committed to enhanced third-party data access, which will create new opportunities for innovative third-party services.

Metrics of Success

The Company will also track metrics focused on enabling and encouraging access and participation of third-party vendors. More detail on metrics and plans to develop targets can be found in **Section 5: Metrics of Success** and in the Updated AMF Business Case, Attachment D: Metrics and Performance Incentives Measures Roadmap.

Total Cost

The Company estimates that the total cost for the CEP, including marketing, research, communications, outreach, CEMP, and data access through Green Button Connect (GBC) to be $26.33M (nominal) over the 20-year period of the Company's Benefit Cost Analysis (BCA).

[6] Listen, Test, Learn was developed by National Grid as an approach to customer education and feedback that aided in early program design and ongoing adaptation of the Worcester Smart Energy Solutions' pilot project (Worcester Pilot). For example, the Company conducted a public summit during the pilot design phase that allowed it to hear from a diverse cross-section of the community and incorporate ideas from customers to improve project design. *See* Association of Energy Services Professionals, Listen, Test, Learn – National Grid's Smart Grid Pilot (June 2016), https://aesp.org/page/ListenTestLearn/Listen-Test-Learn---National-Grid-Smart-Grid-Pilot.htm;

The costs are broken out as follows:

Item	Cost
CEP Marketing, Research, Communications, Outreach	$12.77M
CEMP	$9.20M
Data Access through GBC	$4.36M

Figure 1-2: 20-Year Customer Engagement Plan Costs[7]

In addition, some of the funds allocated to developing future TVR will be utilized for customer engagement purposes in later years. The exact breakdown of funds allocated to TVR has not yet been determined by the Company.

2. Development of the Customer Engagement Plan

2.1 Introduction

Today, customers expect more from their utility. Industry research and customer survey results suggest that customers not only expect their utility to provide clean, affordable, reliable, and safe energy, but also increasingly expect access to actionable information, greater choice and control over their energy use, and delivery of energy services in a simple and convenient way. Based on recent surveys and industry intelligence, National Grid customers:

- Expect their energy experience to be affordable;
- Express a willingness to alter energy use to achieve savings;
- Want to easily access their energy usage data from a variety of channels;
- Have interest in using connected devices to enable greater control over the energy coming into their homes;
- Desire tailored, personalized choices for energy consumption options; and
- Need convenient energy services and solutions.

In Rhode Island, increasing customer empowerment and enablement is a critical component of Docket No. 4600. Some of the primary customer-facing aspects of Docket No. 4600 include:

[7] The $12.77M consists of Marketing/Communications (~$9M), Supporting Staff (~$2M), Customer Insights Research/Studies (~$1M), and Town/Community Outreach (~$0.5M). Of the $12.77M, the Company estimates expenditures of $9.74M over years 1-5, with most the remaining expenditures concentrated in years 6-10. The $9.20M CEMP figure includes Opex and RTB costs, as well as load disaggregation software costs. The $4.36M GBC figure includes Capex, Opex, and RTB costs.

- Empower customers to manage their costs;
- Enable customer-side technologies that automate end-user response to TVR;
- Create customer education and engagement programs to provide all customers (including hard-to-reach customers) with the information and tools to optimize their energy consumption; and
- Help customers reduce their energy burden and address income eligible and vulnerable customers' needs.

The Company's AMF deployment proposal aims to align with Docket No. 4600, and, if approved, would deliver significant progress in each of the above categories. AMF implementation would provide customers with the personalized knowledge and tools needed to better inform their energy decisions and manage their energy costs. Once paired with the thoughtful economic incentives of well-designed TVR in the future, customers will have new opportunities to save both energy and money.

Customers would be able to access and utilize energy information and savings tools in a simple, user-friendly way through the Company's CEMP. Moreover, if they so choose, customers will be able to seamlessly share their energy usage data with third-party energy service providers through GBC to support new innovative service offerings. AMF will also allow for new direct, automated linkages of energy usage data and price signals to a customer's home-area network (HAN). This allows for a more deeply integrated energy experience through automated smart home offerings to optimize savings from energy efficiency (EE) and demand response (DR) programs. It will also allow customers who connect to a HAN to leverage third-party vendor technology, as well as internet-based options to monitor and control their energy usage instantaneously and achieve real-time energy awareness.[8]

Taken together, the future state following the proposed AMF and GMP deployments will be mutually beneficial for both end-use customers and National Grid alike. As the generation mix of the grid increasingly makes effective use of intermittent distributed generation, the ability of the Company to shift load to help balance the grid becomes increasingly important. AMF will provide data critical to distribution planning, DER integration, voltage and outage management, and overall planning and operations. For the customer, the customer engagement capabilities unlocked by AMF and future TVR are vital tools to help balance the grid of the future, in addition to providing the customer benefits noted above. Additional detail on the Company's proposal can be found in the Updated AMF Business Case.

[8] *See* Section 4: *AMF & National Grid's Long-Term Customer Vision* for additional details on these tools.

2.2 National Grid Customer Strategy and Segmentation

Maximizing customer engagement requires a deeper understanding of who the Company's customers are, what they need, and what they want – as well as a recognition that those needs and wants are differentiated across customers. To better serve Rhode Islanders, the Company completed a deep needs-based customer segmentation of residential and commercial customers.

The segments were compiled by gathering feedback from the Company's customers through an extensive online survey, combining the survey data with existing database information, and applying a quantitative cluster analysis to arrive at the differentiated segments. A high-level view of the six residential and five commercial segments identified from the survey are shown in Figure 2-1 and Figure 2-2. The segments are supported with in-depth profiles of energy-related customer attitudes, including what is most important to them; their preferred method of communication; and products and services of most interest to them. Each segment has its own unique tendencies, such as level of satisfaction with the Company, engagement preference, and favored means of interaction.

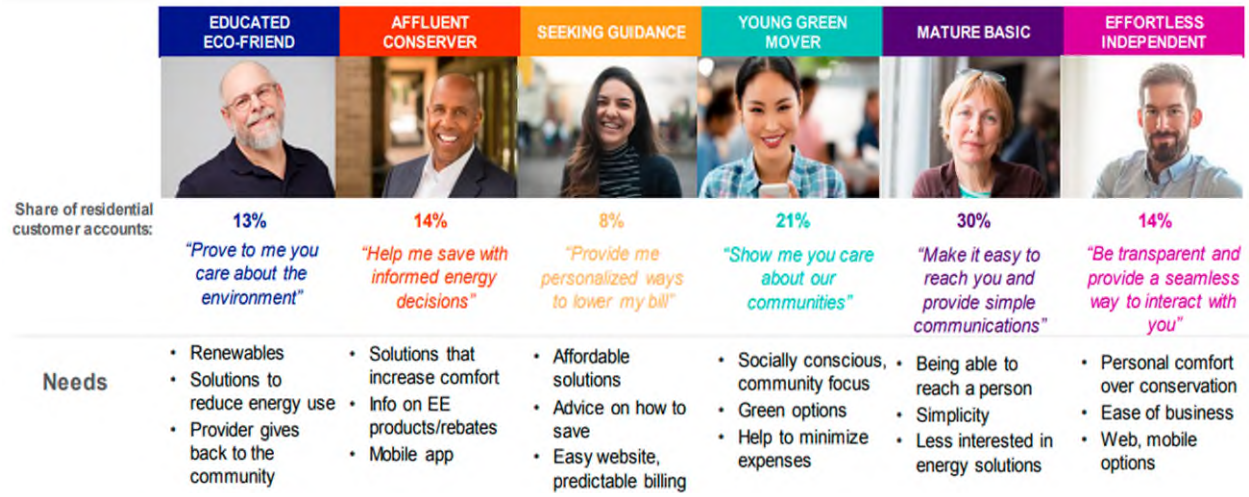


Figure 2-1: National Grid Residential Customer Segmentation

	LEAN & GREEN	SMALL & SEAMLESS	SEEKING SOLUTIONS	NO FRILLS	BIG BUSINESS
					
	"Show you care about the environment with more action, less words"	*"I don't need much, just an easy way to get in touch with you"*	*"Be more proactive instead of reactive when communicating with me"*	*"Make it straight forward to reach someone"*	*"Make it easier to manage multiple accounts and locations"*
Size based on energy use	• Smallest companies	• Small companies	• Medium companies	• Medium companies	• Largest companies
Needs	• Socially conscious • Renewables • Energy advice, recommendations	• Ease of business • Online & mobile tools • Renewables lower priority	• Energy management solutions • Predictable bills • Advice and info to track usage, savings	• Effective customer service • On time service • Prepared & responsive in emergencies	• Commercial solutions • Help to manage multiple accounts • Advice on products, services, providers

Figure 2-2: National Grid Commercial Customer Segmentation

National Grid has begun to leverage these customer insights to better identify and target customers for different product and service offerings. For example, the Company's residential analysis revealed two segments (*i.e.*, Educated Eco-Friends, Affluent Conservers) that are most interested in engaging with National Grid by purchasing energy-related products and services. Approximately 30-35% of customers fall into this grouping.

Notably, many of the products and services classified as low awareness but high interest across customer segments, are relevant to AMF functionality – such as TVR, high-usage alerts, access to more granular energy usage data, and load disaggregation. Half of all Educated Eco-Friends, Affluent Conservers, and Young Green Movers want access to hourly electric and gas usage data while only ~15% are aware of products and services that can provide that data. Among Seeking Guidance customers, 70% are interested in that granular data, nearly two-thirds are interested in load disaggregation functionality, and over half are interested in TVR.

The remaining customers are less interested in energy management solutions; nearly 30% fall into the Mature Basics category, with the remaining 25-30% comprised of Effortless Independents and Young Green Movers. Note that these segments are *needs-based* and not necessarily based on income or other demographic factors; Rhode Island customers on an income-eligible rate, for example, are distributed across all segments.[9]

[9] See Appendix B: National Grid Rhode Island Customer Demographics for additional demographic detail.

For many products and services, this analysis can be used to determine which segments to target based on their needs and interests. For this Plan, which seeks to engage *all* Rhode Island customers, the Company expects to utilize digital footprint habits (how customers use technology) and desired brand interaction channels (such as website, phone calls, paper bills, apps) from each segment to differentiate its outreach to customers with preferred messages and communication channels (*e.g.*, direct mail, website, email, social media, community meetings, Rhode Island Energy Innovation Hub). This approach will help the Company most effectively educate and empower different customers to maximize the benefits of AMF. Personalized messaging through preferred channels improves the customer experience and will prompt customers to engage more actively with AMF by utilizing newly available granular energy data to manage energy costs, connect with third parties, and potentially engage with future technologies, like load disaggregation and smart home device integration.

The Company will continue to test and learn from its segmentation analysis to optimize between universal and targeted messaging. The Company will also refresh its segmentation analysis periodically to ensure its insights remain relevant and useful to ongoing customer engagement efforts.

2.3 Key Learnings

In developing this Plan, the Company also drew on insights from affiliate AMF pilots, collaborative discussions with the PST Advisory Group, the GMP and AMF Subcommittee, and external research. This section highlights key learnings on what customers care about, affordability, visibility, control, choice and convenience, and how AMF can help address those items.[10]

Affordability: When given the right tools, customers will take a more active role to minimize total energy costs. For example, customers have shown a willingness to temporarily adjust or shift energy use in return for bill credits or other incentives, as indicated by customer research,[11] the Company's affiliates experience with the Clifton Park, New York REV Demonstration Project (Clifton Park Demonstration) and the Worcester, Massachusetts Smart Energy Solutions Pilot (Worcester Pilot).[12]

[10] *See* Section 3: *Customer Engagement Plan* for additional detail on how the Company incorporated these learnings into the CEP.

[11] National Grid, *Value Proposition Research: A Study of 3 Energy Solution Areas* (2017).

[12] In the Worcester Pilot, participants had the opportunity to respond to critical peak pricing events to achieve bill savings. *See* National Grid, *Value Proposition Research: A Study of 3 Energy Solution Areas* (2017).

Visibility: Customers express a need for personalized insights and information on specific actions that can help reduce their usage.[13] They also expect this information to be easily accessible and available through numerous channels (*e.g.*, the Company's website, mailings, Customer Service Center). More visible usage and cost information enables better customer energy management and helps achieve cost savings.[14] This is particularly valuable in a future environment where default pricing plans evolve from a traditional flat rate to a TVR structure.

Control: Customers want better control over how and when they use power in their homes, businesses, and facilities.[15] A majority of both residential and commercial customers express interest in tools and devices that can help them manage their energy use, such as connected thermostats that can be controlled remotely and learn a customer's habits and preferences based upon usage patterns.[16] The Company has already taken initial steps in this field through its existing multi-sector EE and DR programs and it expects AMF to enable this need further through the provision of personalized, granular usage data.

Choice: Greater levels of choice have the potential to empower customers – from home/business energy management alternatives to various clean energy solutions to pricing options.[17] Customers also want the ability to choose what type of communication they receive, when they receive it, and through which channels, to best personalize their energy experience. While consumers express an interest in increased levels of choice, behavioral science research also suggests that overloading consumers with too many choices can result in decision inertia and less satisfaction with an eventual choice.[18] Default options help facilitate better customer decision-

[13] Opower/Oracle, *Five Universal Truths About Energy Consumers* (2013), https://go.oracle.com/LP=42705?elqCampaignId=74615.

[14] National Grid, *Value Proposition Research: A Study of 3 Energy Solution Areas* (2017).

[15] *Id.*

[16] *Id.*

[17] *Id*.

[18] Sheena S. and Mark R. Lepper, *When Choice is Demotivating: Can One Desire Too Much of a Good Thing?* 79 [6] J. of Personality and Soc. Psychology 995-1006; *see also* Richard H. Thaler and Cass R. Sunstein, Nudge: Improving Decisions About Health, Wealth, and Happiness (2009).

making with opt-out settings driving higher participation levels, as demonstrated by studies on dynamic pricing plans.[19, 20]

Convenience: Building on "choice," the Company recognizes that a key aspect of customer convenience is delivering information and solutions to customers through their most preferred channels. In today's connected world, this requires an increased focus on web-based and mobile solutions, allowing customers to manage and optimize energy usage via an "anytime, anywhere" experience. In expanding on convenience, automation offers further decision optimization by simplifying or reducing repeatable actions; for example, the enablement of "auto-bill pay" and/or "set it and forget it" features. An industry study on "The New Energy Consumer" showed that 60 percent of those surveyed would be interested in technology that could completely automate the management of their electricity or gas use.[21] This type of automation cannot be fully utilized without an enabling AMF foundation and a platform that can connect with smart devices.

However, National Grid is cognizant that not all customers have the time, ability, or preference for engagement via digital solutions, and thus a multi-channel outreach strategy throughout smart meter deployment is critical.[22]

[19] Richard H. Thaler, *Unless You Are Spock, Irrelevant Things Matter in Economic Behavior*, N.Y. Times, May 8, 2015 (online), https://www.nytimes.com/2015/05/10/upshot/unless-you-are-spock-irrelevant-things-matter-in-economic-behavior.html; *see also* Thaler & Sunstein, *supra* note 18.

[20] Opt-out default options significantly increase participation, as seen in the Worcester Pilot, where 95 percent of participating customers stayed on the default critical peak pricing rate plan and did not opt out. See Navigant, National Grid Smart Energy Solutions Pilot Final Evaluation Report (May 2017).

[21] Accenture, The New Energy Consumer Architecting for the Future (2014), https://www.accenture.com/t20170225t000140__w__/us-en/_acnmedia/pdf-3/accenture-new-energy-consumer-architecting-future.pdf.

[22] As of 2015, according to the National Center for Education Statistics, 86.9% of Rhode Island households have a computer and/or smart phone, and 78.9% have internet access.

Figure 2-3 highlights selected external research insights and their impact on the CEP.

Source	Selected Insights	Impact on CEP	CEP Section
Smart Energy Consumer Collaborative (SECC)[23]	Don't wait until consumers ask – start a conversation now	Begin engagement with Phase 1: Awareness	**Section 3.1**
SECC	Use an "all of the above" channel strategy to reach segments by preferred means	Develop and utilize a variety of educational materials in a multi-channel outreach and engagement approach	**Section 3.1.2**
SECC	Consumers want to be in the driver's seat	Empower customers with accurate and personalized energy usage information to choose products & services	**Section 3.2.2**
US Department of Energy (DOE)[24]	Treat customers as partners	Listen, Test, Learn approach	**Section 3.1.4**
DOE	Engage employees from the start and continue throughout program	Educate employees early & often, enable employees to server as community champions	**Section 3.5**
DOE	Start customer engagement efforts prior to deployment	Begin engagement with Phase 1: Awareness	**Section 3.1**
DOE	Meet customers in preferred forum (traditional mail, in person, online)	Leverage insights from customer segmentation analysis and other surveys	**Section 3.1.2**
DOE	Recognize importance of listening and engaging with customers who have concerns about technology	Listen, Test, Learn approach	**Section 3.1.4**

[23] SECC, 2018 State of the Consumer Report (February 2018), https://smartenergycc.org/2018-state-of-the-consumer-report/. The SECC is a 501(c)(3) nonprofit organization that works to learn the wants and needs of energy consumers in North America, encourages the collaborative sharing of best practices in customer engagement among energy stakeholders, and educates the public about the benefits of smart energy and energy technology. National Grid is a member of the SECC.

[24] DOE Office of Electricity and Energy Reliability Advanced Grid Research Division, Voices of Experience Series, Leveraging AMI Networks and Data (March 2019), *https://www.smartgrid.gov/document/VOE_Leveraging_AMI_Networks_Data*

Opower/Oracle[25]	Customers express need for personalized insights and information on specific actions that can help reduce their energy usage	Empower customers with accurate and personalized energy usage information, to choose products & services	**Section 3.2.2**
***Journal of Personality and Social Psychology*[26]**	Overloading customers with too many choices can result in decision inertia and lower satisfaction	Recommended opt-out approach for meters and TVR	**Section 3.4**
***New York Times* (Richard Thaler)[27]**	Default options help facilitate better customer decision-making, higher participation levels with dynamic pricing plans	Recommended opt-out approach for meters and TVR	**Section 3.4**
Accenture[28]	Majority of consumers surveyed prefer personalized experience, over half are comfortable sharing additional information in this pursuit	Empower customers with accurate and personalized energy usage information, to choose products & services	**Section 3.2.2**

Figure 2-3: External Research Insights

[25] Oracle/Opower, Five Universal Truths About Energy Consumers (2013), https://go.oracle.com/LP=42705?elqCampaignId=74615.

[26] Sheena & Lepper, *supra* note 18, https://faculty.washington.edu/jdb/345/345%20Articles/Iyengar%20%26%20Lepper%20(2000).pdf.

[27] *See* Thaler, *supra* note 19; s*ee also* Thaler & Sunstein, *supra* note 18.

[28] Accenture, New Energy Consumer – New Paths to Operating Agility (2017); https://www.accenture.com/_acnmedia/Accenture/next-gen-5/insight-new-energy-consumer-2017/Accenture-NEC2017-Main-Insights-POV.pdf.

2.3.1 National Grid AMF Pilots

National Grid has learned a great deal in recent years from customer engagement on smart meter deployment. This Plan builds upon the Company's robust Customer Engagement Plan developed as part of its affiliate's Advanced Metering Infrastructure (AMI) filing in New York, as well as the customer education and outreach plan developed for Massachusetts. As previously discussed, the Company's affiliates have also developed and implemented pilot projects (*i.e.*, Worcester Pilot and Clifton Park Demonstration) to better understand how to effectively deploy AMF, determine customer needs, engage customers and positively affect customer energy behavior changes. This Plan leverages lessons learned and best practices from the Company's own experiences in its other jurisdictions while focusing on Rhode Island customers and what is most useful for them. Key customer engagement recommendations from the Company's pilot and demonstration programs are summarized below in Figure 2-4: Worcester Pilot Recommendations and Figure 2-5: Clifton Park Demonstration Recommendations.

Worcester Pilot

Recommendation	Description
Phased approach	Implement a phased approach to customer engagement to better educate and inform customers. Follow with three phases: awareness, deployment, and program education/enrollment.
Early development of customer engagement tools	Tools to support customer engagement, such as GBC, the CEMP, and the E-Commerce Platform, should be developed in advance of deployment to allow customers to immediately realize AMF benefits.
Customer data access and end-use automation technology	In-home technology devices deliver higher efficiency, demand savings (up to 31%), and customer satisfaction compared to those without. Customers without in-home technology who visited Worcester smart customer web portal saved at least twice as much in each year as those who did not visit the web portal.
Personalized insights and outreach	Tailor user profiles to fit individual users to increase customer participation.
Opt-out design	An opt-out design, for both AMF meters and time-of-use/critical peak pricing (TOU/CPP), allows for strong customer enrollment, participation, and retention (98% for Worcester Pilot customers after four years).
Recurring customer feedback surveys	Survey and solicit consistent customer feedback via multiple surveys and channels to support continuous improvement of the program and enhance messaging based on the Listen, Test, Learn approach.
Local events	Local events (*e.g.*, city meetings, farmer's markets and other outreach events) were helpful in promoting the pilot and increasing awareness and participation. The Company also utilized the Worcester Sustainability Hub as a center for customer support and questions.

Figure 2-4: Worcester Pilot Recommendations

Clifton Park Demonstration

Recommendation	Description
Communication cadence	Communicate early and often.
Local community events	Being present at local community events are great ways to interact with customers to help to create community champions to advocate for benefits to reach all customer segments, non-profits, schools, community groups, faith communities, and community action councils (income-eligible services).
Personalized messaging	Utilize personalized messaging for a better customer experience.
Simple, easy to understand language	Communicate options and provide notifications in simple, easy to understand language.
Ongoing feedback	Continue to get feedback and measure customer experience (Listen, Test, Learn).

Figure 2-5: Clifton Park Demonstration Recommendations

2.3.2 National Grid Customer Council

In mid-2018, the National Grid created the Customer Council (Council) – an online panel of ~6,100 residential customers across its service territory in Rhode Island, New York, and Massachusetts. The Council was designed to tap into customer feedback on a continuous basis, keeping the finger on the pulse of customer needs and expectations to deliver customer insights that inform data-driven business decisions.[29]

The Council has conducted 30+ projects (*e.g.*, interviews, surveys, forums, and studies) to generate insights from the Company's customers on what they want and expect from National Grid. The results from various Council projects highlighted customers' desires for the Company to fulfill the role of "trusted energy advisor" by providing personalized recommendations based on energy usage – a goal that is difficult to achieve without the timely, granular data that AMF provides.

According to one study, National Grid customers recognize the potential of newer technologies, and consider it essential to optimizing their lifestyle and managing their bills. Many customers expressed openness to receiving and accessing energy-related data to help change their behaviors to reduce energy costs. For customers, 86% appreciate notifications of upcoming bill changes. The Company plans to continue to utilize the Council to test customer interest in additional specific AMF benefits and messaging as part of this Plan.

[29] The Company is not seeking funding for the Customer Council as part of the Updated AMF Business Case filing.

2.3.3 Collaborative Process and Learnings

National Grid also sought input and feedback on its proposed customer engagement approach from the GMP and AMF Subcommittee Group as part of the PST Advisory Group. Multiple sessions were held to discuss the Company's proposed three-phase approach (*e.g.*, awareness, deployment, and empowerment/enablement), lessons learned from the Worcester Pilot and Clifton Park Demonstration, and associated customer benefits.

The Company incorporated key feedback from the GMP and AMF Subcommittee, including the importance of educating income-eligible customers, engaging with organizations that support income-eligible customers, differentiating approaches to customer segments, and utilizing behavioral science for developing customer engagement strategies. Figure 2-6 summarizes key areas of feedback and how the Company has incorporated that feedback into the CEP.[30]

Feedback	Impact on CEP	CEP Section
Focus on what customers care about	Use learnings from National Grid AMF pilots, Customer Council and Customer Strategy & Segmentation analysis, collaborative process and external research to develop CEP.	**Section 2**
Differentiate approach by customer segment	Utilize learnings from Customer Strategy & Segmentation analysis; utilize digital footprint habits & desired brand interaction channels to differentiate outreach and education by customer segments.	**Section 2.2**
Incorporate behavioral science research	Use opt-out program design, start engagement early, treat customers as partners, utilizing research from SECC, DOE, Opower/Oracle, *Journal of Personality & Social Psychology, New York Times* and Accenture.	**Section 2.3**
Clarify Opt-out process	Developed additional detail as part of section 3.4 to explain opt-out process for each phase of the CEP.	**Section 3.4**
Importance of income-eligible customers	Leverage insights on different customer segments; meet the customer where they are; include non-electronic and non-primary language communications; engage with consumer advocate organizations.	**Section 3.6**
Be concise and specific	Refined CEP to focus on key inputs, specific timelines, materials and communications approaches, and how AMF fits the Company's long-term customer engagement vision.	**All Sections**

Figure 2-6: PST Advisory Group GMP and AMF Subcommittee Feedback and Impact on CEP

[30] See also Appendix C, Rhode Island PST Advisory Group AMF and GMP Subcommittee Meeting Overview.

2.4 Alignment with Ongoing Customer Initiatives

National Grid is dedicated to becoming the trusted energy advisor for Rhode Islanders and providing a customer experience that is among the best of utilities. The Company is focused on being a market enabler that develops customized solutions for customers, facilitates the efficient integration of third-party resources by sharing information with customers and market participants, and sends appropriate price signals. These efforts both align with and will be enhanced by AMF deployment.

2.4.1 Customer Experience Products (CXP)

National Grid is building out a comprehensive suite of Customer Experience Products (CXP) that aim to fundamentally change how the Company interacts, services, and communicates with customers via a more integrated digital approach, including a responsive website, social media outreach, and Customer Service Center. This initiative is structured around delivering maximum customer value during the "Moments that Matter," as illustrated in Figure 2-7 below.[31]

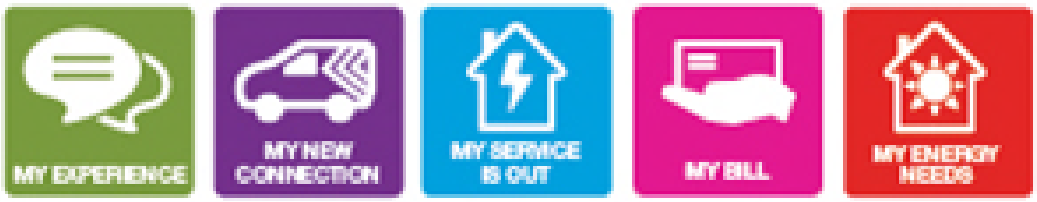


Figure 2-7: Customer Experience Products – Customer "Moments that Matter"

Ongoing efforts related to the CXP work include:

- Enabling customer preference management for proactive communications, including new proactive alerts for outages and service appointment reminders;
- Enhancing the customer experience over the web to be mobile responsive;
- Personalizing the customer experience by offering individualized program offerings for customers over the phone; and
- Upgrading core telephony infrastructure with new capabilities for Company employees to assist customers.

[31] *See also* Appendix D, *Customer Experience Products (CXP) Overview*. Note, the Company is not seeking CXP funding as part of the AMF filing.

Increased frequency and granularity of customer energy consumption data from AMF deployment will enhance the Company's efforts to provide a best-in-class experience across these efforts and the "Moments that Matter" by giving customers more timely and useful insights prior to the delivery of their monthly energy bill. Figure 2-8 further details how AMF enhances "Moments that Matter" throughout the customer lifecycle.

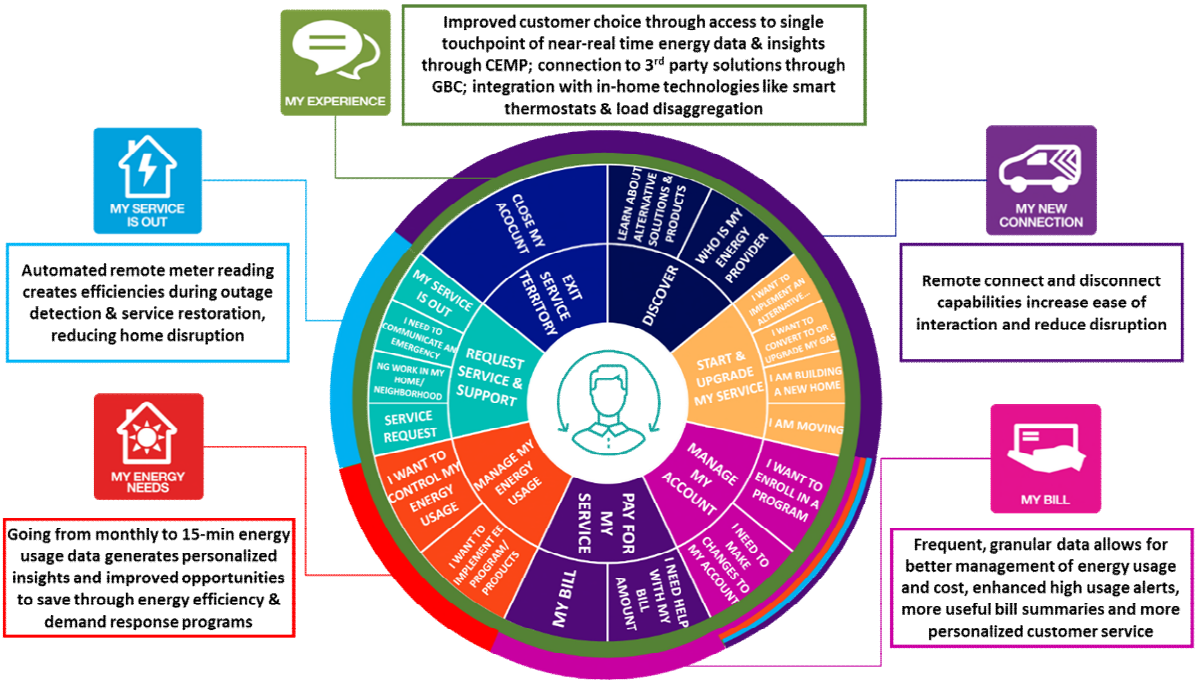


Figure 2-8: AMF, the Customer Lifecycle, and the "Moments that Matter"

2.4.2 Customer Energy Management Platform (CEMP)

A component of this Plan is the Company's vision to develop the CEMP to build on the current CXP work by enhancing initiatives with AMF data. It will serve as an integrated hub of energy data, insights, and actions available to all customers. The CEMP will allow customers to access accurate and personalized energy usage information, as well as various choices and options to enroll in Company and third-party programs and services that can leverage the more granular data provided by AMF meters. Some CEMP components, like monthly energy summaries with average usage in smaller increments, could also be layered into non-digital communications like the customer bill or bill insert.[32]

[32] *See* Section 3.3, *Phase Three: Customer Empowerment and Enablement* for more detail on how the Company plans to educate and empower customers to use and benefit from the CEMP.

The Company plans to coordinate the deployment of the CEMP to ensure it is fully operational and functional on day one when new meters are installed. This includes two years of back-office work that will align with other pre-meter deployment efforts, process design, and communications planning. For this Plan, the first year of back-office work will focus on detailed design and procurement of the main CEMP features. The second year will focus on testing, implementation, and deployment, in advance of initial meter installations.

National Grid also plans to expand and update the CEMP over time as necessary to meet the evolving needs of customers. New features and existing programs, such as integration with DERs (like solar), energy storage, and electric vehicles, can be integrated into the CEMP as these technologies become more widely accepted and utilized by customers. National Grid envisions the CEMP to be the one-stop place to manage all customer energy needs today and in the future.

3. Customer Engagement Plan

Using the learnings discussed in Section 2, the Company developed a robust plan to inform and educate National Grid customers on the benefits of smart meters and to empower customers to use new AMF-enabled insights and services. As the Company is seeking approval of full-scale AMF deployment to its electric customers, the CEP is focused on the benefits of electric AMF meters. Gas customers will have their metering upgraded over time through the normal course of business and subsequently integrated into the AMF network. This Plan is structured around the three phases of AMF customer engagement (awareness, deployment, and empowerment/enablement), which are summarized in Figure 3-1:

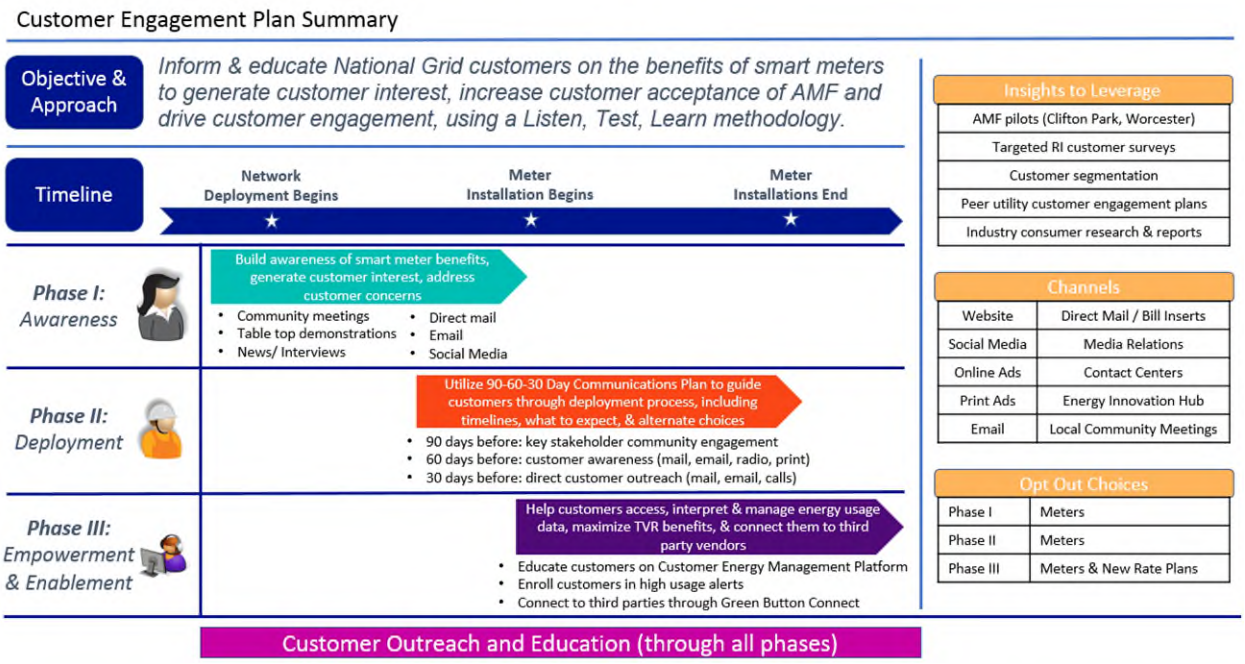


Figure 3-1: Customer Outreach and Education Timeline

This phased approach, modeled after the Company's successful Worcester pilot, will support the customer journey and will include specific marketing strategies with defined messages, audiences, channels, and educational materials to generate customer interest, increase customer awareness, and drive customer engagement. Simple, easy-to-understand materials will be developed across brand interaction channels to target different customer segments and reach a diverse audience.

National Grid is also committed to customer choice, and customers will have the opportunity to decline the receipt of a new smart meter during all phases of the Plan.[33] The Company also recognizes the importance of its employees as key ambassadors for positive customer engagement.[34]

[33] See Section 3.4, Customer Choice and Opt-out.

[34] *See* Section 3.5, *Company Transformation, Employee Engagement and Training* for more detail on how the Company will seek to educate and empower its employees as part of wider business unit integration.

Throughout each phase, the Company will apply a Listen, Test, Learn approach, using feedback from customer surveys, community partners, Company Consumer Advocates,[35] call center representatives, and the Company's Customer Council, to continue refining messages and outreach strategies. This approach has been foundational to supporting continuous improvement of the Worcester Pilot and the Clifton Park Demonstration, and supports DOE research on the importance of treating customers as *partners*.[36] Messages that are not resonating will be adjusted and newly deployed. As described in Section 5 and Attachment D (Metrics and Performance Incentives Measures) to the Updated AMF Business Case, the Company will use various metrics to understand and proactively manage customer engagement performance throughout the AMF project.

The Company estimates the total spend on customer engagement for AMF to be $26.33M in nominal terms. This includes $12.77M over 20 years for marketing, research, communications and outreach costs; $9.2 to build the CEMP; $4.36M to build enhanced third-party data access through GBC; and additional funds allocated to developing future TVR, some of which is likely to include customer engagement costs in later years.[37] For additional details, please see the Section 8 (Benefit Cost Analysis (BCA) Evaluation Under Docket 4600) of the Updated AMF Business Case.

3.1 Phase One: AMF Awareness

3.1.1 Objectives and Approach

The Phase One (AMF Awareness) objectives are:

- Build an internal foundation of informational materials on AMF and customer benefits ("why this is good for the customer?") to be utilized externally;
- Educate and train National Grid employees, including executive leadership, customer service representatives, customer and community managers, account managers, regulatory team members, and corporate communications, on the AMF program, rationale, and benefits;

[35] Consumer advocates are National Grid employees designated to engage with customers in one-on-one conversations at National Grid organized "Community Expos," local organizations, National Grid's Rhode Island Innovation Hub, workshops, town hall meetings, and other events.

[36] DOE, Voices of Experience: Leveraging AMI Networks and Data (March 2019).

[37] The total $12.77M consists of Marketing/Communications (~$9M), Supporting Staff (~$2M), Customer Insights Research/Studies (~$1M), and Town/Community Outreach (~$0.5M). Of the $12.77M, the Company estimates expenditures of $9.74M over years 1-5, with most the remaining expenditures concentrated in years 6-10. The $10.75M CEMP figure includes Opex and RTB costs, as well as load disaggregation software costs. The $3.79M GBC figure includes Capex, Opex, and RTB costs.

- Begin territory-wide customer and stakeholder outreach effort, including grassroots campaign and media relations, to build smart meter awareness and generate interest prior to meter installation; and
- Proactively address potential customer concerns (*e.g.*, health, privacy, etc.) prior to deployment and as they arise.

During Phase One, National Grid will aim to develop customer and stakeholder trust through continuous, transparent communication. External research highlights the importance of: 1) starting any conversation with customers early;[38] and 2) beginning AMF customer engagement efforts prior to deployment to maximize engagement.[39] As the Company further learned from the Worcester Pilot and the Clifton Park Demonstration, National Grid customers want to be educated early and often on new features, technologies, and offers.

Furthermore, internal customer surveys have shown that customers have a limited awareness of smart meters, indicating the need for early communication to build awareness, generate interest and support, and mitigate any potential barriers to adoption or customer concerns. Phase One will begin following regulatory approval of the AMF filing and will continue through back-office implementation and network deployment, leading up to three months prior to meter installation.

3.1.2 Educational Materials and Outreach Strategy

In Phase One, the Company will focus on introducing customers and stakeholders to what smart meters are, how customers will benefit, and what the deployment process and timeline will look like. Based on feedback provided by the GMP and AMF Subcommittee, the Company will prioritize the engagement of community leaders and specific customer groups (*e.g.*, income-eligible consumer advocacy organizations, seniors, etc.) prior to the onset of broader customer outreach. Following key stakeholder engagement, the Company will leverage the success of the Worcester Pilot and Clifton Park Demonstration to develop and utilize a variety of educational materials in a multi-channel outreach and engagement approach.[40] For example, in the Clifton Park Demonstration, the Company's affiliate reached 100% of customers through the channels illustrated in Figure 3-2.

[38] SECC, 2018 State of the Consumer (February 2018).

[39] DOE, Voices of Experience: Leveraging AMI Networks and Data (March 2019).

[40] With the November 2020 approval of the New York affiliate's AMI filing, the Company also expects to leverage lessons learned from the affiliate's implementation of the New York AMI customer engagement plan.

Figure 3-2: Scope of Clifton Park Outreach

National Grid plans to build on that approach by developing a variety of materials on AMF across the above channels and beyond, including customer education videos, a "Getting Started Guide" to provide step-by-step instructions and visuals for customers, testimonials, social media engagement, and creating relatable case studies for customers. Figure 3-3 summarizes channels and materials the Company plans to utilize for engagement with key stakeholders and customers.

Audience	Channels	Materials
Community Leaders	• Community Events • RI Energy Innovation Hub • Customer and Community Managers / Account Managers • Email	• Fliers / Leave-Behinds / FAQs / Fact-Sheets / Welcome Brochures • "Hands On" Experience • Education Campaign • Instructional Videos
Residential Customers	• Direct mail • Email • Web Banners • Website • Out of Home Ads • Online/Print Ads • RI Energy Innovation Hub • Energy Efficiency Program Delivery • Community Events • Social media engagement	• Customer Testimonials • "Getting Started Guide" to provide step-by-step instructions and visuals for customers • Social media engagement (*e.g.*, Facebook, Twitter, YouTube) • Opt-Out communications • Fliers / Leave-Behinds / FAQs / Fact-Sheets / Welcome Brochures / Door Hangers • Vendor toolkits • Education Campaigns • Instructional Videos
Small C&I Customers	• Direct mail • Email • Web Banners • Website • Customer and Community Managers • Chambers of Commerce / Community Leadership Organizations	• Customer Testimonials • "Getting Started Guide" to provide step-by-step instructions and visuals for customers • Opt-Out communications • Fliers / Leave-Behinds / FAQs / Fact-Sheets / Welcome Brochures • Education Campaigns • Instructional Videos
Medium & Large C&I Customers	• Account Managers • Customer and Community Managers • Website • Social Media engagement • Online/Print Ads	• Fliers / Leave-Behinds / FAQs / Fact-Sheets / Welcome Brochures • Education Campaign • Instructional videos
National Grid Employees (including field crews)	• Town Halls • Employee Communications • RI Energy Innovation Hub • Online Learning platform	• Fliers / Leave-Behinds / FAQs / Fact-Sheets / Welcome Brochures • "Hands On" Experience • Instructional videos / presentations / webinars • Call center training manuals and scripts addressed to customers

Figure 3-3: Phase One Customer and Stakeholder Outreach

All educational materials will be available in various languages, including Spanish, based on Rhode Island customer demographics.[41] Frequently Asked Question (FAQs) documents for stakeholders, community leaders, call-center representatives, residential customers, small- and medium-sized businesses, commercial customers, income-eligible customers, and senior citizen customers will be regularly updated to ensure timely and accurate information. The Company will also regularly solicit feedback on material and channels from each audience to provide improvements and refinements.

While there is value in utilizing an all-of-the-above channel strategy to reach as many customers as possible,[42] the Company will also seek to leverage insights from its customer segmentation analysis and other surveys to build out more impactful, tailored messaging through different channels to different customer groups. Research from the DOE, Opower/Oracle and Accenture, learnings from the Company's Worcester Pilot and Clifton Park Demonstration, energy-efficiency community-based initiatives, and findings from other utility smart meter deployments, all highlight the importance of meeting customers in their preferred forum with personalized insights. An example of how the Clifton Park Demonstration translated demographic insights into tailored messaging is provided in Figure 3-4.

[41] According to the 2017 American Community Survey from the U.S. Census Bureau, 78% of RI households speak only English, 22% speak a language other than English (many also speak English well), 12% speak Spanish, 7% speak other Indo-European languages, and 2.3% speak Asian and Pacific Island languages.

[42] SECC, 2018 State of the Consumer.

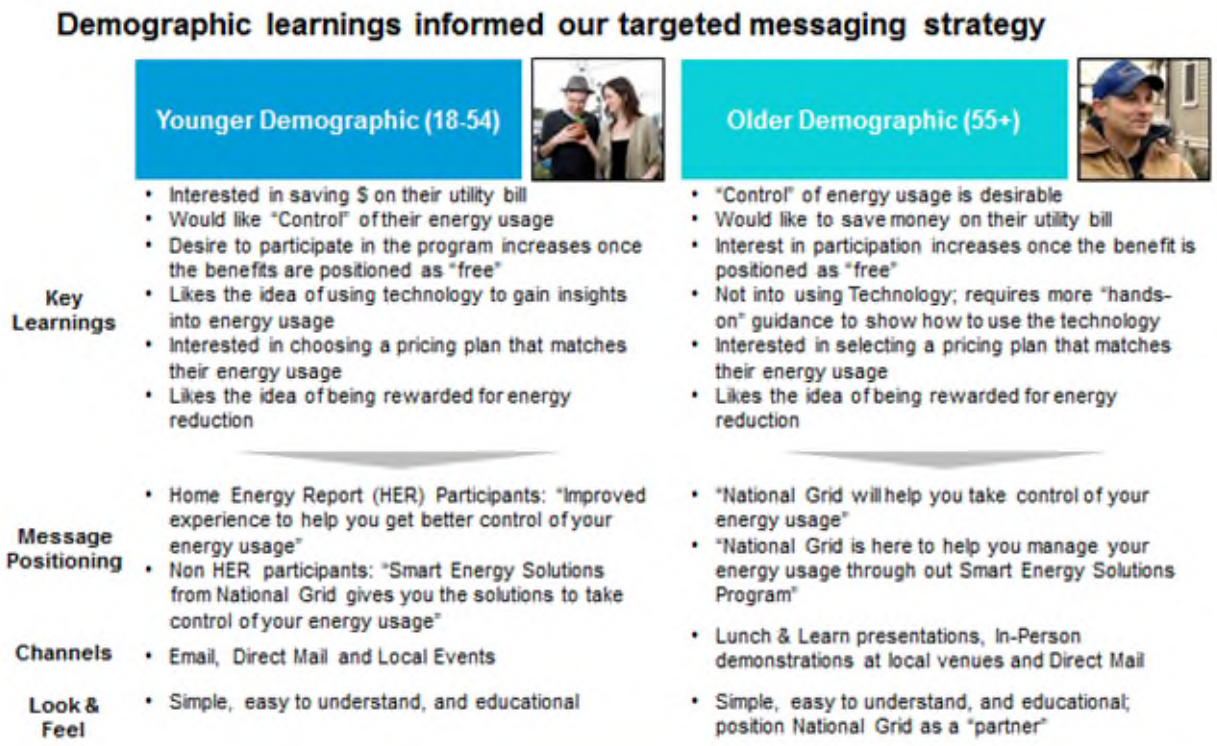
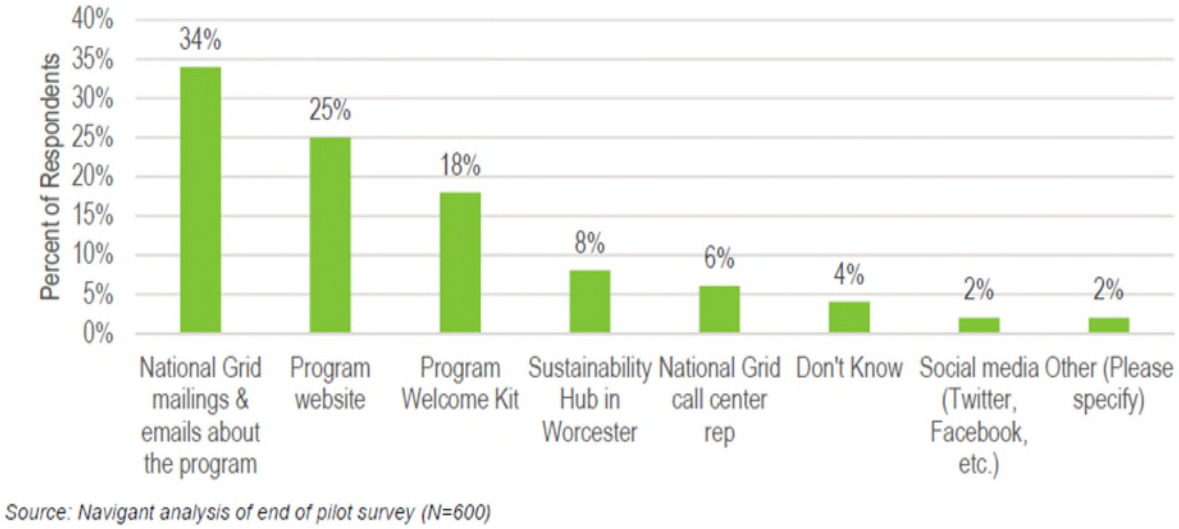


Figure 3-4: Targeted Messaging Example from the Clifton Park Demonstration

The Company will also lean on its learnings from its Worcester Plot in optimizing its outreach strategy during this Phase. Figure 3-5 highlights customers' most useful sources of information about the pilot.



Source: Navigant analysis of end of pilot survey (N=600)

Figure 3-5: Most Useful Sources of Information from Worcester Pilot (2015-2018)

The Company will also establish a dedicated section on smart meters on its website to serve as a resource for information and addressing customer concerns. The website will contain fact sheets, FAQs, and a proposed deployment schedule/timeline, and it will be regularly updated to ensure timely, accurate, and up-to-date information for customers prior to and during meter deployment. It will also include information on health and safety, smart meter security and privacy, data access policies and functionalities,[43] and general information about the benefits of smart meters, as shown in the FAQs section of the Worcester Pilot website in Figure 3-6. The website will contain materials in English, Spanish, and Portuguese.

[43] For more detail, please see Attachment B: AMF Data Governance and Management Plan.

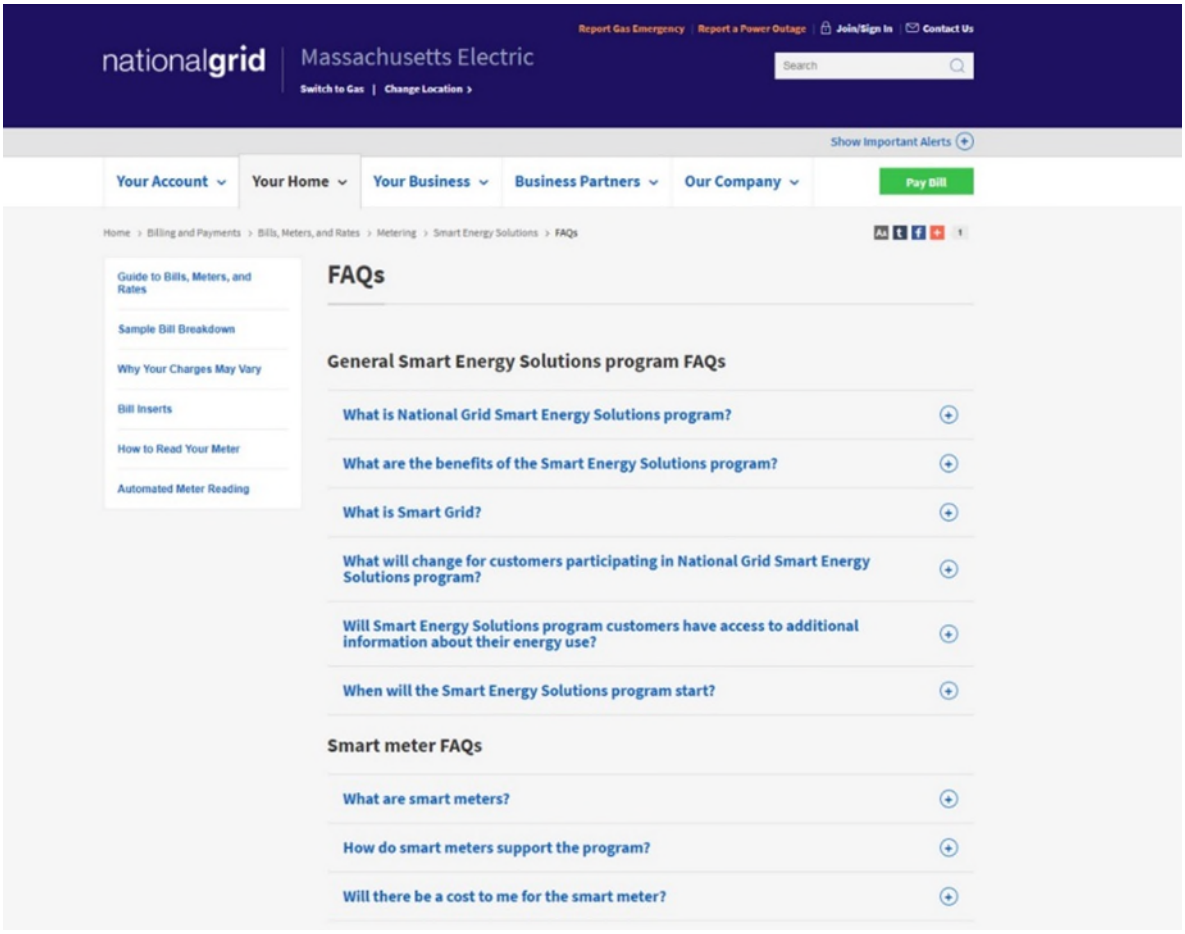


Figure 3-6: FAQs on National Grid Website for Worcester Pilot

3.1.3 Spotlight: Rhode Island Energy Innovation Hub

National Grid recognizes that AMF is a technically advanced and innovative tool that is likely new to many customers. As a result, the Company is particularly excited to utilize its Energy Innovation Hub (Hub) in Providence, Rhode Island to engage customers with in-person discussions on AMF benefits, questions, and concerns.

Figure 3-7: Rhode Island Energy Innovation Hub

The Hub was launched in November 2017 to serve as a physical location for connecting with customers about the changing energy landscape and how the Company's energy efficiency services and programs could help customers save in their homes and their communities. In the two years since, the Hub has had approximately 3,300 visitors. Inside the Hub, customers can find information on residential and commercial energy efficiency programs, electric vehicles, solar power, wind generation, and the coming advances in disaggregation and artificial intelligence. The Company plans to develop new content for display at the Hub, solely focused on AMF technology and deployment. The Company also plans to hold multiple public information sessions at the Hub, through which it will share how AMF will benefit customers by empowering them to take control of their energy use, bolstering the many already successful energy efficiency programs offered in Rhode Island.

National Grid views the Hub as a great place for customers to call or visit for in-person support on any pre- or post-deployment-related issues, especially those customers without internet or access to other channels of communication. In the Worcester Pilot, the affiliate's Sustainability Hub in Worcester, Massachusetts was an important touchpoint for in-person interactions. In the past, the Rhode Island Hub has been staffed by college students serving as student ambassadors, creating a bridge to the community that the Company hopes to continue to utilize.

3.1.4 Addressing Customer Concerns

As part of its Listen, Test, Learn approach, the Company seeks to engage customers early, often, and transparently regarding AMF.[44] In addition to the general AMF FAQ materials described above, the Company plans to leverage existing customer-facing information and communications from its affiliates' pilot experiences to develop new, Rhode Island-specific materials to address customer concerns related to privacy, security, data sharing, as well as health and safety impacts of smart meters. The Company has developed a detailed repository of various customer concerns raised during the pilots and from the experience of other utilities deploying smart meters nationwide. This information will prove valuable to ensuring distribution of information across different customer touchpoints, including FAQs, Customer Service scripts, media materials, website, and town hall materials throughout all phases of this Plan.

Figure 3-8 and Figure 3-9 together provide an example of the Privacy and Security Brochure developed for both the Worcester Pilot and the Clifton Park Demonstration. The materials serve as illustrative examples and will be updated to reflect the most relevant information for the Company's customers.

[44] DOE research (Voices of Experience: Insights on Smart Grid Customer Engagement) further emphasizes the importance of listening and engaging with customers who have concerns about technology.

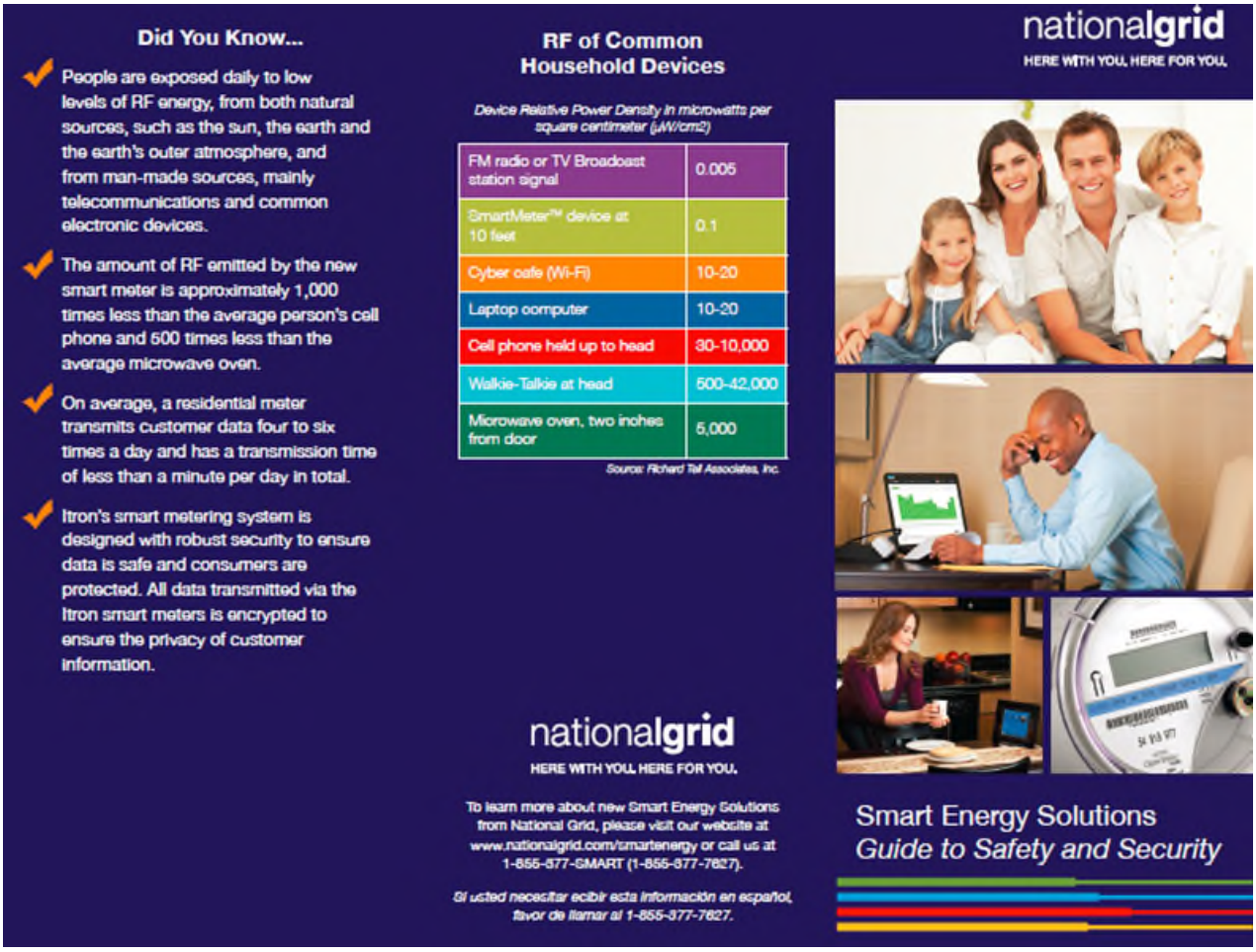


Figure 3-8: Worcester Pilot and Clifton Park Demonstration Sample – Guide to Safety and Security Brochure (Cover and Back)

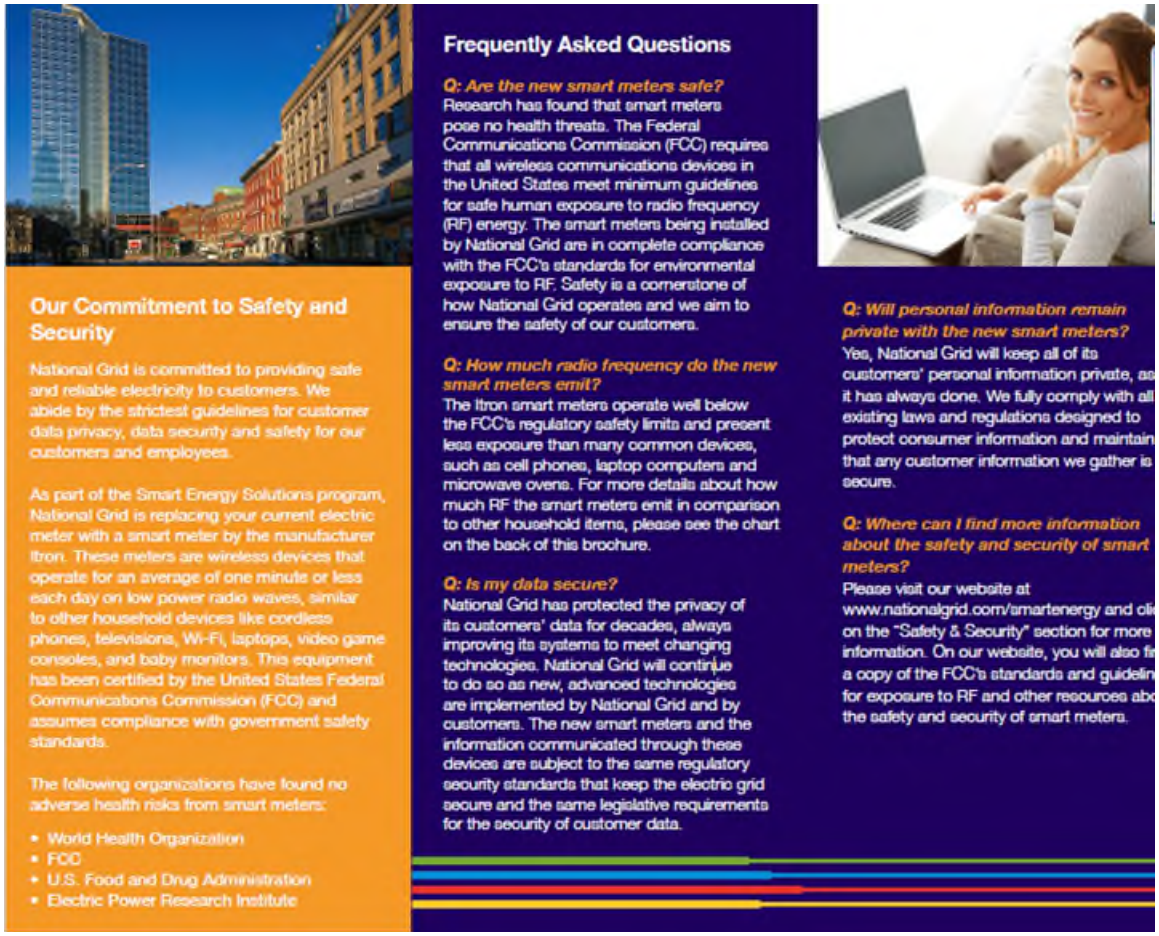


Figure 3-9: Worcester Pilot and Clifton Park Demonstration Sample – Guide to Safety and Security Brochure (Inside)

As described in the materials above, National Grid is committed to providing safe, reliable service to its customers and ensuring that all health and safety concerns are fully addressed. The Company also recognizes that many Rhode Islanders will naturally be wary of having new technologies installed in or near their homes and businesses, especially as smart meter solutions in other states have previously generated concerns around radio frequency (RF) exposure. Thus, the Company has conducted research across government organizations, scientific studies, industry groups, consumer education non-profits and court rulings, all of which have concluded that the low-level frequency produced by a smart meter poses no credible health or safety threat to consumers.[45]

[45] *See* Section 5.4 of the Updated AMF Business Case for additional details.

The Company also recognizes that some customers may express fatigue or frustration if they feel they are overloaded with information, though the Company's affiliates notably did not observe much fatigue feedback from customers during the Worcester Pilot and the Clifton Park Demonstration. Still, to mitigate the potential concern, the Company is developing an integrated preference management tool to allow customers to set preferences on how frequently the Company communicates with them and through which channels (*i.e.*, texts, emails, or phone calls). The Company aims to provide customers with the ability to select those preferences via customer service representatives or through the CEMP.

Beginning with Phase One, the Company will also begin coordinating with building inspectors, code enforcement, law enforcement, first responders and municipalities to prepare them for a possible increase in questions or requested services caused by smart electric meter installation. National Grid will provide the services to elevate the meter site, change the meter, verify communications, and record all necessary meter-related information. National Grid will not be responsible for meter channel and service and wiring, including service entrance cable.[46]

3.2 Phase Two: Deployment

3.2.1 Objectives and Approach

The objectives of the CEP in Phase Two (Deployment) are:

- Narrow focus of outreach and education efforts toward individual customers in the three months leading up to their electric meter installation;
- Inform customers of the AMF deployment plan and transparently communicate tactical information on installation in a timely manner;
- Ensure that customers understand the installation process, timeline of events, what to expect, how they will be impacted, and alternate choices, including opting out of meter installation;
- Address customer concerns (*e.g.*, health, safety, or privacy); and
- Preview tools and options that will be available to customers following smart meter deployment.

[46] National Grid customers are responsible for certain equipment at the premise including the meter channel and wire that runs on the outside of the house and is connected to the Company's service lateral. If these are damaged and require repair for safety purposes, it is the customer's responsibility. Once the repair is made a municipal inspector must inspect/verify the service is safe before the Company can provide service by installing the meter.

3.2.2 Educational Materials and Outreach Strategy: Ninety-Sixty-Thirty Day Communications Plan

In Phase Two, National Grid will leverage the materials and communication channels described in Phase One as a foundation for focusing the message. The Company will also use any lessons learned and feedback received from Phase One to further support and inform the outreach during Phase Two. Direct customer communications aimed at preparing customers for AMF electric meter installation will be rolled out 90, 60, and 30 days prior to installation of the smart meter and will be locally timed to the Company's meter installation schedule. The Company plans to conduct additional testing of messaging and communication channels by customer segment to best optimize its outreach strategy during each of these periods. The 90-60-30-day communications plan is summarized in Figure 3-10 below.

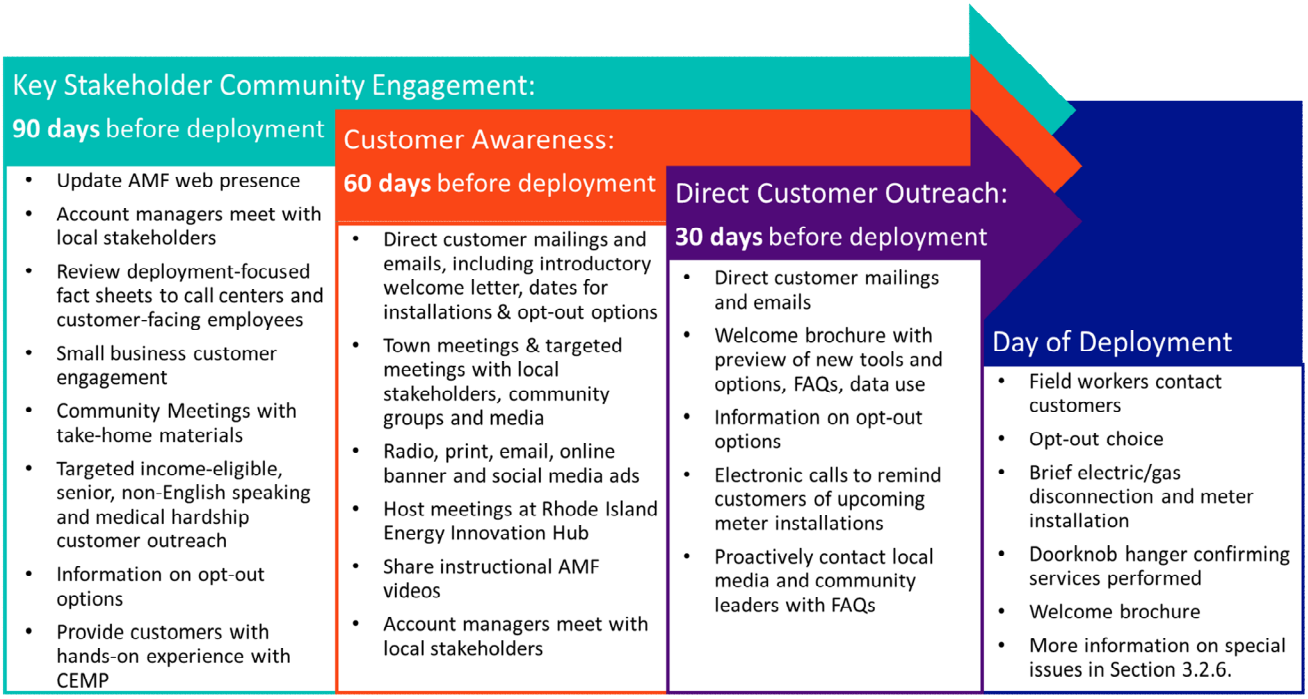


Figure 3-10: 90-60-30 Day Communication Plan

3.2.3 Ninety Days Prior to Deployment

As regions are scheduled for AMF meter installation, the Company will build upon the steady education of, and engagement with, community leaders from Phase One to begin direct and targeted education. Ninety-days prior to deployment, the Company will enhance its community outreach by hosting town hall meetings and having Company employees attend more local events to connect directly with customers on AMF benefits, as seen in Figure 3-11. The Clifton Park pilot has shown this type of engagement to be particularly successful in reaching customers.

Figure 3-11: Community Meetings

This type of outreach may include:

- Orchestrating meet-and-learn events at local venues with customers, town officials, press and external stakeholders. Events will take place at various times (*e.g.*, daytime, evening, weekday, weekend) to accommodate varied customer schedules, and will include Company representatives who can speak other languages (*e.g.*, Spanish, Portuguese, or other) to accommodate those who do not speak English;
- Leveraging existing events (*e.g.*, energy efficiency or other community events) to start discussing AMF;
- Developing targeted presentations focused on customer benefits;
- Providing customers with a “hands-on” experience with the new CEMP and learning how to utilize it;
- Providing step-by-step guides as take-home materials for customers after these events;

- Clearly identifying customer options to opt-out of smart meter installation;
- Updating the Company's web presence to include a timeline for the roll out of information for impacted areas. The website will provide contact information (such as toll-free phone numbers and email addresses) for representatives who can assist in answering customer questions; and
- Launching a series of messages that provide customers with more specific information about the smart meter rollout in their area. An example of this approach from Clifton Park can be seen in Figure 3-12. As part of this effort, the Company will begin deploying home and business advertising, email, and social media content.

Figure 3-12: Sample Rhode Island Bus Shelter Displays

3.2.4 Sixty Days Prior to Deployment

Sixty days prior to deployment, the Company will continue to hold educational events to speak directly with customers as described above. It will also begin engaging customers through direct mail letters and emails with detailed information about the technology, benefits, and deployment process/timeline including specific dates when installers will be in the customers' area, with a "call to action" to help drive customers to the National Grid website. The Company will indicate in these communications that customers can opt out of receiving a new smart electric meter if they choose.[47] In addition, the Company will use these communications to describe its meter replacement responsibilities (*e.g.,* meter, wire to the point of attachment) and what conditions could prevent meter installation. Customers will be responsible for the same components they are currently responsible for today (*e.g.,* meter box, meter channel, after-meter channel, and cable). Bill inserts, social media posts, and digital ads will also be activated with updates, timelines, and links to more detailed information on the web. Figure 3-13 shows an example of a program introduction letter that was used in the Clifton Park Demonstration.

[47] *See* Section 3.4, *Customer Choice and Opt Out,* for additional detail on ways customers can opt out of receiving an AMI meter.

Dear [Name],

We are excited to introduce Smart Energy Solutions – an innovative energy management program, developed specifically for our Clifton Park customers. It's so much more than your current online experience and Home Energy Reports. With an improved website experience, you will receive more detailed and near real-time information as well as valuable insights to take better control of your energy use. You will also have the opportunity to earn rewards and make better informed choices. All of this will be provided at no additional cost and could help you save money!

Smart Energy Solutions will provide you with:

CONTROL **Better manage your energy use with near real-time information, detailed reports, alerts and tips.**

REWARDS **Earn gift cards and contribute to a greener community when you reduce your electric energy use.**

CHOICE **Select how and when to manage your energy use, pick an electric pricing plan that is right for you and participate in energy-efficiency improvements.**

It all starts with new meters.
National Grid will automatically upgrade meters in Clifton Park, at no additional cost to you, to enable Smart Energy Solutions. We will notify you as to when we will be in your neighborhood to replace your [METER TYPE(S)] meter.

There's a lot more to come.
Throughout the year, we will provide you with more information on how to better manage your energy use. If you do not wish to participate in Smart Energy Solutions, please call **1-877-466-3433** (Monday–Friday, 8am–5pm) by 2/28/17.

It's your energy. And, soon, you can manage it your way!

Sincerely,

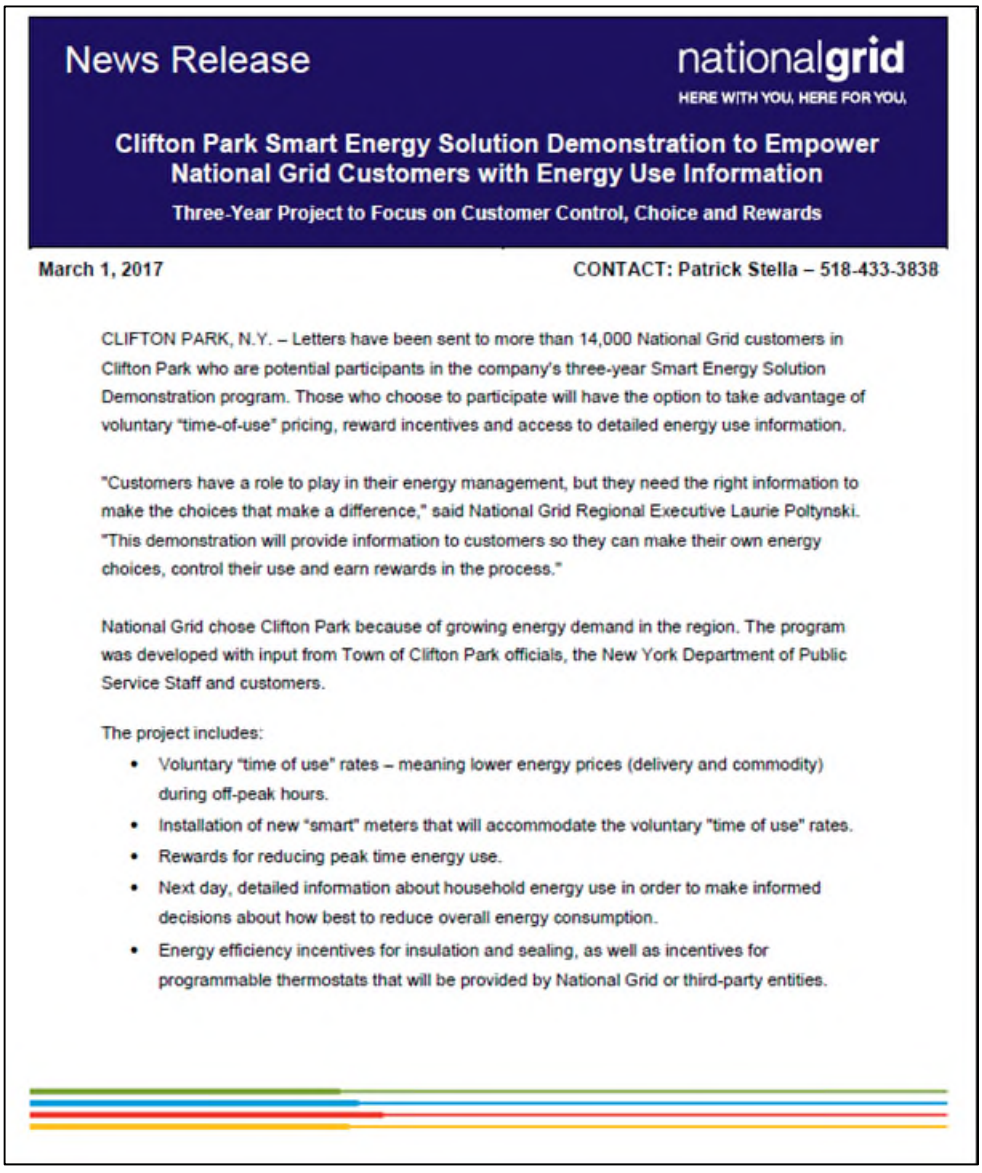
Laurie J. Polityński
Regional Executive

Manage your energy your way. Learn more at ngrid.com/cliftonpark

National Grid does not guarantee savings. Savings and energy-efficiency experiences may vary. Some restrictions may apply. National Grid will share your energy use data with a third party partner to provide you with energy management recommendations. Your information will not be used for solicitation of goods and services. © 2017 National Grid USA Service Company, Inc.

Figure 3-13: Sample Program Introduction Letter from Clifton Park Demonstration

These channels will be supplemented with print advertising and broadcast media channels, as well as continued engagement with local stakeholders. The Company aims to have knowledge of smart meter deployment become commonplace among communities, neighbors, and friends during this phase. Figure 3-14 is an example of a news release that may be targeted to a region or community.



News Release

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Clifton Park Smart Energy Solution Demonstration to Empower National Grid Customers with Energy Use Information

Three-Year Project to Focus on Customer Control, Choice and Rewards

March 1, 2017 **CONTACT: Patrick Stella – 518-433-3838**

CLIFTON PARK, N.Y. – Letters have been sent to more than 14,000 National Grid customers in Clifton Park who are potential participants in the company's three-year Smart Energy Solution Demonstration program. Those who choose to participate will have the option to take advantage of voluntary "time-of-use" pricing, reward incentives and access to detailed energy use information.

"Customers have a role to play in their energy management, but they need the right information to make the choices that make a difference," said National Grid Regional Executive Laurie Poltynski. "This demonstration will provide information to customers so they can make their own energy choices, control their use and earn rewards in the process."

National Grid chose Clifton Park because of growing energy demand in the region. The program was developed with input from Town of Clifton Park officials, the New York Department of Public Service Staff and customers.

The project includes:

- Voluntary "time of use" rates – meaning lower energy prices (delivery and commodity) during off-peak hours.
- Installation of new "smart" meters that will accommodate the voluntary "time of use" rates.
- Rewards for reducing peak time energy use.
- Next day, detailed information about household energy use in order to make informed decisions about how best to reduce overall energy consumption.
- Energy efficiency incentives for insulation and sealing, as well as incentives for programmable thermostats that will be provided by National Grid or third-party entities.

Figure 3-14: Sample News Release from Clifton Park Demonstration

Outreach for larger commercial and industrial (C&I) customers will occur primarily through National Grid jurisdictional representatives and account managers and will leverage preferred communication channels, such as direct conversations, the Company's website, bill inserts, and emails.

3.2.5 Thirty Days Prior to Deployment

During the thirty days prior to deployment, community leaders will be briefed on deployment status and provided with updated FAQs so they have up-to-date information to use when responding to constituent questions and to support deployment. As the Company approaches deployment in regional areas, customers will receive informational materials such as a welcome brochure, FAQs, data use and safeguard statements, emails, and postcards, as well as clearly identified reminders of methods for opting out. National Grid will also provide press releases, respond to media inquiries, post reminders to social media, and proactively monitor and respond to social media comments.

Additional outreach targeting specific customers (*e.g.*, seniors and income-eligible), will be included in local newspapers and direct mail.[48] These channels will highlight ways and locations in which these specific customers can ask questions and receive answers as to how the smart meter deployment will directly affect them. Based on learnings from the Worcester Pilot, the Company recognizes that senior customers prefer face-to-face interactions and in turn plans to facilitate this interaction through direct conversation as much as possible. The Company also plans to test and develop targeted messaging and channels based on the customer segmentation work described in **Section 2.2: National Grid Customer Strategy and Segmentation**.

3.2.6 Day of Meter Deployment

On the day of electric meter installation, field workers will begin by attempting to contact the customer by telephone or other appropriate methods. If on the day of installation, the customer chooses to opt-out when the field worker makes initial contact, the technician will not install the new smart meter at that location. Specific detailed appointment scheduling and exception handling will be further developed during the back-office implementation phase prior to meter installations.[49]

Upon arrival, the field worker will disconnect the customer's electricity service to provide for a safe working environment for the technician. Service will be reconnected by the field worker after the new smart meter is installed. A typical meter installation may take less than 30 minutes depending on the location of the meter. Customers do not have to be present during the

[48] See Section 3.6, Income-Eligible and Other Specialized Customer Communications.

[49] *See* Section 3.4, *Customer Choice and Opt Out*, for more detail on opt-out procedures.

installation if the meter is located outside. Customers with metered solar or distributed energy resources (DERs) will follow the same process as any other customer; likewise, the time to change out the meter is expected to take less than 30 minutes to ensure there is little to no impact on the customer system. For commercial customers, power loss may not even have to take place as most commercial meters have a by-pass function allowing for uninterrupted service.

For any reason and at any time customers can cancel and reschedule the installation of their new meter by calling into the customer service number provided. Installations will typically take place Monday through Friday between 8:00 AM and 6:00 PM; if required, a specific installation window can be scheduled. Moreover, additional days and hours can be accommodated for those customers who cannot make these times, such as weekends as needed. Customers can also reschedule appointments at any time by calling or emailing the customer service center – Company contact information will be provided during each phase of outreach.

Upon installation of the AMF meter, National Grid will provide the customer with a doorknob hanger that confirms services have been performed and a supporting "Welcome Brochure," including a toll-free number for customers to call and website addresses if they have questions about their new smart meter and/or general questions about the smart meter program.

If the Company encounters an issue that could be unsafe for the customer and the customer meter is unable to be upgraded, the Company will notify the customer of the safety hazard and information will be left at the residence to include the reason installers were unable to install the smart meter as well as any actions the customer may need to take for the service to be completed. If the issue preventing installation could cause harm to the customer or dwelling, the Company representative will not leave the property until service has been disconnected. The Company would then actively contact the customer to notify them of the issue and the required steps to rectify the situation. The Company will monitor all communications channels to ensure customers feel supported, informed, and comfortable with their new smart meter. The Company does not expect a high volume of safety issues based on past meter deployments.

In the case of indoor or inaccessible meters (*i.e.,* meters in basements), multiple attempts will be made to reach the customer to access the meter. For example, doorknob hangers will be left upon departure to schedule an appointment. After several attempts, the Company will reach out directly to the customer to schedule an installation appointment.

For customers identified in the Company system as possessing life support equipment or requiring uninterruptable service for medical reasons, meters will not be changed without explicit permission and the scheduling of a pre-arranged installation time. Multiple attempts will be made to reach the customer to schedule the meter change. When installers are in the area, doorknob hangers will be left to schedule an appointment if the customer does not come to door. Meters will not be changed without acknowledgement and permission from the customer.

3.3 Phase Three: Customer Empowerment and Enablement

3.3.1 Objectives and Approach

In Phase Three, the Company will focus on helping customers fully realize the benefits of their newly installed smart meters through access to more granular energy usage data.

As outlined in Section 2.4.2, the Company continues to build out the CEMP, which will be the customers' new touchpoint to access their energy data. Furthermore, based on learnings from the Worcester Pilot, tools to support customer engagement, such as GBC and the CEMP, will be developed in advance of deployment to allow customers to immediately realize AMF benefits.

The Company will help customers understand how to use the CEMP, including how to interpret their energy consumption, and how to manage their energy usage to reduce energy consumption and costs. This phase will also introduce interested customers to third-party offerings that can help supplement customer needs with new and innovative products and services that are incremental to the utility-provided customer service offerings enabled by AMF.[50] The Company will seek to optimize its outreach strategy in Phase Three and beyond by expanding its use of communication preferences from customer segmentation insights to include personalized energy-related needs and interest in new products and services.

Importantly, the Company recognizes that not all customers will seek to engage digitally with the benefits enabled by smart meters. Although the CEMP is a digitally focused tool that supports the modern energy experience for customers, the Company will develop educational and engagement materials through traditional channels, such as bill inserts and customer service representatives. Augmenting the digital tools with traditional approaches for customer education will ensure all customers are empowered and enabled with the right information, insights, and opportunities to act to manage usage and total energy costs. The Company will leverage existing programs and services to market through these channels, such as bills, energy efficiency programs, and community events. This non-digital collateral will be consistent with the digital information to ensure all customers are receiving the whole breadth of information but personalized for their individual needs and consumption preferences.

Educational materials will continue to be available in various languages, including Spanish and Portuguese, based on the customer demographics noted in **Section 3.1.2: Educational Materials and Outreach Strategy**. The Company will seek feedback throughout this phase to continually improve the channels of communications and refine the messages, as needed.

[50] *See* Section 4.2, *Third-Party Data Access*, for more detail on GBC and third-party data access.

3.3.2 Educating Customers on the CEMP

Creating and delivering new value to customers is central to any successful business venture, and National Grid's AMF deployment is no exception. The CEMP will serve as an integrated hub of energy data, insights, and actions for all customers, delivering value and enabling benefits by connecting customers to their energy usage data. It will allow customers to access accurate and personalized energy usage information, as well as enable various choices and options to enroll in programs and services that can leverage the more granular data provided by AMF meters.

The Company will develop an estimated timeline of major milestone events to ensure that the CEMP is fully operational in advance of the first meters being installed. The need to have this functionality in place prior to installing meters is a critical step to engaging customers with their smart meter data.

The Company is planning for two years of back-office work for the CEMP. The first twelve will focus on detailed design and procurement of the main CEMP features. The remaining time will focus on testing, implementation, and deployment, in advance of the initial meter deployments.

The CEMP will streamline several existing customer portals, third-party websites, and existing educational and safety information (currently provided to customers on the Company's home webpage), with the goal of providing customers with simple, seamless access to tools, information, and actionable insights that can be easily accessed via a new streamlined website or by mobile device. Figure 3-15 below shows how current web components are available to customers today.

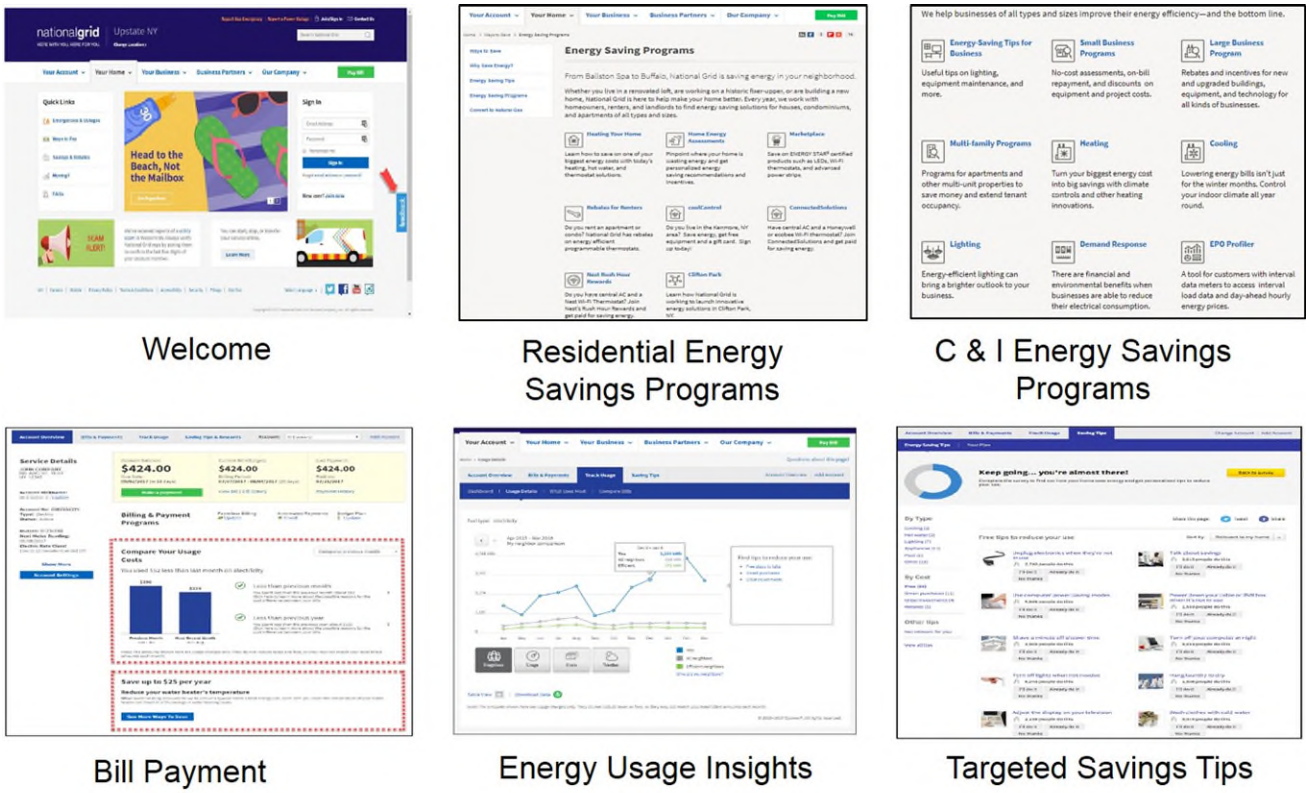
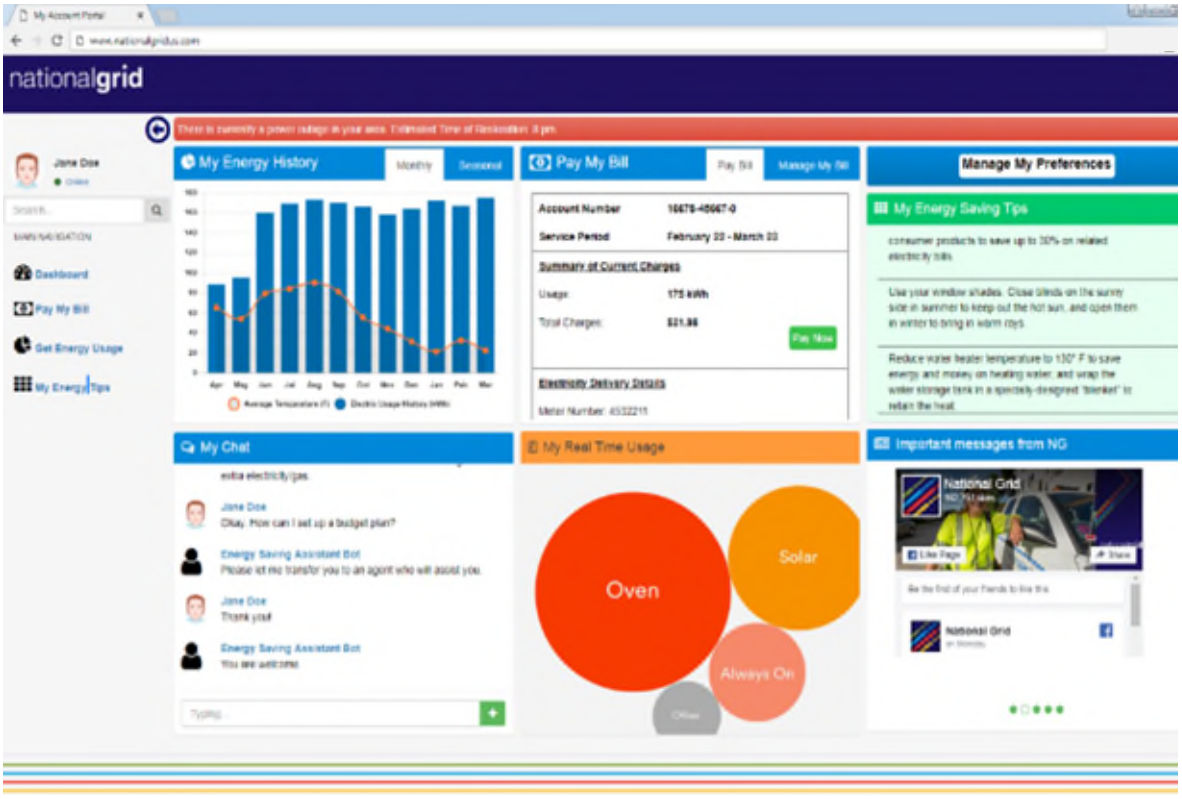


Figure 3-15: Current Customer Webpage Highlights

Figure 3-16 provides an illustrative example at what a CEMP view might look like across web and mobile platforms.

For additional details, including an example of load profile "Energy Signature" analysis from the Worcester Pilot, please refer to ***Appendix E: Envisioned Customer Energy Management Platform Features and Functionality*.**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My Energy History
Pay My Bill
Manage My Preferences
My Energy Saving Tips
My Chat
My Real Time Usage
Important messages from NG
Oven
Solar
Always On

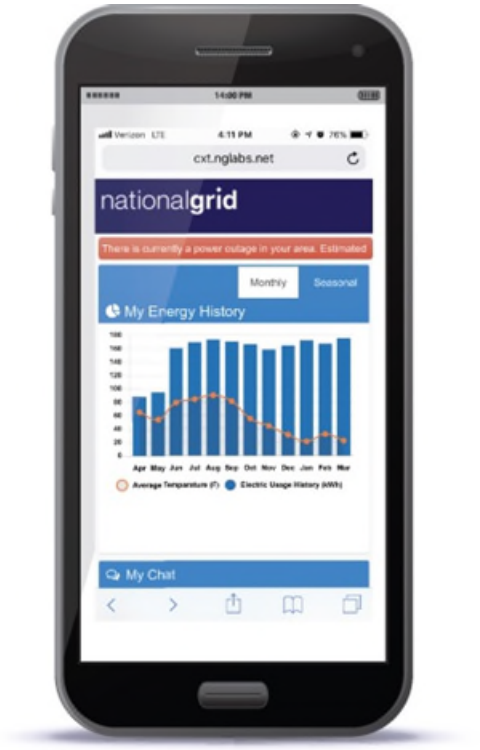


Figure 3-16: Illustrative Example of the Customer Energy Management Platform

To enable a holistic and seamless customer experience, the CEMP will include Company-facing internal features and integration with traditional collateral. For example, tools for account managers, sales, and marketing teams will enable targeted program information and offerings to improve energy efficiency program participation and performance rates for C&I customers. Integration with billing and customer service will add personalized detail to the non-digital channels with the aim of providing equitable opportunity and customer experience for all customer sectors regardless of the customer's preferred channel.

One example of this could be providing customer service representatives with access to load disaggregation data to review with customers during high-bill calls and then providing summary follow-up information on the subsequent bill. The Company could auto-enroll customers in high electric and gas usage alerts based on customer-selected preferred communication methods and applicable laws. High-usage alerts are a feature that will notify customers during a billing cycle if they are predicted to use substantially more energy than usual by the end of the billing cycle. Under current non-AMF high-bill alerts, the Company sends alerts to customers trending to exceed the prior month's use by 30%, based on forecasted temperatures and prior month usage. AMF insights would allow for more accurate estimates of cost and usage, allowing customers

more time to respond to variances. Without smart meters as the enabling technology, it is difficult to acquire this information and take action to manage energy usage.

National Grid plans to offer fifteen-minute electric interval data available on a 30- to 45-minute latency and one-hour gas interval data available every eight hours for raw data, with bill quality data will be available after twenty-four hours. National Grid intends to provide interval data at a granularity consistent with future TVR designs.

As the Company builds the detailed requirements for the CEMP, it expects to provide the following list of electric data types. Any additional data types will be evaluated in the detailed design process.

- Read Date & Days
- Read Type
- Total Kilowatt Hours (kWh)
- Delivery Charges
- Supply Charges
- Late Payment Charges
- Total Charges
- Metered Peak Kilowatts (kW)
- Metered On-Peak kW
- Billed Peak kW
- Billed On-Peak kW
- Time of Use (TOU) On-Peak kWh (as applicable to specific rate design)
- TOU Off-Peak kWh (as applicable to specific rate design)
- Reactive Power (RkVA)
- Load Factor

As shown in Figure 3-17, the CEMP is comprised of three main components: personalized insights, tools, and integrated customer actions.

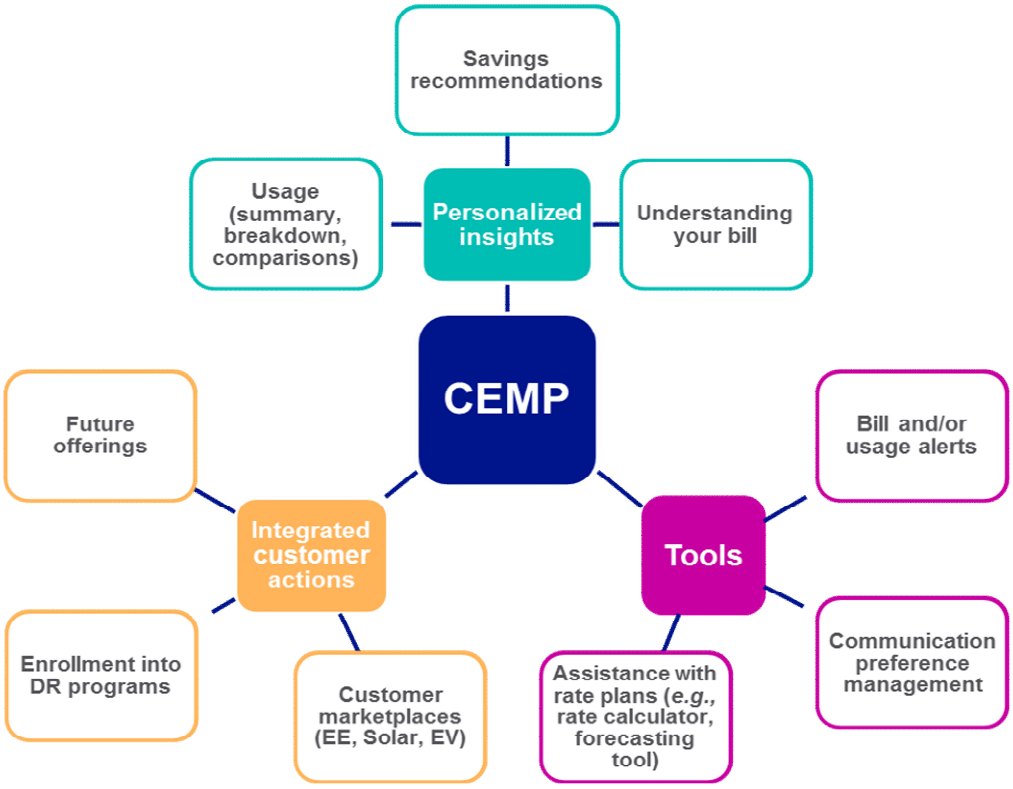


Figure 3-17: Customer Energy Management Platform Overview

The first CEMP component, personalized insights, will bring together customer energy usage (both electric and gas), better understanding of customer bills, and energy savings recommendations. Primary features include:

- The ability to view current and historical energy usage in a graphical format;
- Detailed analytics, including weather, price, and carbon footprint considerations;
- Bill education, with detailed information on how to review and analyze an energy bill; and
- The ability to share billing and energy consumption data with third parties via GBC.[51]

C&I customers will have access to new features, such as a portfolio-level view allowing them to seamlessly access information across multiple accounts. Driven by the customer segmentation insights noted in **Section 2.2: National Grid Customer Strategy and Segmentation**, personalization will leverage usage data, load profile, customer-selected preferences, account activity, load disaggregation, and other factors to enable meaningful insights for an individual

[51] *See* Section 4.2, *Third-Party Data Access*.

customer. In a future state with TVR, this information will provide suggested actions that could help reduce consumption and/or shift load to less expensive periods.

The second CEMP component, tools, helps assist the customer with their pricing plans and energy expenses through calculators, reporting, and forecasting. Customers will be able to set (digital and non-digital) communication preferences with the Company for notifications related to energy usage, high-usage alerts, and proactive notifications of future energy-related events (*e.g.*, critical peak pricing events). Primary features will include:

- Bill forecasting to use historical usage data to predict future energy bills; and
- A rate calculator, using historical data to model customer rate plans, and enabling the Company to proactively engage customers with information about plans that may be better suited for their needs.

The third CEMP component, integrated customer actions, will empower customers to take educated actions based on the personalized insights and tools mentioned above. Actions such as enrollment in the Company's demand response and energy efficiency programs, purchases from established marketplaces for energy saving technologies,[52] and other actions can all occur in one convenient location on the CEMP. As illustrated in Figure 3-18, components like the monthly energy summary (with average usage represented by the column chart on the platform and mobile device) could also be layered into non-digital communications such as the customer bill or bill insert.

[52] *See e.g.*, National Grid Rhode Island's Solar Market Place, https://www.nationalgridus.com/RI-Home/Ways-to-Save/Learn-About-Solar.

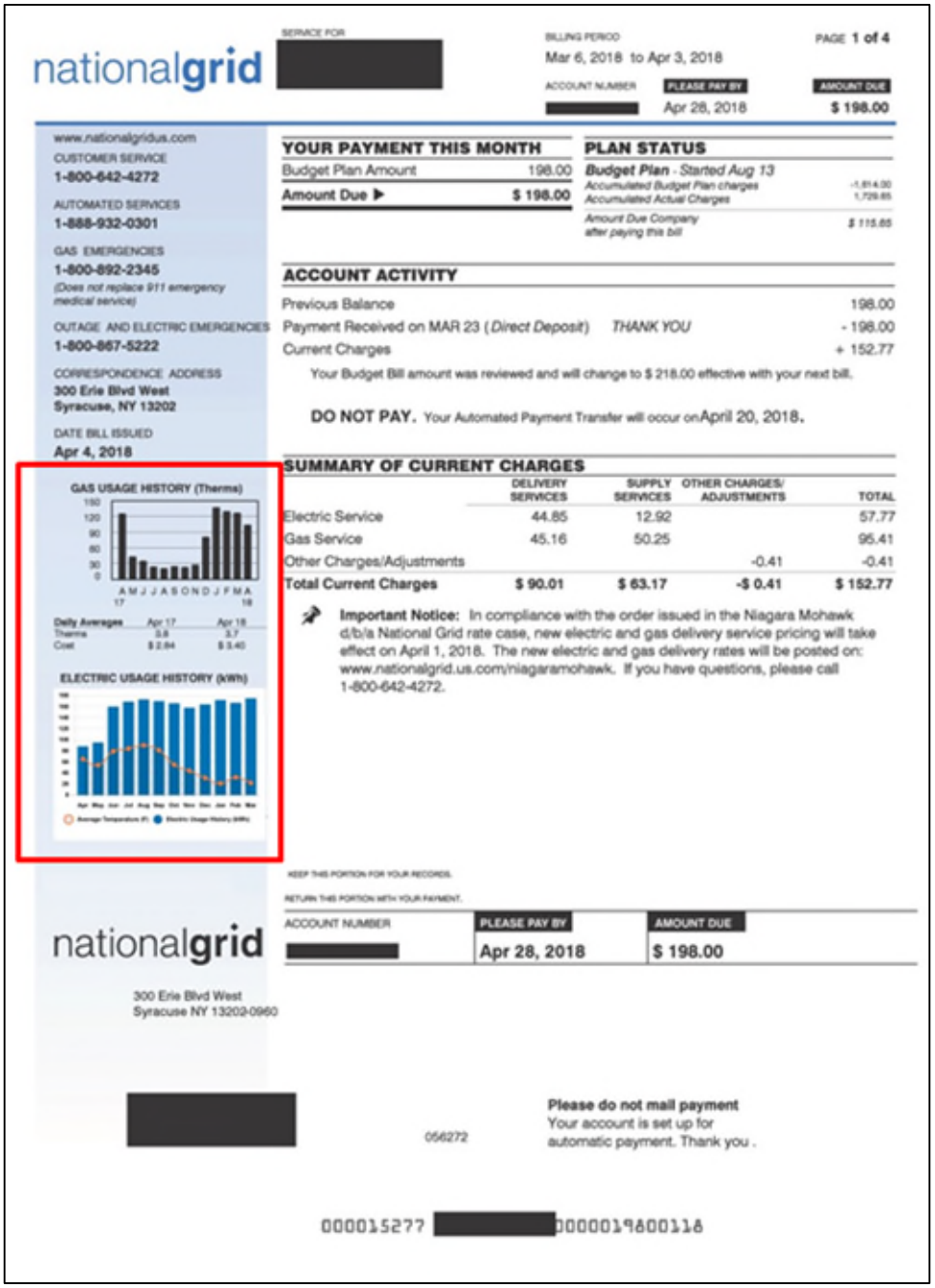


Figure 3-18: Representative view of bill with monthly summary usage

For additional feature details, and the associated customer and utility benefits, please refer to ***Appendix E: Envisioned Customer Energy Management Platform Features and Functionality.***

3.3.3 Residential Customer Journey

Each residential customer has different needs when it comes to using, understanding, and paying for their energy. Recognizing this, the Company will design the CEMP to not only provide better insights and tools in one place, but to allow for alerts, predictive analytics, and a window into the use of granular smart meter data. For example, high-usage alerts will proactively help customers to better manage their energy consumption.

Residential Customer Example

An illustrative residential customer's journey is shown in Figure 3-19. In this scenario, a residential home owner has received an energy bill and does not understand why the bill is so high or what to do about it. The customer can log onto the CEMP web portal (shown as image A in Figure 3-19) and consider their high-level dashboard of options. As an alternative (*e.g.*, no internet access or prefers to speak with a customer service representative), the customer can call the Company's toll-free number to make an inquiry.

Considering paying their bill (image B), the customer can see how much energy they have used and their total charges. From there, and on the same page, the customer may be able to live chat (image C) or, if preferred, speak directly to a customer service representative (image D) who will have access to the same customer data on the customer service representative system.

Customers can then look deeper into their energy history over time, and now with the addition of smart meter data, the Company can provide high-usage alerts (image E) to notify a customer during their billing cycle that they may be heading towards a higher monthly bill. The high-usage alerts can utilize this near real-time data to provide customers with the insights needed to understand how they are consuming and being charged for energy. With this knowledge, the customer can explore and learn about energy savings programs (image F), tips (image G), budget plans, and third-party services to help save on their bills – all from the integrated CEMP.

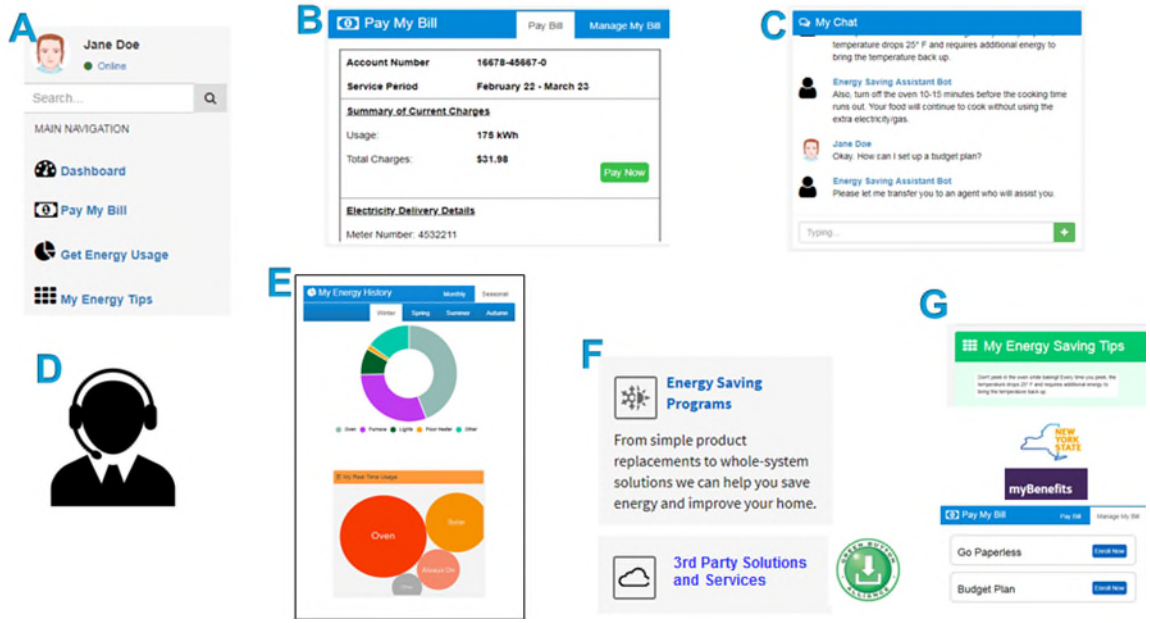


Figure 3-19: Residential Customer Journey

For a commercial customer journey and additional details of envisioned CEMP features and functionality, please refer to ***Appendix F: Commercial Customer Journey.***

3.4 Customer Choice and Opt Out

The Company is committed to customer choice. As described earlier, customers will have the opportunity to decline the receipt of a new smart meter during all phases of deployment. Customers will be given advanced notice, via mail and email, of plans to install AMF meters and of the opportunity—and procedure to be followed—to opt out of the AMF metering program. Processes and resources will be in place to support customers who are considering or have decided to opt out. All customers, including those who opt out, will retain the right to purchase energy from third-party suppliers. For landlord/renter situations, the Company will provide the planned communications, as described above, with the account holder, typically the renter. The account holder is expected to make the opt-out decision, per details below.

3.4.1 Customer Opt Out in Phase One

In Phase One: AMF Awareness, customers will be able to choose to opt out of a smart meter through customer service support and/or neighborhood installers/representatives. If a customer calls the Customer Service Center, the customer service representative will ask to understand the reason for opting out, provide additional information as appropriate, and complete the opt-out

process. During this phase, the Company will aim to inform customers of program benefits, privacy information, and impacts of opting out to minimize meter opt-out rates via direct mail, email, the National Grid website, community meetings, advocacy groups, social media, paid media, and customer service support.

3.4.2 Customer Opt Out in Phase Two

In Phase Two: AMF Deployment, customers will continue to be able to opt out at any time leading up to the day of installation. If, on the day of installation, the customer chooses to opt out when the utility representative makes initial contact, the technician will not install the new electric smart meter and/or gas module at that location. The utility representative would contact a supervisor to hold installation and the Company would then provide the customer with a form for submission to confirm their choice to not receive the new equipment. If the customer then chooses to opt out and submits the opt-out form to the Company, the Company will follow-up with a confirmation letter or email to the customer that clearly explains the new customer experience and specifically what the customer is responsible for moving forward.

If a customer chooses to opt out of a meter, the Company will seek to learn as much as possible from the customer during this time, including why they are choosing to opt out of receiving the new equipment and foregoing the opportunity to participate in future benefits. This will allow the Company to focus additional resources toward other sectors, or specific customer groups that may be at risk of opting out. Customers choosing to opt out of a smart meter will receive additional education on the benefits they would likely forego by not participating, based on their access to features and services requiring smart meter data (*e.g.*, more personalized usage insights and bill-saving opportunities with new potential TVR plans). If a customer prefers not to receive the additional materials, they may inform the Company, and the Company will honor the customer's request.

Customers who opt out of AMF will be subject to charges consistent with the terms and conditions specified in the Company's current opt-out meter reading tariff. These charges will be communicated within each phase of the plan and can be examined in the years prior to meter installation and will be calculated in a Company analysis similar to that prepared in Docket No. 4342, in which the PUC approved the current AMR opt-out fees. Charges are likely to include a one-time meter exchange fee and a monthly manual meter reading fee.

3.4.3 Customer Opt Out in Phase Three

In Phase Three, there is a continuous aim to improve meter participation. If a customer has opted out of a meter in the past, the Company will provide information on program benefits, health, safety, privacy, and security, as well as the path to opt-in through the website and customer service support. Customers who choose to receive an AMF meter after initially opting

out, will receive a meter at no additional cost. Customers who have received smart meters during Phase Two will still be able to opt out at any time and have their new smart meters replaced. They will, however, be responsible for the same fees (*i.e.*, meter exchange and monthly meter reading fee) listed above.

The Company envisions that by Phase Three, TVR will also be in place. If so, customers will also be able to opt out of these envisioned future rate plans. As mentioned earlier, TVR considerations are discussed in more detail in Attachment C to the Updated AMF Business Case and will ultimately be considered in a future proceeding.

3.5 Company Transformation, Employee Engagement and Training

For National Grid, implementing AMF is one building block in evolving the way the Company interacts with its customers and delivers energy. Deploying smart meters requires a significant change in how the Company operates its physical infrastructure, IT systems, and data architecture going forward. To that end, functions and business units across the Company have coordinated in this effort to leverage value across programs while integrating and embedding new tools and ways of working within core business units.

As part of this effort, the Company is implementing a robust program management structure and strategy to ensure the AMF project is executed in the most efficient way. The Company is in the process of refining this approach based on lessons learned from discussions with other large internal programs, pro bono meetings with consultants in the implementation space, and meeting with peer utilities who have implemented AMF.

The AMF team will coordinate tasks and work with other teams within the Company focused on customer engagement, such as Customer Insights, Marketing, Customer Energy Management, and Customer Experience Products. Working collaboratively, they will ensure the materials, processes and outreach efforts defined in this Plan are successfully executed and evaluated. As customer needs evolve, this team will develop the means through which insights or benefits continue to be delivered.

The Company's employees are key ambassadors and vital to a successful deployment as many live in the Company's service territory. As noted in ***Section 2.3: Key Learnings***, DOE research suggests that while changing a culture is difficult, "once employees see the value of AMI, it 'becomes contagious.'"[53] The Company will educate employees, including customer service

[53] DOE Office of Electricity and Energy Reliability Advanced Grid Research Division, Voices of Experience Series, Leveraging AMI Networks and Data (March 2019), *https://www.smartgrid.gov/document/VOE_Leveraging_AMI_Networks_Data*

representatives, field workers, customer and community managers, C&I account managers,[54] corporate communications, regulatory team members and senior management early and often on the entire AMF effort through a variety of channels, including employee forums, webinars, learning platforms, email outreach, senior management-led presentations and discussions, and other general communication methods utilized for critical Company updates. Field workers will be trained similarly with more detailed specifics closer to regional meter deployment. By enabling employees to serve as community champions for smart meter deployment, overall customer awareness and education will be vastly improved.

As shown in Figure 3-20, all employees will receive communications, materials, and handouts with key messaging to best support their new National Grid ambassador role. Post-approval, employees will be provided an online learning platform, which will include:

- An overview of the AMF program, objectives, and customer benefits;
- Talking points and key messages they can utilize when interacting with customers in their respective communities, including customer benefits, pricing plans, data privacy, and the opt-out processes for both meters and pricing plans; and
- FAQs and welcome brochures to proactively address customer questions and concerns.

Audience	Messaging	Channels	Materials
Employees	• Overview of AMF • Customer Benefits • Opt-Out Process • Pricing Plan • Data Privacy • Address Health Concerns	• Town Halls • Employee Communications • Online Learning platform	• FAQs • Welcome Brochure • "Hands On" Experience • User Manual • Instructional Videos

Figure 3-20: Company Employee Campaign

As the front line for assisting the Company's customers, customer service representatives will be a strong focus of internal training. The team will be equipped with information on how to handle customer inbound calls, opt-out requests, privacy concerns, and FAQs. Training and central documentation will provide consistency of experience and ensure customer service representatives are current with information provided to customers. In addition, learnings and queries by the customer service representatives will be shared internally and contribute to the improvement of materials and the engagement effort throughout the deployment process. Figure 3-21 highlights the targeted approach for customer service representatives.

[54] These Company employees are valuable ambassadors for engagement with C&I customers, specifically those with managed accounts and dedicated internal contacts and representatives.

Audience	Messaging	Channels	Materials
Customer Service Representatives	• Deployment Process • Customer Benefits • Opt-Out Process • Customer Service System (CSS) • Data Security, Health and Privacy Concerns	• Town Halls • Employee Communications • Email • In-person Training Session	• FAQs • Welcome Brochure • "Hands On" Experience • User Manuals • Instructional Videos

Figure 3-21: Customer Representative Campaign

In the Worcester Pilot and the Clifton Park Demonstration, a subset of the customer service representatives team was trained to provide support to those specific customers. This model was successful as it allowed these representatives to become subject matter experts (SMEs) and provide a specialized service to customers in these communities. Initially, the Company will follow this same path. However, as the AMF environment becomes the "new normal," every representative will receive training on AMF to fully address any AMF-related customer needs during any type of customer call.

3.6 Income-eligible and Other Specialized Customer Communications

National Grid is committed to ensuring all customers receive clear communications about the benefits of smart meters and new pricing plans. As described throughout this Plan, the Company recognizes that some customers may need targeted and specialized communications, including income-eligible customers, senior citizens, non-English speaking households, and customers under a protected status (such as medical life support customers). The Company also seeks to leverage its insights on needs and brand interaction channels by customer segment to optimize messaging and channels where appropriate.

The Company currently uses a variety of communication strategies to ensure all customers are receiving tailored information to meet their energy needs for services, such as the discounted rate, the arrearage management program, budget billing options, energy efficiency, and "no-fee" cash payment centers. Some of these channels include:

- Direct marketing, such as postcards, emails, bill inserts, on-bill messages, outbound phone calls, and social media posts (Facebook, Twitter, and Instagram).
- Media advertising on bus sides, shelters, and posters in communities, at retail stores, and other service locations.
- Community partnerships, such as community events, municipal partnerships, and referrals and information sharing through local organizations.

- Company consumer advocates, whose job it is to make themselves available for one-on-one conversations at National Grid organized "Community Expos," local organizations, National Grid's Rhode Island Energy Innovation Hub, and through other workshops and events.
- Personalized call center software, which helps National Grid call center employees identify and prioritize services and messaging that will best meet a customer's individual needs and circumstances.

The Company will leverage these existing strategies to ensure multi-faceted smart meter communication efforts that will meet the customer where the customer is located: in their town, neighborhood, or home. All written and verbal messages and forms will be clear and concise, paper and electronic, and translated from English into the primary languages spoken in Rhode Island (e.g., Spanish and Portuguese). The Company's Customer Call Center is also fully equipped with foreign language services and can provide services to customers in nearly 200 spoken languages.

Educating the Company's network of community partners will also be useful in helping increase awareness of smart meters and will be important for customer communications. Company consumer advocates and other National Grid representatives will ensure related agencies *(i.e.*, Rhode Island Community Action Programs, the Division of Elderly Affairs, Municipalities, United Way and other similar organizations) are well educated on smart meters and have resources available to assist customers who reach out with questions or concerns.

3.7 Remote Connect and Disconnect

AMF metering allows for the technical capability to connect, disconnect and reconnect electric services to a customer remotely. These capabilities should improve the ease of interaction and reduce home disruption for customers, who currently need to wait for an appointment to have electric service turned on or off. However, this ability must be exercised in compliance with all governing documents, whether legislative, regulatory, or otherwise. National Grid remains committed to ensuring that all applicable requirements and conditions are met before a customer's service is terminated.

Specifically, the PUC's Rules and Regulations require that residential service termination occur only on certain days and during certain hours of the day.[55] National Grid will take all measures necessary to restrict residential remote disconnects to the days and times allowable under the rules.

[55] *See Rhode Island Public Utilities Commission Rules and Regulations Governing Termination of Residential Electric, Gas and Water Utility Service*, 810-RICR-10-00-1.6, http://www.ripuc.org/rulesregs/commrules/810-RICR-10-00-1_Termination.pdf.

The rules also specify that "the individual making the disconnection shall immediately inform a responsible adult that service has been terminated, or, if a responsible adult is not on the premises at the time of disconnection, the individual making the disconnection shall leave on the premises in a conspicuous place a note or letter advising that service has been terminated." Thus, National Grid would still be required to have an employee on site at a residential premise when the disconnect is carried out.

It might seem that the remote disconnect technology brings no change to the residential termination process. On the contrary, the employee on site during a service disconnect call would no longer require the level of technical training to work with gas and electrical metering equipment. This allows the training of collection field personnel to shift more toward customer-service and advocacy skills – of special benefit to the state's most vulnerable households.

Remote disconnect capabilities will also provide safety and security benefits to customers. Company employees will no longer need to enter customers' homes for indoor meters, work with customers to access difficult to reach meters, or access meters in poor weather conditions.

4. AMF & National Grid's Long-Term Customer Vision

4.1 Understanding Customer Preferences and Future Surveys

National Grid is committed to understanding evolving customer preferences and will continue to collect customer feedback and opinions on its ongoing operations, services, programs, and offerings. Feedback from online surveys, mail surveys, telephone surveys, in-person focus groups, online focus groups, and customer forums enhance the Company's overarching approach to smart meter deployment: Listen, Test, Learn. Additionally, as the Company continues its solicitation of customer feedback within its Clifton Park Demonstration, it will integrate learnings/insights as appropriate for service territory-wide deployment.

Following regulatory approval of AMF, as part of the CEP future research/studies are planned to gain additional insights to help achieve the following objectives:

- Monitor customers' awareness of smart meters and their overall engagement throughout all three phases.
- Optimize communications throughout the entire customer engagement journey to prioritize transparency with customers and to help mitigate meter opt outs.
- Utilize the Customer Council to test messages that would resonate with Rhode Island customers.
- Track customer satisfaction across all three engagement phases.

- Identify customer attitudes and perspectives toward potential TVR structures to assist with detailed pricing plan designs, and to ensure maximum customer participation and benefits.
- Gauge customer interest in potential new service offerings to inform future design and implementation.

National Grid will continue to keep customer research, insights, and feedback at the core of its design and decision-making processes as it progresses along the smart meter deployment journey.

4.2 Third-Party Data Access

As discussed in Phase Three, smart meters and the CEMP will provide new opportunities for third parties. Standardizing third-party access to customer energy usage data, subject to customer consent, helps remove barriers for third-party providers to offer energy products and services that can benefit customers and the distribution grid. Furthermore, National Grid is considering ways AMF and the CEMP may serve as platforms for third-party enablement, akin to how smartphone providers deliver significant value for consumers and developers alike through an app store.

Utility data industry group Mission:data recently noted:

> [R]ealizing significant gains in energy efficiency will come not from consumers interacting with their raw energy data, but rather indirectly from technology companies and service providers who process, digest and act upon energy data on the customer's behalf.[56]

This sentiment is increasingly important in a future with TVR, where there is an even greater economic incentive for customers to reduce and shift load. External research suggests customers are increasingly comfortable sharing this information if they feel their experience is personalized.[57]

Beyond the envisioned functionality of the CEMP described in ***Section 3.3: Phase Three: Customer Empowerment and Enablement***, and in support of the above vision, National Grid strongly supports secure, scalable, and accessible data sharing consistent with Company policies,

[56] Mission:data, Got Data? The Value of Energy Data Access to Consumers, 36 (January 2016), http://www.missiondata.io/news/2016/2/2/got-data-report-shows-benefits-of-consumer-access-to-their-energy-data. (Mission:data is a national coalition of 35-plus innovative technology companies that empower consumers with access to their own energy usage and cost data.).

[57] Accenture, New Energy Consumer – New Paths to Operating Agility (2017).

procedures, and applicable laws. Currently, the industry-led GBC initiative is viewed as the most widely deployed and adopted method for customers to grant data access to third-party service providers.[58] National Grid has already implemented Green Button Download My Data, which allows for customers to download a tabular file containing their energy data. For residential customers, this is just monthly kilowatt hour (kWh) information. With the deployment of smart meters, this data will be enhanced with more granular information. GBC, which the Company proposes to implement as part of the AMF solution, facilitates computer-to-computer communication to allow for a standard protocol by which authorized third-parties can enhance the value of granular smart meter data.

Figure 4-1 highlights an example today of using the Green Button Download My Data function on the Company's current website to download monthly usage information.

Figure 4-1: Green Button Download My Data

Through careful integration of GBC functionality in the CEMP, National Grid envisions a simplified and streamlined customer experience for customers who wish to access future third-party services. Customers would be able to access their data in a simple, user-friendly way through the Company's CEMP and seamlessly share their energy usage data, if they so choose, with third-party energy service providers through GBC. National Grid is actively researching industry best practices of peer utilities with active GBC deployments. For example, San Diego Gas & Electric and London Hydro actively offer customers several dozen third-party offerings on a GBC platform.[59] Likewise, the Company's New York affiliate is in the midst of launching

[58] DOE, Green Button, https://www.energy.gov/data/green-button. (The Green Button initiative was launched in January 2012, and to date, over fifty utilities and electricity suppliers have signed on to the initiative. As listed on DOE's website, National Grid is a utility committed to using Green Button.).
[59] For examples of current Green Button Connect implementations, please refer to: San Diego Gas & Electric or London Hydro.

GBC functionality for its customers. Transparency and customer control are crucial to GBC in managing the sharing of customers' energy data.

As Green Button continues to gain adoption by utilities and companies continue to build software offerings utilizing the standard, new value streams for customers can be developed. Upon the implementation of the GBC functionality, the Company will move closer to a plug-and-play platform for third-party providers. This will significantly reduce the cycle time for innovation, integration, and implementation, as well as associated costs, required to bring new offerings to customers. This future state will help accelerate progress toward meeting the Docket No. 4600 customer-facing aspects noted in ***Section 2.1: Introduction*** and the Company's ability to continue to exceed customer expectations.[60]

4.3 Enabling Integration with Future Technologies

The benefits of the CEMP are made possible by the confluence of several technologies.

First, the deployment of the smart meters and associated communication network will provide significantly more granular data than is available with current AMR technology, create a two-way communication pathway between National Grid and the customer, and establish a grid-edge computing platform, including software applications that are deployable to the meters for both grid- and customer-facing use cases.

With initial AMF deployment, customers will be able to leverage these foundational infrastructure and capabilities to provide new customer solutions. For example, through the establishment of a home/business area network, home energy management systems will be able to send and receive secure communications from the Company or third-party market entities. This can enable basic load disaggregation (a breakdown of electricity consumption by appliance) and real-time customer access to meter data, including load/price signals.

[60] *See* Updated AMF Business Case, Attachment B for additional details on the Company's approach to data governance.

More specifically, the Company's AMF solution will include a physical radio and associated firmware to provide a wireless signal to a HAN, which will allow customers to monitor and control their energy usage instantaneously.[61] Using open and secure communication standards, customers will be able to leverage third-party vendor technology, as well as internet-based options, to achieve real-time energy awareness. This offers a cost-effective solution with greater functionality than alternatives like KYZ circuit cards[62] or non-meter-enabled home-energy monitors.

In addition to internet-based offerings, the home/business area network provides the secure network infrastructure to automate end-use response to future TVR. Future programs could leverage this infrastructure for innovative smart home offerings to fuel participation in energy efficiency and demand response programs. For example, once successfully enrolled and fully authorized by the customer, connected thermostats can help shift peak by responding to signals to pre-cool buildings earlier in the day or slightly increase temperature set points to reduce peak demand during peak hours on particularly hot and humid summer days. If successful at scale, these programs, where customers can participate to save, could be incorporated into new non-wires alternative solutions.

Looking forward, there is the potential for many additional future functionalities utilizing the grid-edge computing platform to support software applications deployable to meters. For example, AMF vendor solution capabilities and development roadmaps include more advanced capabilities like real-time integration with smart devices such as thermostats, water heaters, and other appliances, real-time load disaggregation (immediate visibility into which appliances are using energy), and temperature monitoring. The Company envisions utilizing the CEMP and enabling technologies to further customers' ability to adopt smart, connected devices that can

[61] For a customer to connect a HAN-related device to an AMI meter, the customer will first confirm the eligibility/compatibility of the device with the AMI meter and then activate the device by logging into their secure online account on the Customer Energy Management Platform ("CEMP"). Once logged in, the customer will navigate to the activation page, enter the applicable device credentials, and receive an activation acknowledgment through encrypted channels. From there, the customer may begin using his or her HAN device, such as an in-home display or home energy manager – need to make clear that this is an item that the customer will need to purchase and not part of the AMF deployment. In this way, the Company will facilitate customer management of their total energy bill through the secure use of HAN technology to receive real-time energy usage information should the customer choose to purchase an in-home device (IHD).

[62] A KYZ card is what allows a solid-state meter to provide pulse energy for use in customer (generally C&I) energy management systems. Traditionally, KYZ was a direct wired construct into rotary meters, where the "Y" and the "Z" would detect each "pulse" of energy for a set timeframe. With the introduction of solid-state meter, the KYZ card acts as a conversion interface to emulate direct KYZ wiring.

help deliver additional energy and cost savings, as per the customer-facing aspect of Docket No. 4600 discussed in ***Section 2.1***.[63]

4.4 Leveraging the Power of Energy Efficiency

The programs offered through the Company's annual energy efficiency plan cover a wide variety of customer segments reaching hundreds of thousands of customers. The residential programs include no-cost home energy assessments where many energy upgrades are also at no-cost or have generous incentives available to assist customers in moving forward with upgrades. There are programs dedicated to lighting products, HVAC opportunities, and behavioral energy savings.[64] On the commercial side, the Company serves businesses, municipalities, schools, and large C&I companies through retrofit and new construction programs. Both residential and commercial sectors also offer demand response programs, with a focus on reducing peak electric demand and associated costs.

While Rhode Island was ranked third in the country for energy efficiency programs and policies in 2019 by the American Council for an Energy Efficient Economy (ACEEE),[65] the Company recognizes that as time elapses and technologies evolve, it too must offer greater value to customers and continue to offer nation-leading energy efficiency programs. Installation of AMF technology will allow for more granular energy consumption data to enable real-time energy optimization and enhanced or even new energy efficiency programs. This would result in an improvement to the current non-AMF high-bill alerts described in ***Section 3.3.2: Educating Customers on the Customer Energy Management Platform.*** AMF insights would allow for more accurate estimates of cost and usage, allowing customers more time to respond to variances. Further, analytics generated by AMF may be helpful in targeting customers for relevant promotions or offerings thus impacting program participation and providing customers a more personalized experience.

To better inform customers of the coming transition to AMF, the Company will leverage its current energy efficiency program structure and vendor network to disseminate information. In Rhode Island, the Company has partnered with cities and towns to conduct comprehensive energy efficiency education campaigns where towns promote energy-saving measures to residents and small businesses through official communications and events. In these towns, the Company may provide materials and host on-site, in-person information sessions related to AMF.

[63] *See* Updated AMF Business Case, Section 5.3.

[64] National Grid, Rhode Island Energy Savings Programs, https://www.nationalgridus.com/RI-Home/Energy-Saving-Programs/

[65] ACEEE, 2018 State Energy Efficiency Scorecard (October 2018), https://aceee.org/press/2018/10/aceee-2018-state-energy-efficiency

Further, the Company has a vast vendor network that delivers the energy efficiency programs to customers. Whether it is a technician conducting an on-site home energy assessment or the monthly Home Energy Report (HER) that delivers energy insights to customers via direct mail or e-email, there is ample opportunity to ensure that customers are informed of the coming AMF roll-out. To ensure that vendors are well versed in this opportunity, the Company may engage its Trade Ally network to host info sessions or provide materials to empower vendors to have these conversations with customers. In all the aforementioned cases, costs will be appropriately allocated between the energy efficiency and AMF programs.[66]

5. Metrics of Success

The Company is committed to tracking its overall performance and its progress on customer engagement. To maximize the customer benefits of AMF, the Company will need to be effective in engaging customers through all three phases of this Plan – before, during, and after meter deployment as new services are enabled for customers. In addition to customer-focused and third-party engagement metrics, the Company has also developed metrics on cost efficiency and program implementation and operations.[67]

[66] *See* Updated AMF Business Case, Section 7.5 for additional information on AMF and its potential impact on energy efficiency and other customer programs.

[67] *See* Updated AMF Business Case, Attachment D.

6. Conclusion

The Company developed this Plan, with support and input from the GMP/AMF Subcommittee, to support successful AMF program implementation and achievement of AMF benefits. A portion of the benefits are dependent on customer adoption of smart meters, understanding smart meter technology and benefits, and resulting changes in customer behavior. The CEP provides a comprehensive plan for how to inform and educate customers about National Grid's smart meter implementation – with a primary goal of enabling and empowering customers to save and to choose how they consume energy.

In developing the CEP, the Company utilized customer engagement learnings from AMF pilots in Worcester, Massachusetts and Clifton Park, New York, its recent Customer Strategy and customer segmentation analysis, other ongoing internal customer initiatives, and external behavioral research. The resulting plan encompasses three phases:

- Phase 1 (Awareness): Following regulatory approval, the Company will begin engaging with customers early and often through a variety of channels to build early smart meter awareness, generate interest, and address customer concerns.

- Phase 2 (Deployment): Beginning 90 days prior to meter deployment, the Company will target the focus of its communication to individual customers to provide tactical information to guide them through the day of meter installation.

- Phase 3 (Empowerment and Enablement): After smart meters are installed, the Company will shift its focus to ensuring customers understand how they can take full advantage of their more granular, timely energy usage data through the CEMP, including data sharing with third-party energy service providers.

Importantly, the Company recognizes that customer needs evolve over time and plans to adapt its engagement strategies as appropriate. Throughout the three phases, the Company will collect customer feedback on awareness, engagement and satisfaction through additional online surveys, mail surveys, telephone surveys, in-person focus groups, online focus groups, and customer forums as part of its overarching approach to smart meter deployment: Listen, Test, Learn.

Full-scale deployment of smart meters creates a new paradigm for National Grid, the state, and third-party energy service providers to offer new customer solutions and advance state policy and strategy objectives. Smart metering is a cornerstone of Grid Modernization and will be increasingly important during the state's transition to a clean energy future. National Grid will continue to keep customer research, insights, and feedback at the core of its design and decision-making processes as it progresses along the smart meter deployment journey.

7. Appendices

Appendix A: Acronym List

Acronym	Description
ACEEE	American Council for an Energy-Efficient Economy
AMF	Advanced Metering Functionality
AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
C&I	Commercial and Industrial
CEMP	Customer Energy Management Platform
DER	Distributed Energy Resources
DOE	Department of Energy
EE	Energy Efficiency
EPRI	Electric Power Research Institute
FAQ	Frequently Asked Questions
FCC	Federal Communications Commission
GBC	Green Button Connect
GMP	Grid Modernization Plan
HAN	Home Area Network
HER	Home Energy Report
HVAC	Heating Ventilation Air Conditioning Add IHD In-Home Device
KVAR	Kilo Volt Ampere reactive
KWH	Kilowatt-hour
LMI	Low and Moderate Income
PST	Power Sector Transformation
RF	Radio Frequency

Acronym	Description
SECC	Smart Energy Consumer Collaborative
SME	Subject Matter Expert
TOU	Time of Use
TVR	Time-Varying Rate

Appendix B: National Grid Rhode Island Customer Demographics

This section highlights the demographics that influence the messaging, channels, and materials developed to educate customers and create awareness of AMF deployment.

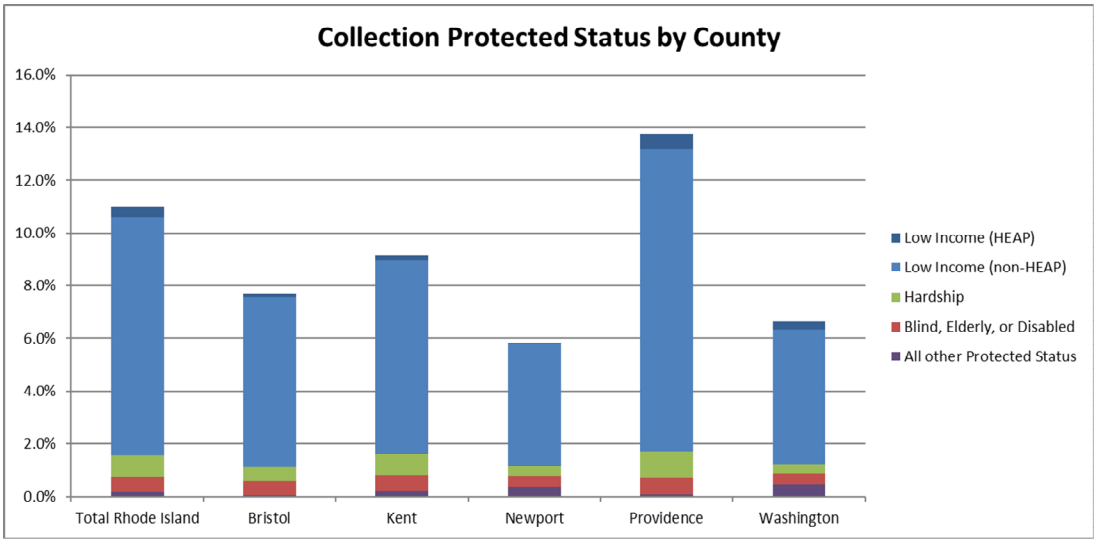


Figure 7-1: Collection Protected Status by County

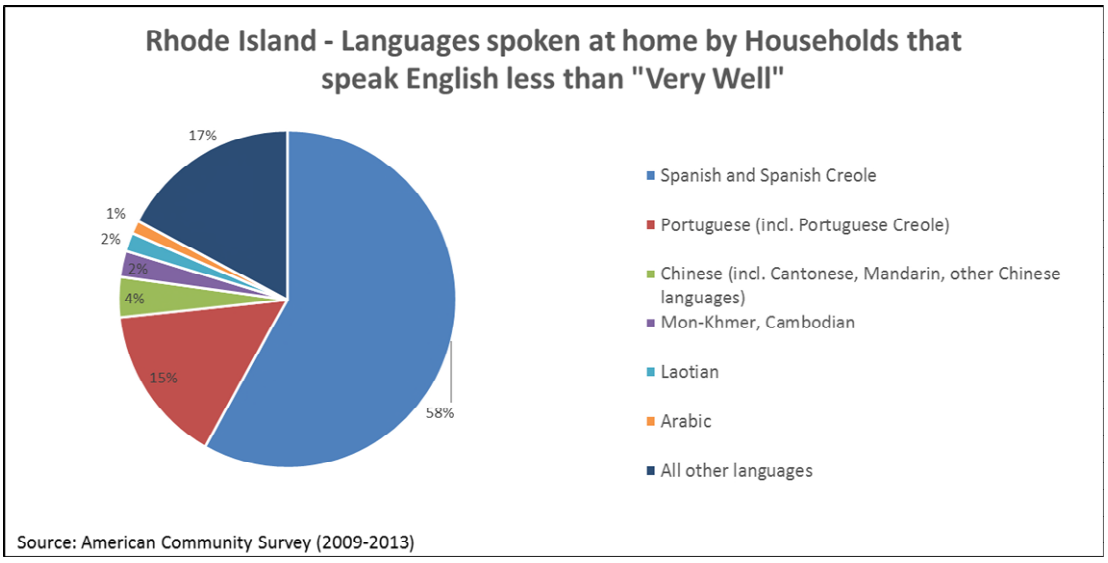


Figure 7-2: Languages spoken at home by households that speak English less than "very well"

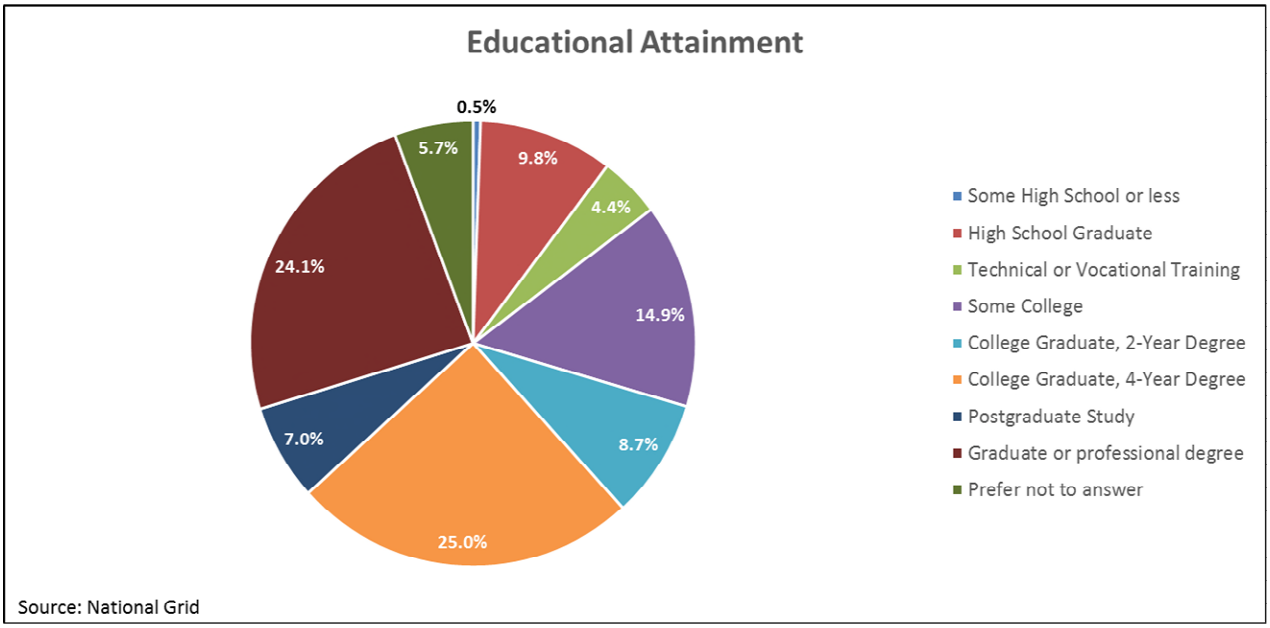


Figure 7-3: Educational Attainment

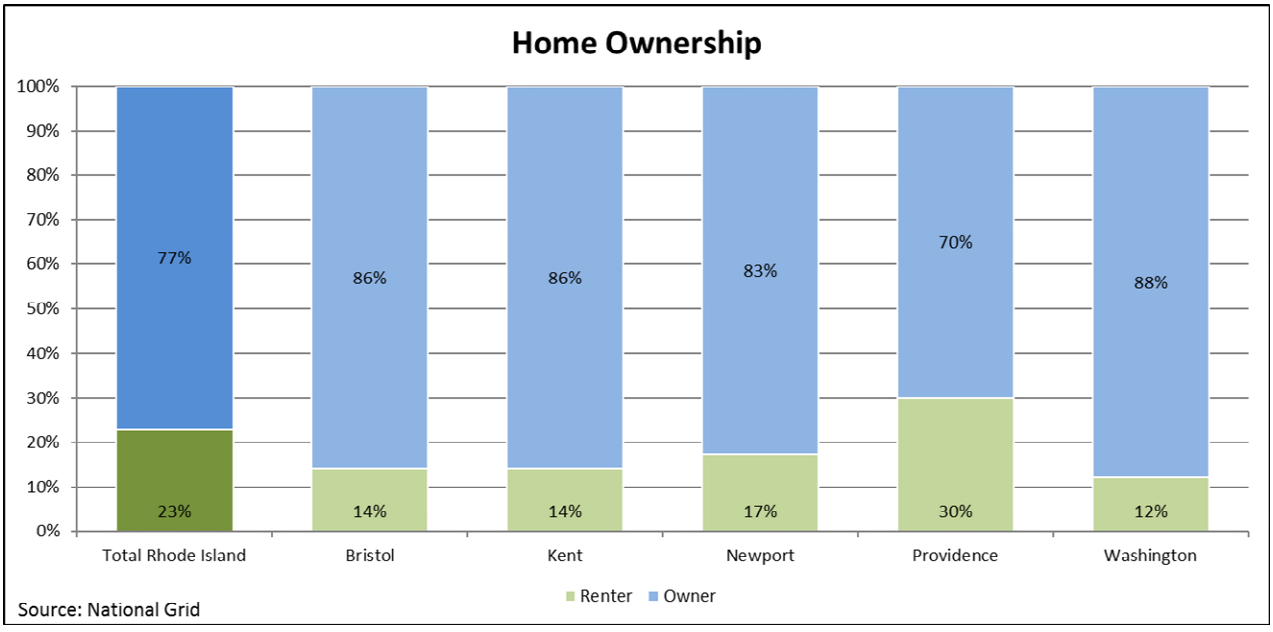


Figure 7-4: Home Ownership

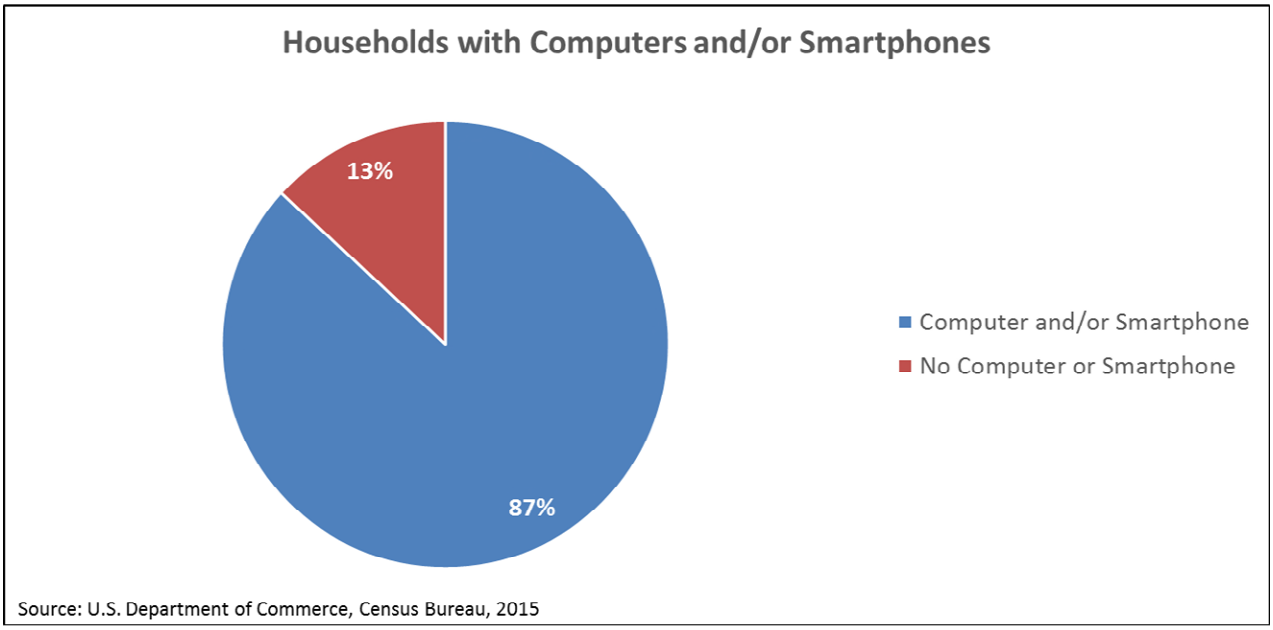


Figure 7-5: Households with Computers and/or Smartphones

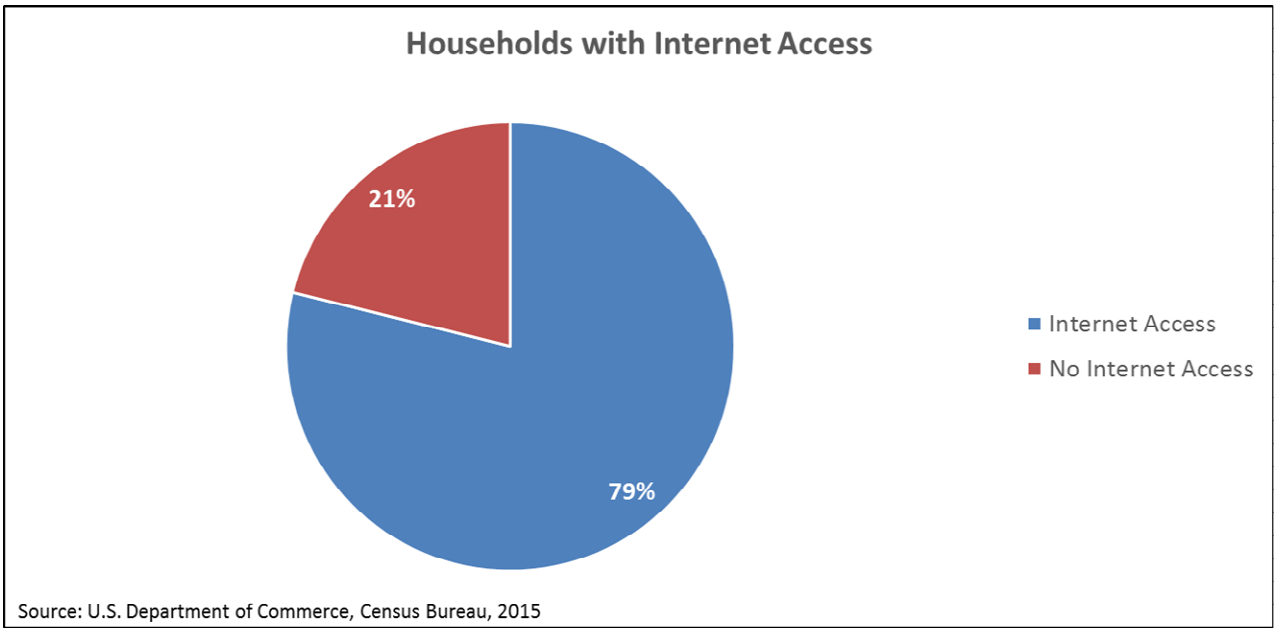


Figure 7-6: Households with Internet Access

Appendix C: Rhode Island PST Advisory Group AMF and GMP Subcommittee Meeting Overview

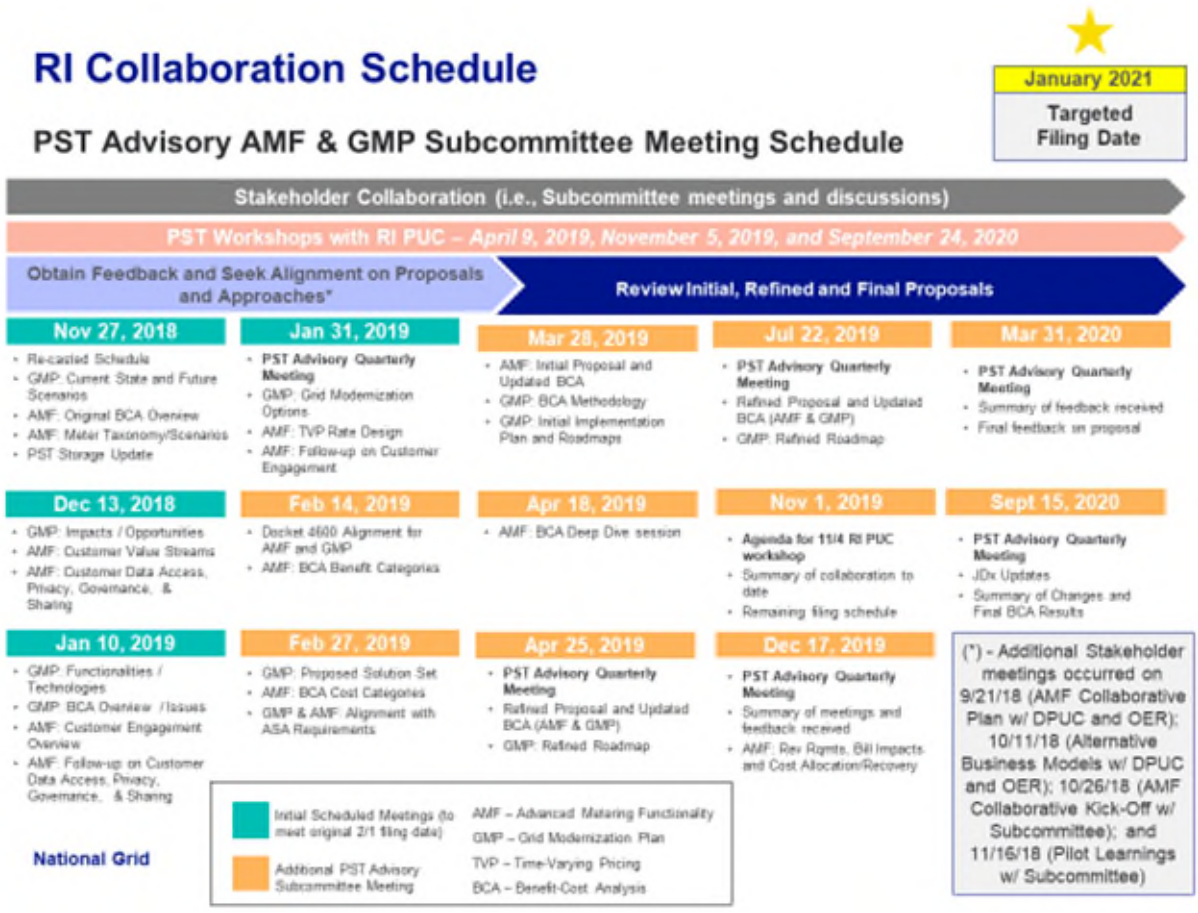


Figure 7-7: PST Advisory Group GMP and AMF Subcommittee Meeting Schedule

The details below are organized by AMF deployment phase, with the associated subcommittee meeting dates noted in parentheticals.

AMF Awareness

- Customers should be made aware that remote disconnect/connect abilities will lead to a reduction of service-reconnection waiting time. (12/13/2018)
- Customer engagement should be tailored to the program and end goals. Specifically, opt-out programs and opt-in programs should be approached differently, and promoting customers to opt into a TVR rate is unique from promoting customers to engage with their usage. (1/10/2019)
- Features that are new and features that are unchanged should be communicated clearly to customers to avoid “Big Brother” fear of unknown new device on site. (1/10/2019)
- Income-eligible customers have the potential to benefit more from TVR than those with similar usage amounts due to the potential for increased price response given the high value of each dollar to these customers. (3/5/2019)

Deployment

- Company employees sent to disconnect service should be trained in skills such as creating customer payment plans. If these employees have expertise interacting with customers, service terminations should decrease along with uncollected revenue. (12/13/2018)
- Income-eligible customer engagement should occur at two levels: Conversations with organizations that support income eligible customers as well as direct conversations with income-eligible customers. (3/5/2019)
- Determining most effective avenues for customer outreach will be an ongoing process that incorporates past experience and new learning as the program unfolds. (3/5/2019)

Customer Empowerment and Enablement

- Different portals should be available to suit the needs of different users - i.e. System Data Portal (provides system data to third parties), Market Portal (allows for purchase of third-party products/offerings), and Customer Portal (data provided to customers). (11/27/2018)
- The subcommittee urges the Company to engage with groups at Brown University studying behavioral science to enhance customer engagement. (1/10/2019)
- Different customer segments should have unique customer experiences based on how they interact with their energy usage. (1/10/2019)
- It would be helpful to develop a “customer bill of rights” that includes items such as a list of situations that generate outbound calls/emails/texts. (1/10/2019)

Appendix D: Customer Experience Products (CXP) Overview

This multi-year CXP initiative seeks to enable a best-in-class customer experience by implementing numerous capabilities, technologies, and program management strategies. Key focus areas, aimed at delivering maximum customer value during "Moments that Matter," include:

- Move in and move out;
- Distributed generation/new connections (electric and gas);
- Website self-service;
- View/pay/enroll in programs;
- Interactive voice response ("IVR")/telecom upgrade;
- Outage reporting and communications;
- Platform/portal technology; and
- Omni-channel capabilities.

AMF deployment will enhance the Company's capability to deliver more sustainable and deeper customer engagement in these key focus areas by enabling:

- Improved awareness of consumer needs and behaviors;
- A 360° view of the customer;
- Improved customer satisfaction; and
- Personalized solutions.

Detailed energy insights will help expand choice in how customers receive and act on that valuable information, including the authorized sharing of that information with qualified third-party solution providers. Additionally, the combination of obtaining granular AMF data with the implementation of foundational CXP capabilities will best prepare and continuously assist customers in participating in potential future TVR plans, discussed in detail in the Company's RI AMF TVR Report.

Smart meter deployment is particularly relevant to enabling both the "My Account/Preference Management" and "Customer Personalization Management" CXP work streams.

Work stream/ Project	Description Customer Benefits	Relevant Customer "Moments that Matter"
My Account/ Preference Management	Establish and enhance the processes and technology changes needed to drive step improvements to the customer experience. The focus is on re-engineering the customer's digital interactions to create a universal and seamless customer experience through omni-channel delivery: web, mobile, text, email, and emerging channels.	
	Improved customer satisfaction through enhanced ability to self-serve; increased online adoption; two-way communication and near real time updates available to customers through preferred channels; prepare for future demand.	
Customer Personalization Management	Develop a solution that will better assist individual customers (*e.g.,* income-eligible), store relevant information securely, and enable analytics to help determine the most appropriate offer for that specific customer. The solution will then inform proactive communications through a campaign and digital strategy as well as provide customer specific data to Customer Service Representatives that will enable them to deliver personalized customer service during a call session.	
	Increase customer satisfaction and trust; increase participation in targeted programs (*e.g.,* income-eligible services, EE programs); increase first call resolution; reduce customer arrears through more informed customer energy management.	

Figure 7-8: Moments That Matter Overview

Appendix E: Envisioned Customer Energy Management Platform Features and Functionality

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Usage Data	View current and historical energy use (kilowatt-hour ("kWh"), kilovolt-ampere reactive ("kVAR") and Therms) in graphical format. Includes both summary information and detailed load profile information. For C&I customers, this offers the same level of service provided via Energy Profiler Online (but at no cost to customer) plus near real time reporting if desired. For income-eligible customers this provides data to make informed choices regarding energy consumption and opportunities to lower bills with adjustments in usage patterns.	Mass market, C&I	Enhanced with Customer Energy Management Platform	Customer energy awareness increases as they view information in a format they understand, via their preferred communication channel (voice, web, short message service ("SMS") or text, etc.).	Ensuring customers can access their usage data in a format they choose/understand; will lead to greater awareness and engagement, driving better management.

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Bill Forecasting Insights	Ability to use historical usage, weather, and other data to illustrate financial impact of current usage and help predict future energy bills. This feature is best utilized with proactive alerts to customers (*e.g.,* high usage alerts). See 'tools' section below.	Mass market, C&I	**Enhanced** with Customer Energy Management Platform	Bill forecasting will give customers early awareness of their energy spending, so that they can take appropriate action to reduce potential high bills, bill shock, and save money.	Bill forecasting will help reduce high bill calls and increase customer satisfaction.
Electric Load Disaggregation	Provide a breakdown of electricity consumption by appliance or end-use for educational purposes and/or recommended actions to save.	Mass market, C&I	**New** with Customer Energy Management Platform	Disaggregation allows customers to better understand their energy usage and creates a foundation for personalized and actionable insights and recommendations.	True disaggregation, enables better load forecasting, improved $/kWh savings from demand side management ("DSM") and EE programs, increased customer satisfaction, and operations and maintenance ("O&M") savings.

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Personalized Energy Insights and Tips	Suggested personalized actions that help reduce consumption and/or shift usage to less expensive periods (in future state with potential TVR plans in place).	Mass market, C&I	**Enhanced** with Customer Energy Management Platform	Customized tips based on customer consumption, pricing plan specifics, load patterns, and lifestyle changes that enable behavior change and customer action. Personalized recommendations are more relevant and actionable, resulting in higher engagement, improved program participation, and increased customer satisfaction. Further, personalized savings tips can provide additional future services, such as appliance replacement suggestions (based on degradation).	Increased customer engagement and participation drives greater load shift/shed, reducing peak risks, and the subsequent usage of 'peaker plants'. Personalized information and notifications enable increased customer satisfaction and reduced high-bill calls.

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
C&I and Multifamily Portfolio View	Enable portfolio view of C&I facilities as well as properties for multifamily unit owners and managers. Enable search/sort, aggregate data and insights, assist with evaluation, measurement, and verification ("EM&V"), and enable usage normalization on variables such as production, sq. ft., occupancy, weather.	C&I	**New** with Customer Energy Management Platform	Detailed customer knowledge and insights of energy performance across a portfolio of buildings and/or multiple accounts.	Better customer insights improve overall engagement and satisfaction.

Figure 7-9: CEMP Personalized Insights

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Carbon Footprint Calculator	Ability for customers to calculate carbon footprint based on usage data and actions to better manage usage.	Mass market, C&I	**New** with Customer Energy Management Platform	Improved energy awareness and engagement.	Provides an engagement mechanism for customers who are motivated by their environmental impact; expands customer engagement.
Configurable and Proactive High Bill/High Usage Customer Alerts	Proactive alerts for variety of electric and gas customer needs, including projected high bill (consumption and/or costs), prediction of high usage during high cost periods, and customizable threshold alert at various points during a billing period. Customers are auto-enrolled into high bill/usage alerts, and would have opportunity to opt-in to other services.	Mass market, C&I	**Enhanced** with Customer Energy Management Platform	Proactive alerts provide customers with a personalized understanding of their energy consumption, improving awareness and management of usage within a potential future TVR plan, driving higher customer EE and peak demand savings.	Increased O&M savings, improved customer response to potential future TVR (especially critical peak usage), and higher customer satisfaction.

Figure 7-10: CEMP Tools

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Participation in Energy Efficiency and Demand Response Programs	Information and direct linkage to/enrollment in Company's existing energy efficiency and Demand Response programs. For example, an offer to immediately enroll within a DR program would be facilitated with purchase of smart thermostat. Future automated recommendations could be based on load disaggregation functionality.	Mass market, C&I	**Enhanced** with Customer Energy Management Platform	An easier enrollment process, combined with a clearer benefit of program participation, will improve program enrollment, participation, and savings. Communication via omni-channel will improve program reach as well, increasing overall customer engagement.	Reduce program marketing spend by targeting customers who are eligible, have a higher probability of participating, and represent the highest potential load shed or shift based on specific consumption. Outreach and communications costs can be reduced by utilizing personalized channels, rather than mass marketing efforts.

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Solar Marketplace	Integrated marketplace for customer research of solar PV adoption, A customer completes an online survey/audit and numerous estimates are provided for customer's review and subsequent selection of options from qualified third-party service providers/installers.	Mass market	**Enhanced** with Customer Energy Management Platform	Better facilitated access to information and quotes for solar photovoltaic ("PV") options.	Enable easier access for customers to renewable energy options.
Green Button Download My Data and Connect My Data	Ability to download data in CSV (Excel) or XML format and ability to share data (Green Button Connect My Data) with vetted third parties. Requires customer's authorization to facilitate data exchange with third parties.	Mass market, C&I	**Enhanced** with Customer Energy Management Platform	Ability to interact with consumption data offline and share with third parties for additional insights and services.	Data access provided via Green Button is pivotal to enable third-party market solutions.

Figure 7-11: CEMP Integrated Customer Actions

Appendix F: Commercial Customer Journey

Commercial customers have different needs than residential customers. The CEMP design will not just have better insights and tools in one place, but will also support a portfolio view of facilities along with other tools geared specifically for commercial customers. Streamlined data access, visualization, and analytics combined with new and improved connections to DER programs and offerings will have the potential to significantly impact how commercial customers meet their energy needs.

Commercial Customer Example

A commercial real estate property management customer currently faces challenges to manage energy across her portfolio and track the value of upgrades. In the CEMP, the property manager can log-in and quickly view energy use information for the portfolio of properties. Links to the most common popular features are provided for quick access in (image A). The customer is then able to drill down by building to access detailed data visualization and analytics tools on consumption data, energy use intensity benchmarking by building, and quickly view recommendations on the best opportunity (images B, C).

The customer can contact their account representative (image D) and discuss relevant energy efficiency opportunities that match the top savings opportunities. This information is quickly connected with vetted service providers for turnkey energy services (image E). This includes third-party solutions and services, which over time will continue to develop increasingly innovative and competitive technology and financing offerings.

The CEMP continuously tracks energy efficiency upgrades, reporting achieved energy efficiency, peak usage reductions, and financial metrics. The CEMP recommends the next best action for future projects to encourage continued participation.

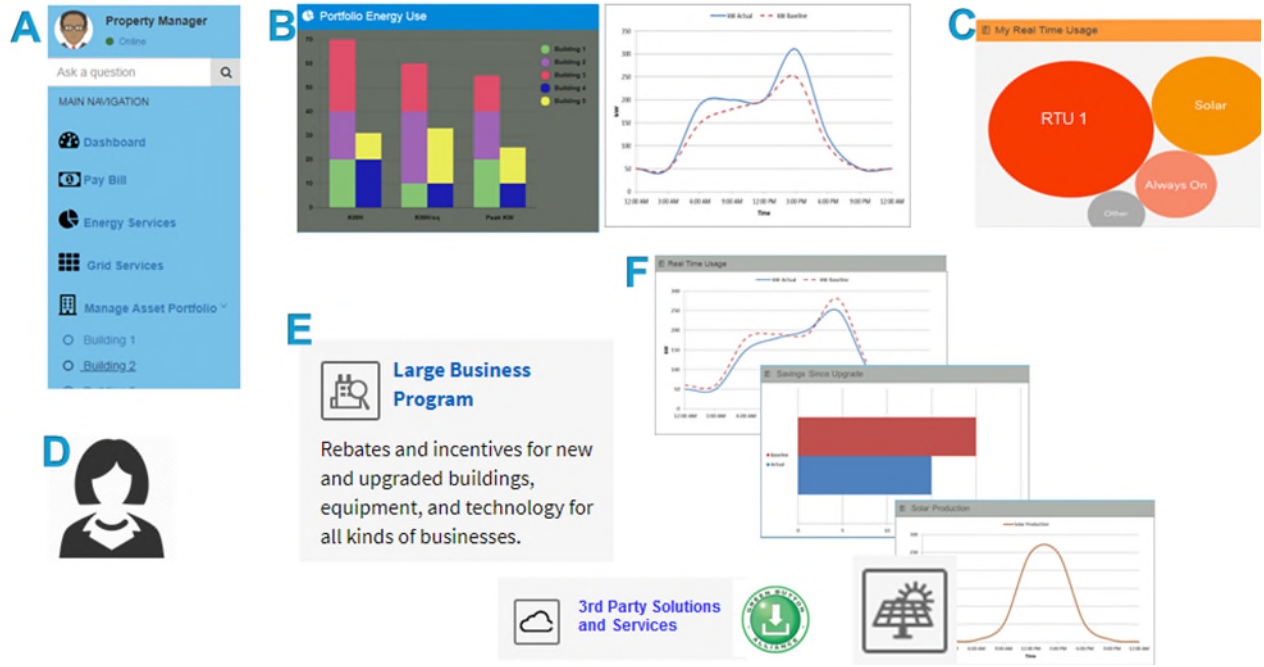
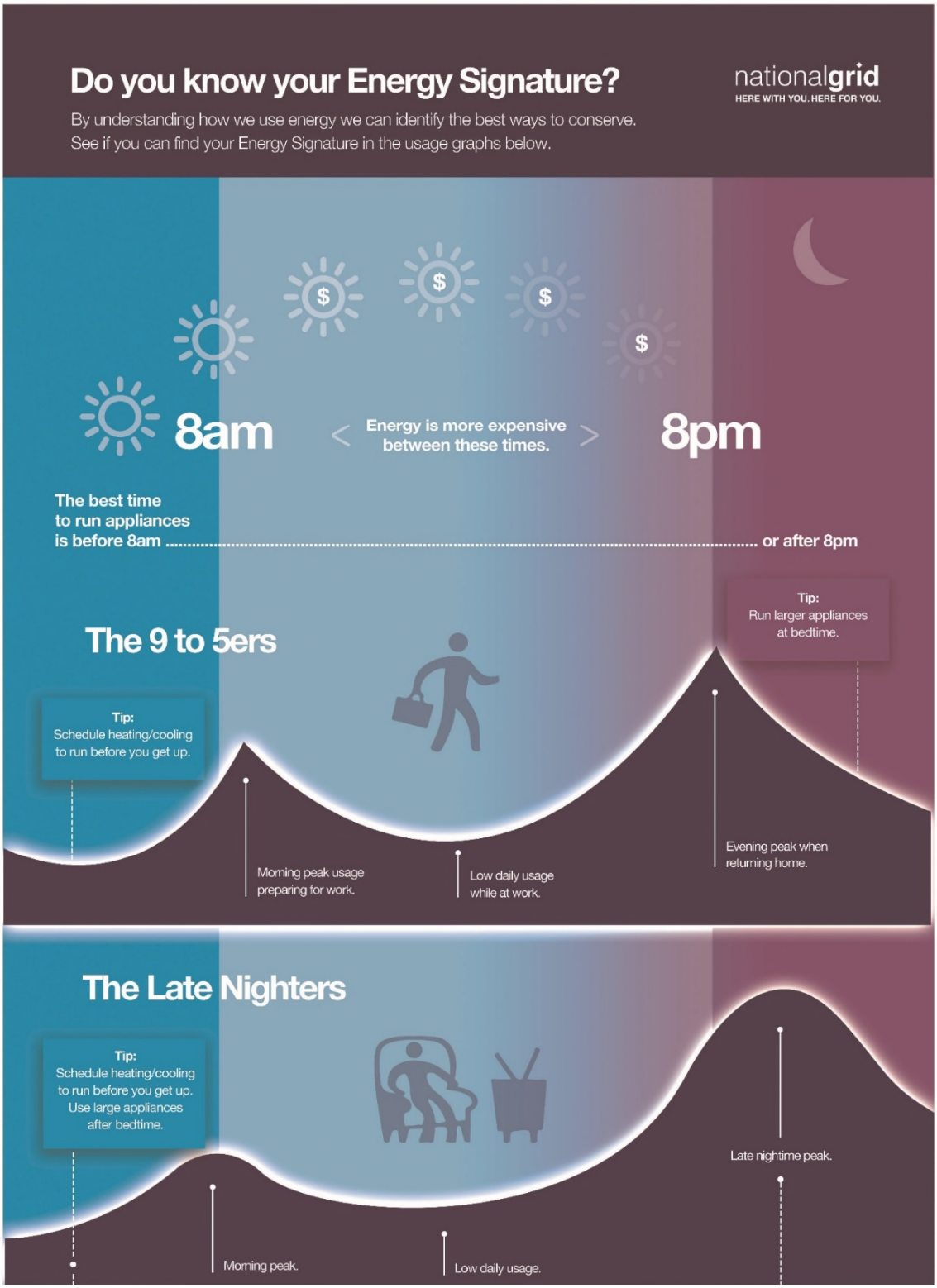


Figure 7-12: Commercial Customer Journey

Appendix G: Energy Signature Examples (on following pages)


Do you know your Energy Signature?
nationalgrid
HERE WITH YOU. HERE FOR YOU.
By understanding how we use energy we can identify the best ways to conserve.
See if you can find your Energy Signature in the usage graphs below.
8am
Energy is more expensive between these times.
8pm
The best time to run appliances is before 8am ..... or after 8pm
The 9 to 5ers
Tip: Schedule heating/cooling to run before you get up.
Tip: Run larger appliances at bedtime.
Morning peak usage preparing for work.
Low daily usage while at work.
Evening peak when returning home.
The Late Nighters
Tip: Schedule heating/cooling to run before you get up. Use large appliances after bedtime.
Morning peak.
Low daily usage.
Late nightime peak.

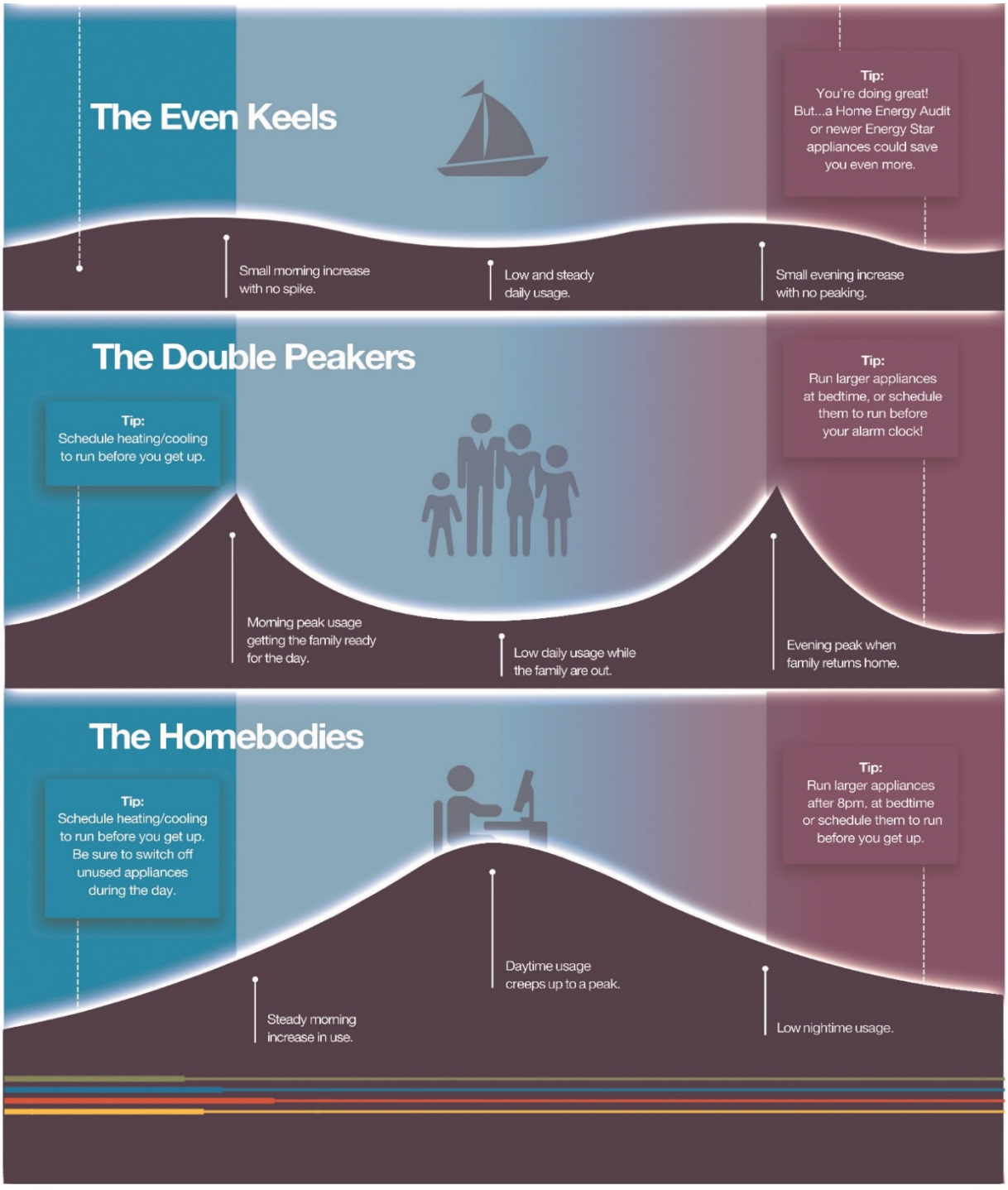


Figure 7-13: National Grid Energy Signatures

Attachment B
Data Governance

Data Governance and Management Plan

Table of Contents

1. Introduction

The Amended Settlement Agreement (ASA) approved by the Rhode Island Public Utilities Commission (PUC) in Docket Nos. 4770 and 4780 on August 24, 2019 required Narragansett Electric Company d/b/a National Grid (National Grid or the Company) to develop:

> A Data Governance Plan regarding timely customer, NPP, and third-party access to system and customer data, (e.g., elements may include, but are not limited to, customer assigned peak load contribution, energy and capacity loss factors, interval usage, or other information needed for efficient wholesale and retail market participation) in place and billing quality customer data (e.g., elements may include, but are not limited to, electric usage in kilowatt-hours containing both "register reads" and "interval reads") with the proper privacy and security protections.[1]

In accordance with the ASA, the Company developed this Data Governance and Management Plan (Data Plan) to accompany its Updated Advanced Metering Functionality (AMF) business case (Updated AMF Business Case). In this plan, the Company identifies a comprehensive set of guiding principles and standards for the customer and system data that will be produced by AMF technology. This Data Plan is designed to ensure the data generated from AMF is collected, managed, stored, transferred, and protected in a way that preserves customer privacy, is consistent with cybersecurity requirements, and facilitates data access in furtherance of grid modernization and clean energy objectives. In addition, as AMF is deployed, this Data Plan provides a process to uniformly analyze the value proposition of evolving data use cases, while also ensuring consistent application of necessary privacy and cybersecurity requirements.

Based on feedback provided by the Rhode Island Power Sector Transformation (PST) Advisory Group and the Grid Modernization Plan (GMP) and AMF Subcommittee (Subcommittee), this Data Plan includes an explanation of how the Company will provide data access and customer-authorized data sharing with non-regulated power producers (NPPs) and other third parties. Furthermore, the proposed data use case evaluation framework provides a process, where ideas can be submitted and discussed collaboratively with the PST Advisory Group in a manner that maximizes the delivery of value for customers and third parties. Through the proposed framework, the Company and the PST Advisory Group will have a platform that allows for ongoing data discussions and the consistent application of data governance principles, without limiting opportunities for continued collaboration among third parties, the Company and the State of Rhode Island.

[1] Amended Settlement Agreement, Article II, Section C.16.b.iv.

2. Energy Data

As set forth in the ASA, there are two broad categories of energy data covered by this Data Plan: customer energy usage data and system data. Customer energy usage data includes a customer's electric usage as recorded at the meter. In the Updated AMF Business Case, the Company proposes to provide such data to customers using two channels. First, the Company will record energy usage at the meter in 15-minute intervals, backhaul it through the head-end and meter data management systems (MDMS), and present it to customers on the web-based Customer Energy Management Platform (CEMP) every 30-45 minutes. Alternatively, customers will have the option to connect directly to the AMF meters using a home-area network (HAN) and receive real-time energy usage data, which they can then share with authorized third parties using Green Button Connect (GBC).

System data, on the other hand, involves grid-facing information, such as planning documents that address grid impacts, load-flow models, distributed energy resource (DER) forecasting, and voltage information. Through the System Reliability Procurement (SRP) process, the Company developed the Rhode Island System Data Portal, where it provides this information, including: Planning reports (e.g., processes, criteria, load forecasts, distribution planning studies);

- Overview of distribution assets (geographic information regarding distribution circuits);
- Heat maps (geographic representation of circuit loading);
- Hosting capacity maps (DER hosting capacity by distribution feeder); and
- Non-wires alternative (NWA) information (NWA opportunities and requests for proposal (RFP)).

3. Data Access

As set forth in the U.S. Department of Energy's (DOE) report on *Data Access and Privacy Issues Relating to Smart Grid Technology*, utility and customer access to customer and system data is a critical issue in the deployment of smart grid technologies like AMF.[2] DOE found that "utilities need access to this energy consumption data for operational purposes…."[3] Likewise, "residential

[2] U.S. Department of Energy, *Data Access and Privacy Issues Related to Smart Grid Technologies* (October 5, 2010) *at* https://www.energy.gov/sites/prod/files/gcprod/documents/Broadband_Report_Data_Privacy_10_5.pdf [hereinafter Energy Data Access Report]; *see also* DOE, *Informing Federal Smart Grid Policy: The Communications Requirements of Electric Utilities* (October 5, 2010), https://www.energy.gov/gc/services/smartgrid-information.

[3] Energy Data Access Report, *supra* note 1 at 3.

and commercial consumers should be able to access their energy consumption data and decide whether to grant access to third parties."[4]

Specifically, DOE stated, "Utilities should continue to have access to [customer energy usage data] for utility-related business purposes like managing their networks, coordinating with transmission and distribution-system operators, billing for services, and compiling it into anonymized and aggregated energy-usage data for purposes like reporting jurisdictional load profiles."[5] DOE also found near "universal consensus on the question of consumer access to their [energy usage data]," further noting broad consensus that customers "should decide whether and for what purposes any third-party should be authorized to access or receive [customer energy usage data]."[6]

This Data Plan is consistent with DOE's key findings. The Company is ensuring that it has access to the customer and system data it needs to safely and reliably operate the grid, while also establishing channels for customers and stakeholders to access data consistent with privacy and cybersecurity protections (*see* Section 5 regarding Data Privacy, Security, and Protection).

3.1 Customer Data Access

As described in the Customer Engagement Plan (Attachment A), the Company will enable customers to access their energy usage data and understand the benefits of their new smart meters. All customers receiving a new meter will be provided with a *Smart Meter Information Privacy Statement* (Appendix). The Company will also:

- Educate customers about their new smart meter;
- Enable access to that data via the CEMP;
- Provide opportunities for customers to enroll in future time-varying rate (TVR) programs;
- Facilitate data sharing with authorized third parties through GBC; and,
- Continue to protect the privacy and security of customer data through all phases of AMF deployment.

The Company's *Smart Meter Information Privacy Statement* ensures that customers have the right to access energy usage data in accordance with applicable privacy and cybersecurity requirements. This approach helps to protect customer data, while also ensuring customer access, understanding, and the ability to share their data through the three channels of customer

[4] *Id*.

[5] *Id*. at 10.

[6] *Id*. at 11.

data access. The Company believes that all customers have the right to access their data, share their data with third parties, and integrate their data with HAN-enabled devices.

3.1.1 Future Enhancements to Customer Data Access with AMF

Today, customers can access their historical energy usage data by either logging into their National Grid account online and viewing their current consumption, downloading their usage data through Green Button Download Data, or by contacting National Grid directly. The Company also provides historical energy usage as part of the customer's bill each month. As mentioned, with its Updated AMF Business Case, the Company has developed new ways of sharing this data with customers and third parties.

The Company's proposed AMF solution contains four key advanced metering elements, as shown in Figure 3-1, that establish a pipeline for customer data:

1) An integrated system of smart electric meters and gas modules capable of capturing customer energy usage data at defined intervals and supporting grid-edge applications;
2) A two-way telecommunications network and related information technology (IT) infrastructure for transmitting the data and control signals that utilize radio frequency and cellular communications technologies;
3) A meter data management system (MDMS) to securely and efficiently collect, validate, store and manage the meter data; and
4) Customer systems including billing and the CEMP to provide energy usage data access, insights, and service offerings that will enable customer energy management.

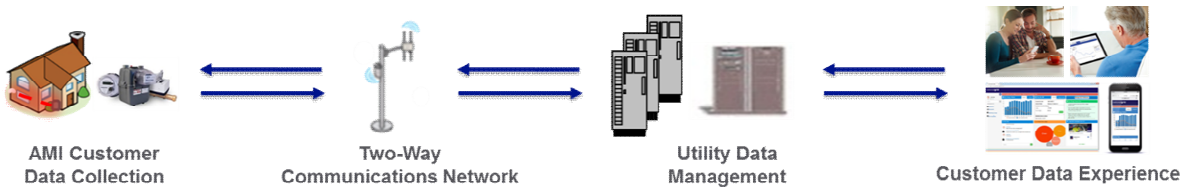


Figure 3-1: Customer Meter Data Access

AMF technology will capture 15-minute interval electric energy usage data from the meter and transmit that data every 30-45 minutes to the CEMP, and one-hour intervals transmitted every eight hours for gas usage. Bill-quality data will be available every 24 hours. This is made possible by utilizing a mesh communications network or cellular network (in the cases where the mesh cannot be built) for backhauling the data. The backhaul transmits the data to the Company's head-end system, which collects the data before it is transmitted to the MDMS, where it is then converted into a form suitable for billing and advanced analytics. The data is then transmitted to customer systems (*e.g.*, the Customer Service System (CSS) for billing or GBC functionality, where, with customer consent, it can be shared with authorized third parties).

As shown in Table 3-1, the AMF solution the Company is proposing provides access to energy usage information for all customer classes. The first two channels, the CEMP and GBC, require the meter usage data to traverse the end-to-end AMF solution, from the meter to the data sharing platforms, in a timely manner. The third channel provides optionality for customers to obtain usage data directly from the meter, through an app or other third-party technology. All three channels and respective capabilities will be made available on day-one when customers receive their new meter.

Table 3-1: Data Access Channels

Data Access Channel	Description	Data Latency
Customer Energy Management Platform (CEMP)	Customers can access their usage data directly and download it for sharing with third parties.	• For electric customers, 15-minute raw interval data will be available every 30-45 minutes • For gas customers, one-hour raw interval data will be available every eight hours • This same information will be available at bill quality data within 24 hours.
Green Button Connect (GBC)	Facilitates computer-to-computer communication allowing customers to provide authorized third parties with direct access to their energy usage data.	
Meter to Home-Area-Network (HAN)	Transmits data directly from meter to HAN.	• Real-time (based on meter to HAN device configuration)

As the Company builds the detailed requirements for the deployment of AMF and the CEMP, it expects to collect the following list of data categories:

- Read Date & Days
- Read Type
- Total Kilowatt Hours (kWh)
- Delivery Charges
- Supply Charges
- Late Payment Charges
- Total Charges
- Metered Peak Kilowatts (kW)
- Metered On-Peak kW
- Billed Peak kW
- Billed On-Peak kW
- Time of Use (TOU) On-Peak kWh (as applicable to specific rate design)
- TOU Off-Peak kWh (as applicable to specific rate design)
- Reactive Power (RkVA)
- Load Factor

This data will be provided through the CEMP, which will be designed to display energy usage data for customers, integrate GBC to enable data sharing with authorized third parties, provide actionable insights and energy savings recommendations, and offer direct linkages to marketplaces for energy saving products, services, and available incentives. A graphical overview of the CEMP is provided in Figure 3-2.

Figure 3-2: Customer Energy Management Platform

The CEMP development and implementation processes is iterative and scalable over time. While the Company plans to build out the initial solution prior to meter deployment, it can consider and facilitate the integration of new functionalities as they evolve to meet the changing customer needs. New features, such as integration with DERs like solar, energy storage, and electric vehicles can be integrated into the CEMP as these technologies are more widely adopted. The Company envisions the CEMP to serve as the one-stop place to manage all customers' energy needs today and in the future.

The Company is planning for two years of back-office work for the CEMP prior to meter installation. This back-office work for CEMP will run concurrently with the back-office systems implementation and detailed design work. This will ensure that the CEMP is operational and functional on day-one when new meters are installed. The first year will focus on detailed design and development of the main CEMP features. The remaining time will focus on testing, implementation, and deployment in advance of the initial meter deployments.
The CEMP will streamline several existing customer portals, third-party websites, and existing educational and safety information (currently provided to customers on the Company's home webpage), with the goal of providing customers with simple, seamless access to tools, information, and actionable insights that can be easily accessed via the Company's website or by a mobile device. The same information will be made available for customer service representatives for customers who want to call in and speak to a live representative.

3.1.2 Data Sharing with Third Parties

The Company currently shares energy usage today with third parties in various formats (XML, Excel, CSV EDI, and via open APIs), where it can be aggregated at the feeder level, and often anonymized, for utilization within the Company's energy efficiency and demand response programs, or as part of pilots, demonstrations, and NWA opportunities. Consistent with the DOE Energy Data Access Report, contractual obligations are in place with third parties including data security agreements (DSAs), non-disclosure agreements (NDAs), and other contractual terms and conditions to ensure customer data is protected, secure, and used for authorized purposes.[7] The DSAs and contractual agreements can be tailored to the security level required, types of data being requested, the use of data, associated costs, and type of third party making the request to access the data.

Today, the Company shares data with over twenty retail and energy service providers (i.e., NPPs) in the State of Rhode Island. When a third-party retail energy provider or energy services supplier submits a request for data to the Company, the customer account is authenticated by the Company and once verified, the data items in Table 3-2 below are exchanged via electronic data interchange (EDI), which is the platform for the structured transmission of data between organizations by electronic means.

[7] Energy Data Access Report, *supra* note 1 at 3 ("Commenters also generally agreed that authorized third parties should be required to protect the privacy and security of consumer data and use it only for the purposes specified in the authorization…").

Table 3-2: Data Shared Today with NPPs

Data Item	Description
Tax Information	Tax exemption status is based on the information customer has provided to National Grid.
National Grid Account Number	Account number assigned to each individual customer account
Supplier's Account Number	Third parties can assign their own account number. Suppliers assign this number based on their algorithm. Once the usage is sent, National Grid and the supplier's account number are listed together.
Energy Usage in KW	Supplier is informed of the electricity that has been used by the customer.
Supplier Charges	For Complete Billing (aka consolidated billing), suppliers provide National Grid with rate information. Thereafter, supplier charges are calculated based on the following information: • Supplier's Rate Code – 3-digit code • Supplier's Price Quote Number – 7-digit code
Usage Period	Date range of billing period
Total Monetary Value	Total billed dollar amount for suppliers, which includes supplier charges along with taxes, if any.
Billing Options	Identifies whether the bill is consolidated or whether each party will prepare their own bill.
Billing Cycle	The cycle number when the billing will be prepared.
Payments	Payments are sent by National Grid to suppliers for Complete Billing accounts and the following information is shared between National Grid and the respective suppliers • Payment date • National Grid's account number, amount • Supplier's account number
Enrollment and Rate Change	Enrollment and rate changes are submitted by the suppliers. • Supplier's account number - Supplier assigns this number based on their algorithm. • National Grid's account number – Customer provides their account number to the supplier. • Tax information - Customer inform Supplier if the respective account is tax exempt.
Historical Usage	Once the request is accepted, Historical usage transaction contains the customer account number along with 13 months of usage and ICAP value (ICAP value is the peak load contribution, or installed capacity tag (ICAP tag) and is determined by the customer's usage during the single highest peak hour from the previous year. The peak hour is the hour during which the usage was the highest across the entire grid).

While the example above is just one way the Company shares data and interacts with third parties today, deployment of AMF will help: enhance new data sharing capabilities such as GBC, establish HANs for additional data sharing functionality, and enable the development of a process for evaluating new data use cases.

3.1.3 Green Button Connect

As noted, the Company is proposing to implement the national Green Button Connect My Data standard. Through the envisioned CEMP, GBC will provide customers with the ability to share their energy usage and billing data with authorized third parties. The Company plans to have GBC implemented and operational for all Rhode Island Customers prior to AMF meter installation. The Company's Upstate New York affiliate is currently working to implement GBC for its customers.[8] The list below contains the data types that customers may share using GBC:

- Read Date & Days
- Read Type
- Total Kilowatt Hours (kWh)
- Delivery Charges
- Supply Charges
- Late Payment Charges
- Total Charges
- Metered Peak Kilowatts (kW)
- Metered On-Peak kW
- Billed Peak kW
- Billed On-Peak kW
- Time of Use (TOU) On-Peak kWh (as applicable to specific rate design)
- TOU Off-Peak kWh (as applicable to specific rate design)
- Reactive Power (RkVA)
- Load Factor

Currently, the industry-led Green Button initiative is the most common method for customers to grant access to their data. Green Button Download My Data and Connect My Data solutions eliminate the need for third-party service providers to support various utility protocols and streamlines the customer authorization process.

Many utilities, including National Grid, have implemented the Green Button Download My Data functionality. This national energy data format and initiative gives every utility customer the ability to download their personal energy consumption data directly to their computer in a secure manner. Additionally, if customers are interested, they can separately upload their data to a third-party application.

[8] *See* New State Department of Public Service Commission Case No. 18-M-0084, Updated Joint Utility Green Button Connect Report (filed October 16, 2019), http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=18-M-0376&submit=Search;

Figure 3-3: Green Button Download My Data

The GBC functionality takes this process further by allowing customers to automate the data sharing process. With GBC, customers can securely authorize both the Company and designated third parties to send and receive data on the customer's behalf. The Company's New York affiliate is currently working with other New York State utilities to develop a streamlined onboarding process in hopes of making it even easier for customers and third parties to share data. This functionality will be developed and deployed as a key feature of the CEMP. The Company will leverage any learnings from its affiliate's New York implementation to support the enablement of GBC in Rhode Island.

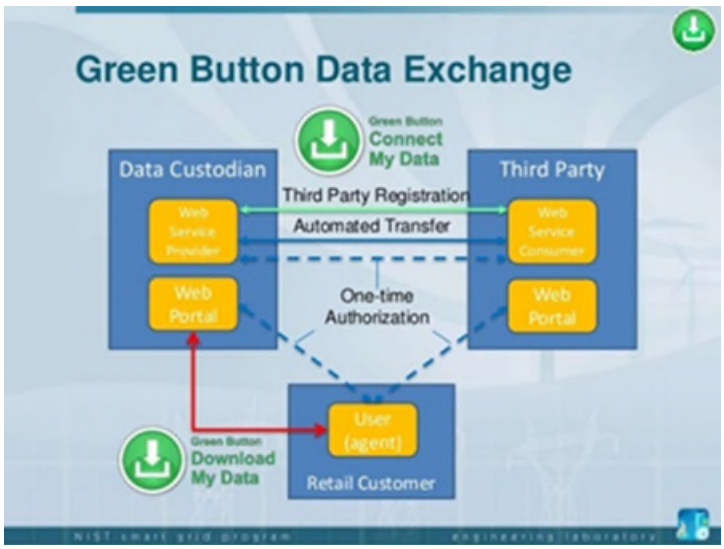


Figure 3-4: Green Button Connect My Data – Data Exchange

In general, the onboarding process will involve third parties submitting their GBC registration form online, a utility representative reviewing the form and contacting the third party regarding next steps. Once the initial step is complete, third parties will execute the required DSA, vendor risk assessment form, and registration forms. The third party will then be listed on the GBC platform as an authorized entity with whom a customer can share energy usage data. With customer consent, data transfers are nearly instantaneous depending on the capabilities of the third party to transfer and accept the requested data.

Please see Figure 3-5: Green Button Connect Third Party Onboarding Process below.

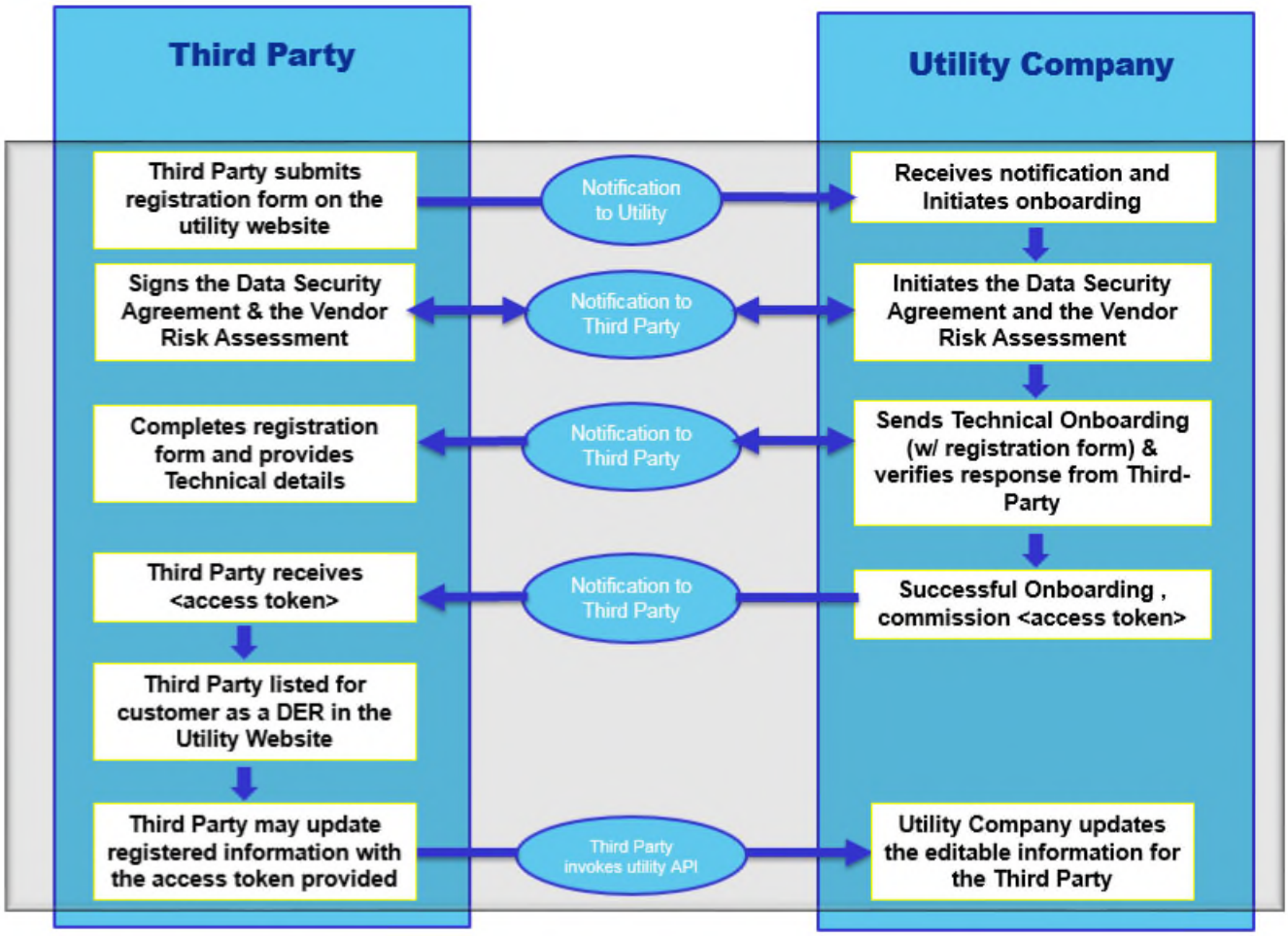


Figure 3-5: Green Button Connect Third Party Onboarding Process

Customers will have the opportunity to connect their new smart meter data with third parties on both the Company's website and via third-party websites, where available. Having multiple channels to connect customers with third parties will enable greater connection for third-party services to be made available. Below is a depiction of the two means in which customers will be able to authorize and begin to share their smart meter data. The design and process will be simple and easy for customers to understand, register, and share data. Please see Figure 3-6: Green Button Connect Authorization Process Flow below.

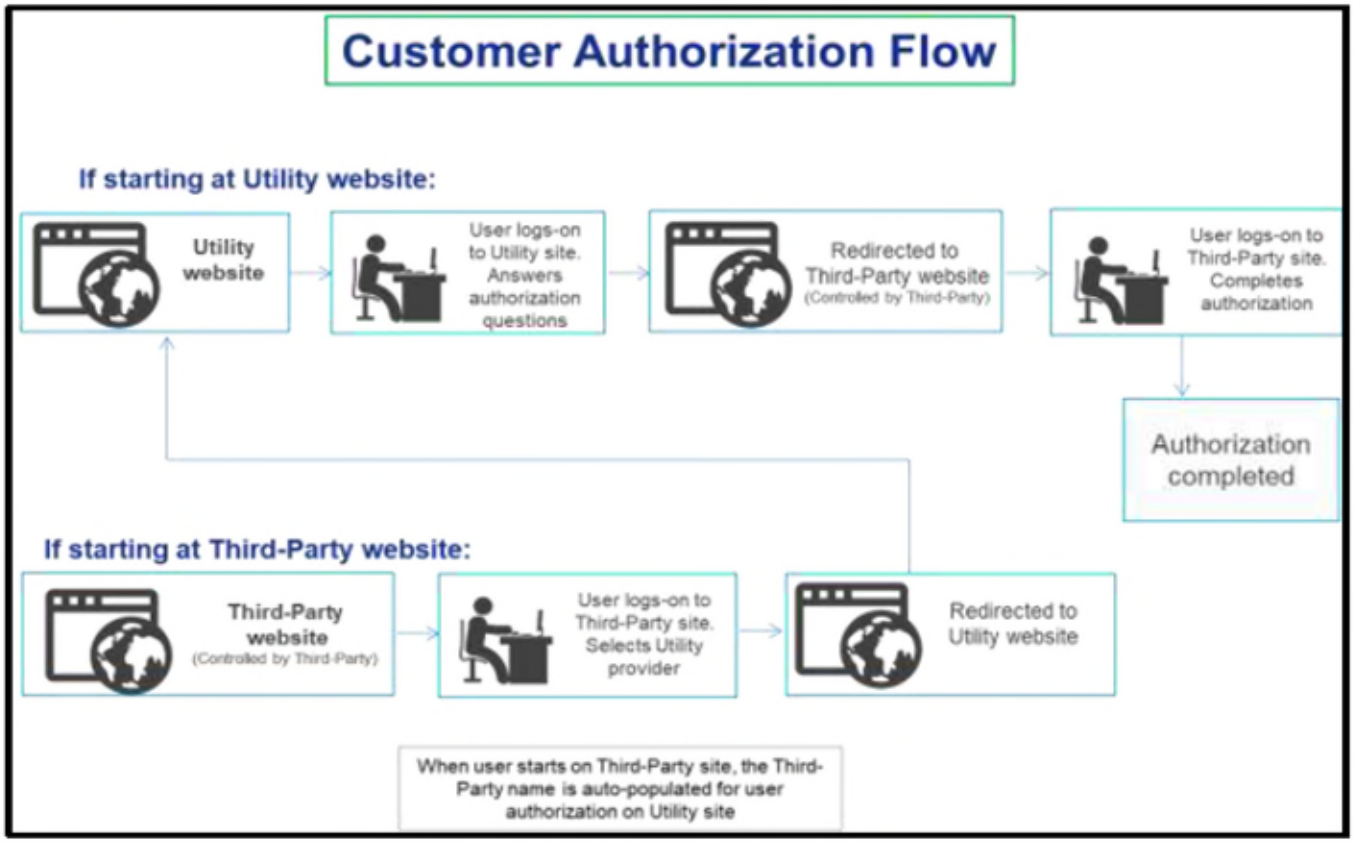


Figure 3-6: Green Button Connect Authorization Process Flow

3.1.4 Customer Access Using the Home-Area Network

The Company's proposed AMF solution will be designed to deliver customers in Rhode Island the capability to connect to a HAN via WiFi and/or other commonly used communication protocols. The Company currently promotes connected-home technology and supports the adoption of energy saving devices such as communicating thermostats through its existing energy efficiency and demand response programs. Ensuring the capability to connect HANs and connected devices with smart meter data provides another channel for customers to share data with third parties.

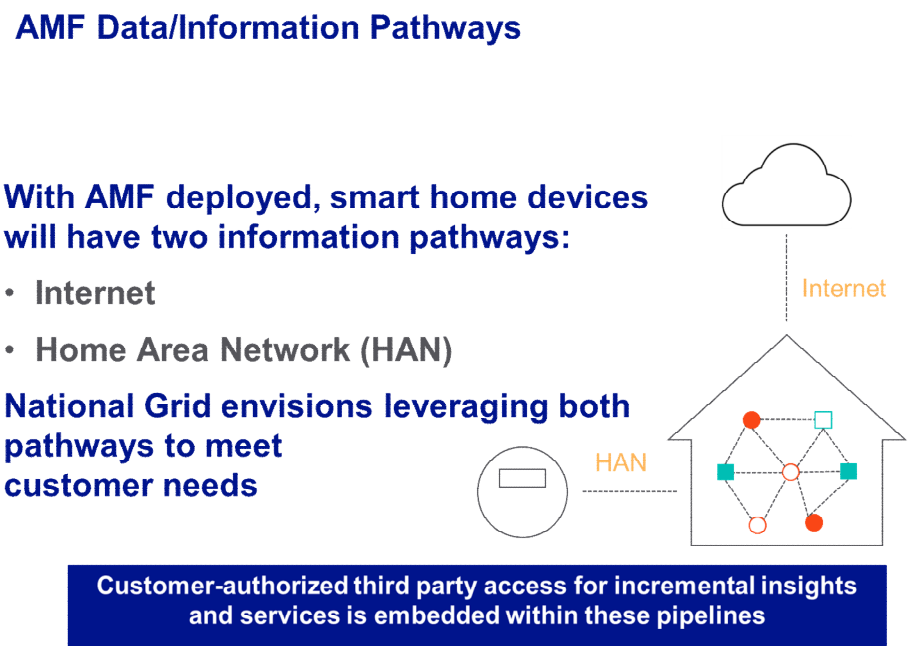


Figure 3-7: AMF Data/Information Pathways

The benefits of the CEMP, as described above, are made possible by the confluence of several technologies.

First, the deployment of the smart meters and associated communication network will provide significantly more granular data than is available with current AMR technology, establish a two-way communication pathway between National Grid and the customer, as well as a grid-edge computing platform, including software applications, that are deployable to the meters for both grid-facing and customer-facing use cases.

Once deployed, future use cases can leverage these foundational infrastructure and capabilities to provide new customer solutions where feasible. For example, through the establishment of a home/business area network, home energy management systems will be able to send and receive secure communications from the Company or third-party market entities. This can enable: 1) real-time customer access to meter data, including load/price signals and potentially more advanced capabilities like real-time load disaggregation; and 2) real-time integration with smart devices such as thermostats, water heaters, and other smart appliances.

In addition to internet-based offerings, the home/business area network provides the secure network infrastructure to automate end-user response to future TVR programs. Future programs could leverage this infrastructure for innovative smart home offerings to fuel participation in energy efficiency and demand response programs. For example, once successfully enrolled and fully authorized by the customer, connected thermostats can help shift peak energy use by responding to signals to pre-cool buildings earlier in the day or slightly increase temperature setpoints to reduce peak demand during peak hours on particularly hot and humid summer days. If successful at scale, these programs, where customers can participate to save, could be incorporated into new NWA solutions.

The Company envisions utilizing the CEMP and enabling technologies to further customers' ability to adopt smart connected devices that can help deliver additional energy and cost savings. Although the provision of in-home technologies is not included within the scope of the Company's Updated AMF Business Case, the Company will continue to promote the use of such technologies through its evolving energy efficiency and demand response programs.
The proposed AMF solution noted within the Updated AMF Business Case will include a physical radio and associated firmware that provides a wireless signal to a HAN – enabling customers to monitor and control their energy usage instantaneously. Using open and secure communication standards, customers will be able to leverage third-party vendor technology, as well as internet-based options, to achieve real-time energy awareness. The Company's proposal supports the HAN-enabled approach, which offers a cost-effective solution with greater functionality than alternatives like KYZ[9] circuit cards or non-meter-enabled home-energy monitors.

For a customer to connect a HAN-enabled device to an AMF meter, the customer will first confirm the eligibility/compatibility of the device with the AMF meter and then activate the device by logging into their secure online account on the CEMP. Once logged in, the customer will navigate to the activation page, enter the applicable device credentials, and receive an

[9] A KYZ card is what allows a solid-state meter to provide pulse energy for use in customer (generally commercial and industrial) energy management systems. Traditionally, KYZ was a direct wired construct into rotary meters, where the "Y" and the "Z" would detect each "pulse" of energy for a set timeframe. With the introduction of solid-state meter, the KYZ card acts as a conversion interface to emulate direct KYZ wiring.

activation acknowledgment through encrypted channels. From there, the customer may begin using their HAN device, such as an in-home display or home energy management system. In this way, the Company will facilitate customer management of their total energy bill through the secure use of HAN technology to receive real-time energy usage information.

3.2 System Data Access

As the modern, digital electrical grid becomes the standard for customers' needs and expectations, the Company's reliance on more granular and accurate data grows. In addition to enabling customers to better monitor and manage their power use and costs, managing an electrical grid requires a perfect balance at all times between what customers use and the available power. Managing line voltage and other operational aspects of the grid has become more complicated as more distributed energy resources are integrated. Having detailed information about how electricity is consumed is key to meeting customer reliability needs.

Integrating AMF data with grid-facing functionalities can produce enhanced performance. The following is a description of the areas where AMF data will enhance grid modernization efforts:

- **System Maintenance and Planning** – Enhance analytics related to load and DER forecasting and distribution system operations to better manage the grid leveraging both utility and customer resources to the extent possible to maximize the utilization of existing distribution infrastructure;

- **Grid Modernization Technologies** – Make possible a "self-healing grid" [10] (e.g., Advanced Data Management System (ADMS), FLISR) and enable energy savings that do not require customer action (e.g., VVO/CVR) when AMF data is used in concert with grid modernization field devices and back-office systems;

- **Outage Management** – Increase awareness about customer power outages and restorations to customers, communities, call centers and control rooms; and

- **Operations Optimization** – Provide operations with new options for DER integration and demand response controls.

The Company's Grid Modernization Plan (GMP) lays out an approach through 2030 that includes the AMF near-term functionalities that are included in the Updated AMF Business Case. Future functionalities will be part of possible future filings and are not included in the Updated AMF Business Case.

[10] A "self-healing grid" can reconfigure to isolate outages and, where possible, restore power to customers with minimal manual intervention.

Table 3-3: AMF Near-Term Functionalities

RI GMP Key Functionality	AMF Enabling Functionality
Customer Information	Customer Energy Management Platform (CEMP), Green Button Connect (GBC), Integration w/ In-Home Technologies
Advanced Pricing	Interval Energy Usage Data
Remote Metering	Remote Interval Meter Reading, Remote Connect & Disconnect
Observability (Monitoring & Sensing)	Load & Voltage Data
Power Quality Management	Load & Voltage Data
Distribution Grid Control	Load & Voltage Data
Grid Optimization	Load & Voltage Data
Reliability Management	Automated Outage & Restoration Notification, Granular Fault Location
DER Operational Control	Remote Interval Meter Reading, Load & Voltage Data, Operational Telecommunications (Tier 3)

Further detail on AMF impacts on GMP functionalities is included below:

- **Customer Information:** The Company's proposed AMF solution provides access to timely, granular energy usage information for all customer classes through the three primary channels mentioned above: 1) web and mobile devices via the CEMP; 2) GBC, which will be accessible from the CEMP; and 3) directly from the meter in real-time through a HAN. AMF also empowers customers to reduce their energy costs using enhanced insights (e.g., high-bill alerts) on more granular, timely energy usage data through the CEMP or using integration with in-home technology.

- **Advanced Pricing:** AMF provides customer and DER level interval energy usage information required to support TVR and customer load management programs that can be used to shift energy consumption between time periods to reduce energy costs and/or alleviate location specific constraints on the delivery system.

- **Remote Metering:** AMF improves operational efficiency by enabling the Company to eliminate operation and maintenance costs associated with AMR meter reading, investigations and visits to connect and disconnect service.

- **Observability (Monitoring & Sensing):** AMF provides granular and timely customer load data to support actionable information on the operating state and condition of the distribution grid and DER assets necessary for safe, secure, and reliable operation.

- **Power Quality Management:** Voltage conservation benefits customers by reducing demand and energy use through conservation voltage reduction (CVR). The advanced Volt-VAR Optimization (VVO) control schemes coordinate multiple voltage regulating devices of a feeder to achieve optimal CVR performance. On average, expected benefits would be a 3 percent reduction in energy and peak demand on the targeted feeders. An incremental 1 percent improvement is expected to be achieved by integrating granular AMF voltage data into the VVO control schemes due to better awareness of feeder voltages compared to using only voltage data from advanced field devices.

- **Distribution Grid Control:** Granular and timely customer load data from AMF supports more accurate load flow calculations, enabling the system operator to better control power flows on the distribution system and optimize power output from renewable DERs (through an ADMS and/or DERMS) to avoided thermal or voltage constraints rather than investing in traditional solutions (e.g., reconductoring, substation upgrades) to relieve the constraints.

- **Grid Optimization:** AMF provides granular customer load data from interval power monitoring at the customer level, which provides a step change in available data for grid planning and operations. While the latency of AMF data is not the same as operational Supervisory Control and Data Acquisition (SCADA) data from advanced field devices, AMF data analytics will significantly improve the load flow models used by distribution planners and within the proposed ADMS for distribution system operators. Today, feeder level data combined with generic load shape analysis is used to model remote end feeder performance. AMF provides more granular, timely values that can be aligned with other system data to create actual loading and voltage profiles at all points along a feeder. This complete data set can be modeled directly and more detailed load and DER forecasts can be developed for planning and operational needs.

- **Reliability Management:** AMF provides autonomous outage notifications to the Company, alerting the Company before receiving customer outage calls. Integrating this functionality with the Company's Outage Management System (via an ADMS) will reduce the notification time from the start of the outage to the Company, resulting in a decrease of total customer outage time, from occurrence of the outage to resolution. AMF also provides restoration notifications enabling the Company to verify whether power has been restored to all meters, reducing the need for crews to verify restoration and alerting the Company if some meters are still out of power. AMF also provides granular outage data at the customer level, increasing the accuracy of fault location capabilities of an ADMS. More accurate fault location improves operational efficiency through a reduction in field crew hours and vehicle miles traveled, and it improves the isolation and restoration capabilities of FLISR.

- **DER Operational Control:** AMF supports DER optimization by providing the interval energy and voltage data at the customer level required for verification and settlement of DER services provided to or received from the grid. AMF also enables the exchange of information and/or control with all residential and small commercial (<25 kW) DER technologies through AMF's investment in a Tier 3 (field-area network) operational telecommunications, which would not be possible without AMF investment.[11]

The table below shows the near-term AMF-enabled functionalities, both customer- and grid-facing, and the proposed dates when the functionalities will be operational. Data will be made available once meter installation, back-end systems, and networks are implemented.

Table 3-4 AMF Functionality Roadmap

	AMF Functionality	Timeline			
		Year 1	Year 2	Year 3	Year 4
Customer Facing	CEMP - Near Real Time Customer Data Access				
	CEMP - Customer Energy Insights				
	CEMP - Bill Alerts				
	CEMP - Load Disaggregation				
	CEMP - Green Button Connect				
	Integration w/ In-Home Technologies				
	Time Varying Rates - Customer & DER				
	Remote Interval Meter Reading				
	Remote Meter Configuration				
	Remote Meter Investigation				
	Remote Electric Connect and Disconnect				
	Theft Detection				
Grid Facing	Voltage Measurement - Voltage Conservation				
	Outage Detection - Automated Notification				
	Time Varying Rates - Load Shift				
	Load & Voltage Data - Situational Awareness/Forecasting				
Shared GMP & AMF Enabling IT Infrastructure	Operational Telecommunications				
	Cybersecurity				
	Operational Information Management				
	Grid Edge Computing				

Legend
Development
Implementation

[11] Currently, the Company requires a dedicated phone line, remote-terminal unit (RTU), and interval meter for all distributed generation greater than 25 kW, but there are no meter requirements for systems smaller than 25 kW.

To facilitate the management and sharing of system data with DER providers and other third parties, the Company has developed the Rhode Island System Data Portal that can be accessed online,[12] which includes the following types of system data:

- Information on Company reports (planning processes and criteria, load forecasts, and completed distribution planning studies);
- Distribution asset overview (a geographic overview of distribution circuits);
- Heat maps (a geographic representation of circuit loading);
- Hosting capacity maps (a geographic representation of DER hosting capability by distribution feeder); and
- A listing of NWA opportunities and RFPs soliciting NWA solutions.

Figure 3-8 below shows where the System Data Portal can be accessed directly from National Grid's website. Figure 3-9 presents a screen shot from the System Data Portal to display Rhode Island hosting capacity. From this opening view the user can view or select a specific location to get more detailed information.

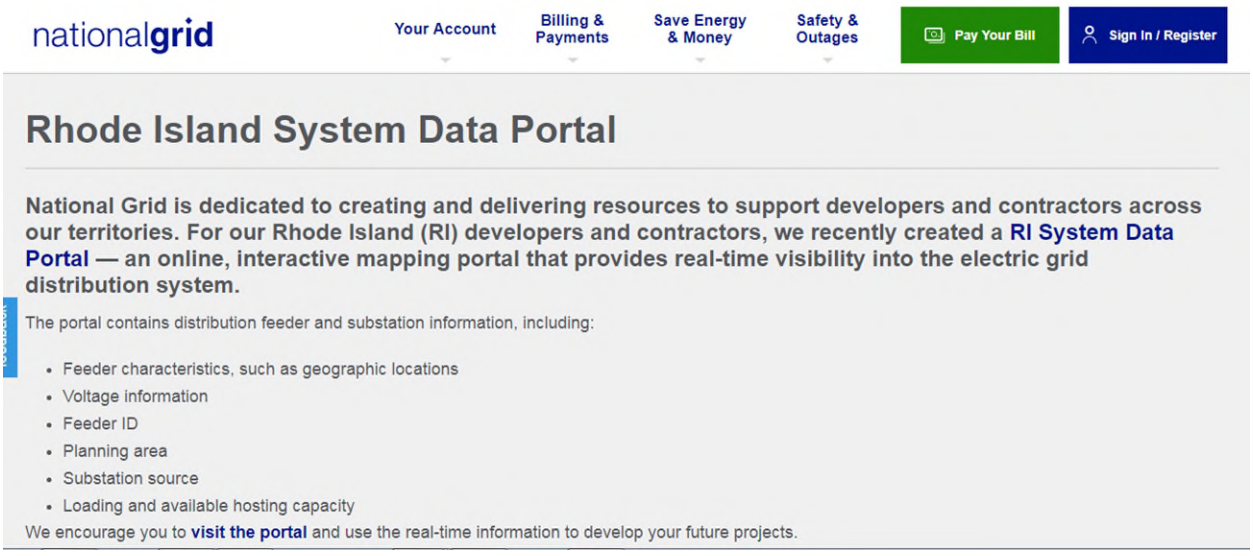


Figure 3-8: National Grid Website Landing Page to the Rhode Island System Data Portal

[12] The System Data Portal can be accessed online via National Grid's public landing page at https://www.nationalgridus.com/Business-Partners/RI-System-Portal.

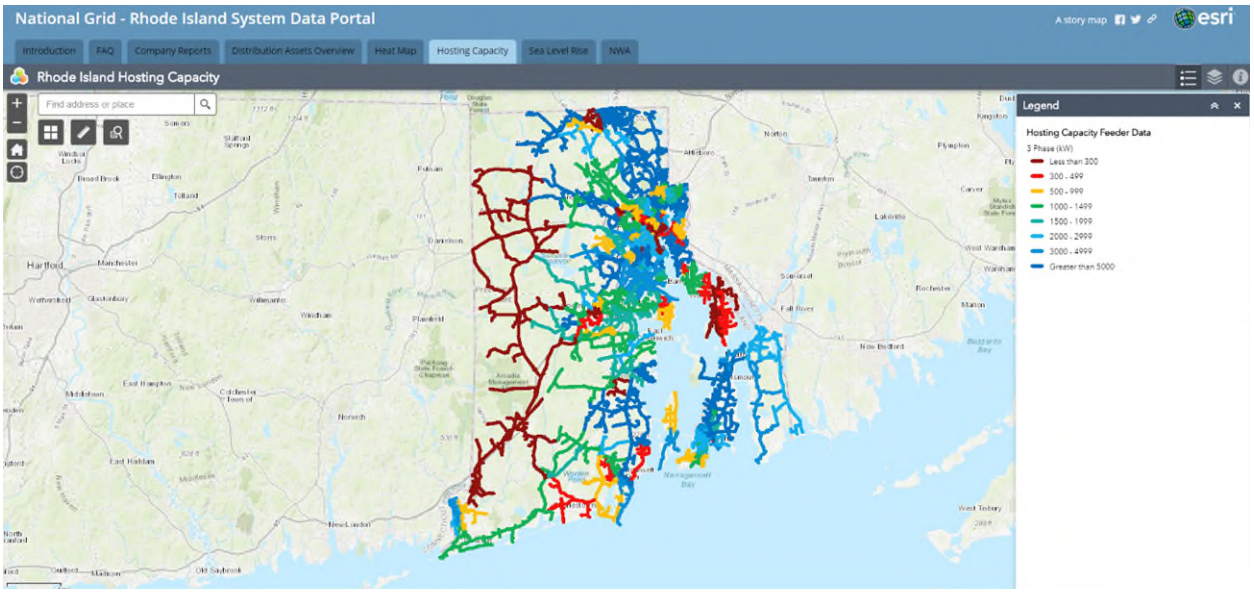


Figure 3-9: Rhode Island System Data Portal Hosting Capacity Screen Shot

The Company considers the System Data Portal to be a foundational component for meeting customer needs and advancing Rhode Island's clean energy policies. The content of the System Data Portal is expected to grow and evolve over time as new tools, data, and analyses are developed.

The Power Sector Transformation Phase One Report detailed the need to establish customer and third-party data access plans:

> **Establish customer and third-party data access plans.** National Grid should include and seek approval of a plan for establishing and improving customer and third-party data access in the upcoming rate case. Updated data access plans should be included in future annual SRP/ISR filings. Inclusion of data access plans within the SRP/ISR filings will provide regulators and stakeholders with the opportunity to provide ongoing review and feedback. [13]

In coordinated alignment, the Company stated in Section 12.1 of the 2020 SRP Report:

[13] *See* Rhode Island Division of Public Utilities and Carriers, Office of Energy Resources, and the Public Utilities Commission, *Rhode Island Power Sector Transformation: Phase One Report to Governor Gina M. Raimondo*, 49 (Nov. 2017), www.ripuc.org/utilityinfo/electric/PST%20Report_Nov_8.pdf.

> SRP establishes customer and third-party data access through the Rhode Island System Data Portal. The 2019 SRP Report proposed further work on the Portal to improve data access for external parties. The 2019 SRP Report also proposed commitment to discussion on posting NWA RFPs and to inclusion of redacted area studies in the Portal. [14]

The Company further improved data access by setting up an NWA Website in order to post information and RFPs on the Company's NWA process and opportunities. The System Data Portal is a part of the SRP process; however, given the synergies with AMF and GMP, the Company proposes a coordinated process for updating the System Data Portal through the new data use case framework detailed in Section 4 below. Following AMF approval, funding for any efforts that update the SRP with AMF data will require coordination among the SRP and AMF proceedings. To that end, the Company recognizes the need to explore how AMF can enhance the System Data Portal and what new use cases can be developed to enhance DER and NWA opportunities.

In Section 10.2 of the 2020 SRP Report, Enhancing the Portal, the Company commits to further System Data Portal enhancements through the following actions:

> Begin coordination work with the Company's proposed Grid Modernization Plan regarding inclusion of hourly (8,760 hours) data in addition to peak load data if the Grid Modernization Plan with this update is approved for funding. Coordination work regarding inclusion of hourly data is a step toward providing more effective information to the market.[15]

Consistent with the 2020 SRP Report guidance seeking greater coordination among the GMP, SRP, and AMF, this Data Plan offers synergies among those plans regarding data governance, access, sharing and possible future use cases. Indeed, as noted in Section 12.4 of the 2020 SRP report,

> **Coordination with Grid Modernization and AMF**: The SRP team is tracking the development and Implementation of the Grid Modernization Plan and Advanced Metering Functionality Business Case filings to ensure future coordination is maintained with the outcome of these plans. The Company will coordinate the SRP

[14] *See* Docket No. 4980, *The Narragansett Elec. Co. d/b/a National Grid, 2020 System Reliability Procurement Report* at 65 (Oct. 15, 2019) [hereinafter 2020 SRP Report], www.ripuc.ri.gov/eventsactions/docket/4980-SRP2020%20(10-15-19).pdf.

[15] *See Id*. at 33.

> Report with the GMP and AMF filings to ensure that efforts, projects, and programs are not being duplicated and to ensure cohesive and comprehensive plan framework and implementation. The SRP team is aware that AMF proposal includes data availability and access. Such data can further improve planning and development of potential NWA opportunities. Additionally, the SRP team understands that third-party data access to AMF may be required for the implementation of certain NWA projects. For example, the addition of smart meter data realized from the AMF investment can provide planners with more granular data and thusly provide the ability to aide in forecasting and strategic planning. The SRP and NWA teams are therefore coordinating with the development and implementation of the AMF filing with these specific data access themes in mind, in addition to following the AMF Business Case in general.[16]

4. Data Use Case Evaluation Framework

Many states in the U.S. are exploring new processes from which to examine the utilization of energy data as grid modernization efforts take place.[17] As new AMF systems and technologies are deployed, a robust evaluation framework will be needed to discuss, explore, pilot, test, and even create new use cases to understand how they can generate value for customers and the distribution system consistent with data access principles, as well as privacy and cybersecurity requirements.

The Company is currently examining many use cases for energy data and data sharing. As part of this Data Governance Plan and its Updated AMF Business Case, the Company proposes establishing a similar process specific to Rhode Island and in alignment with the ASA. Given the uniqueness of grid operations in each state, synergies with data related topics among filings, requirements to ensure low-cost procurement, and the need to examine the benefits and costs in terms of customer value, the Company proposes that a formalized framework is best suited to address the specific needs of the state, customers, other stakeholders, and grid operations.

As the utilization of customer and system data evolve, the Company is proposing that a more formalized and organized framework be developed to collaboratively evaluate and discuss new

[16] *See Id*. at 44.
[17] *See e.g., Proceeding on Motion of the Comm'n Regarding Strategic Use of Energy Related Data*, NYPSC Case No. 20-M-0082, Order Instituting Proceeding (Issued and Effective March 19, 2020) [hereinafter NY Data Proceeding], at 7 ("In order to enable access to energy related data, a clearly defined data access framework must be developed that establishes the necessary privacy and cybersecurity requirements for access to energy related data.").

use cases for data, including presentment, integration, aggregation, and data sharing.[18] An evaluation process is also required regarding the associated costs and benefits to the Company's distribution system and its end-use customers.
During the PST Collaboration meetings that helped shaped the Company's filing, it became increasing evident that interested third party stakeholders are seeking more granular metering, billing, and system data, more frequently, and in multiple formats for a myriad of different uses, of which many have yet to be identified. A comprehensive collaborative process to evaluate new data use cases would ensure the prioritization of the input from the PST Advisory Group, all PST subcommittees, and interested third parties to help develop the most effective processes. Additionally, it would stretch across numerous forums, including: AMF customer data, AMF system data, distribution planning, NWAs, demand response, energy efficiency, and other future undetermined forums. Such a process would encourage participants and third parties to develop new ideas and business models, as well as explore new innovation opportunities ultimately helping to deliver incremental value to customers and the State. Stakeholder engagement meetings will be considered to gain greater insights to third-party interests. The stakeholder engagement meetings could be reoccurring as needed and focused upon specific use cases to ensure the framework applies uniformly to each unique case.

More importantly, this framework does not limit the parties by defining only what use cases exist today but creates an open forum for the exploration of use cases that are yet-to-be-defined or created. Some customer and grid-facing data use cases may be part of future grid modernization efforts as described in AMF Future Functionalities and Rhode Island GMP Functionalities. Developing such a framework that provides an open forum for exploration of new use cases will not limit parties to a defined plan today as new ideas and their associated benefits and costs have yet to be defined. This process can also be utilized to discuss contractual obligations such as changes to data security agreements (DSAs) as this is still an emerging area and use cases will be subject to different contractual terms and conditions.

Figure 4-1 illustrates an initial list of proposed evaluation criteria the Company envisions as key to a robust new Data Use Case Evaluation Framework. The initial framework would require additional review, enhancement, and evolution through discussion with the collaborative stakeholders.

[18] *See id.* ("The establishment of a data Access Framework that clearly defines the process for access, standardizes the necessary privacy, cybersecurity, and quality requirements for access to energy related data will ensure uniform treatment across various energy related data use cases.").

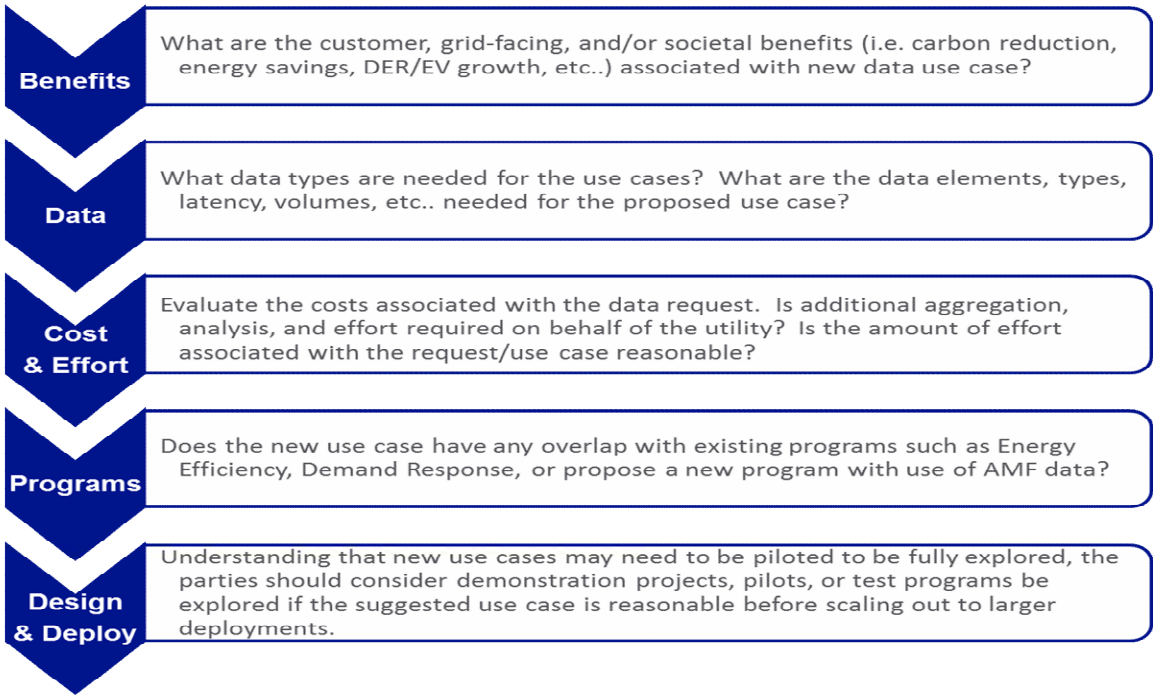


Figure 4-1: New Data Use Case Evaluation Framework

As an example, the concept of aggregated customer data, which was raised during past Subcommittee discussions, stakeholders noted a strong interest in the need to further explore aggregated data for Rhode Island. In New York, as a foundational component of the states' Reforming the Energy Vision (REV), the Company's New York affiliate has implemented the Order Adopting Whole Building Energy Data Aggregation Standard, also referred to as the 15-by-15 standard, which provides:

> [A]ggregated customer usage data is considered sufficiently anonymous to share publicly if (1) the aggregated group contains at least 15 individual accounts, and (2) no one account represents more than 15% of the total load. In general, a privacy standard for aggregated energy data establishes the minimum configuration and characteristics of energy accounts that, when aggregated over a geographic area or building, are expected to provide a reasonable expectation of customer privacy by not revealing or permitting determination of individual customer-specific energy use.[19]

[19] *Proceeding on Motion of the Comm'n In Regard to Reforming the Energy Vision*, NYPSC Case No. 14-M-0101, Order Adopting Whole Building Energy Data Aggregation Standard (April 20, 2018), http://documents.dps.ny.gov/search/Home/ViewDoc/Find?id=%7BB39D7DBD-7D78-4E2C-892B-7CB357C8C890%7D&ext=pdf

The Company is open to employing a similar aggregated data standard in Rhode Island, and believes this topic could serve as an initial opportunity for the proposed Data Use Case Evaluation Framework.

Overall, the Company recognizes that additional criteria will need to be explored on a case-by-case basis and that a more formalized process such as the proposed New Data Use Case Evaluation Framework will require ongoing enhancements. The Company looks forward to further collaboration and development of such a process with the Subcommittee and other interested third-party market participants.

5. Data Privacy, Security, and Protection

The Company is continuously committed to protecting all types of data that are generated by its customer and system operations. This section provides an overview of the Company's data privacy policies, standards, and guidelines. Additionally, providing customers, NPPs, and third parties with access to more granular energy information comes the inherent responsibility to secure, protect, and manage the data.

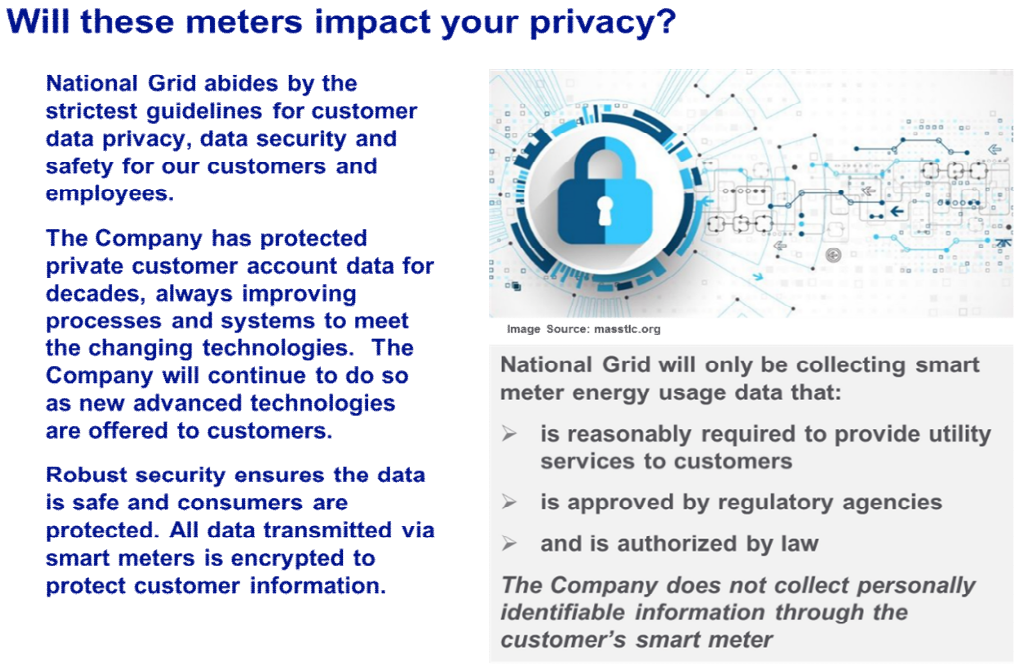


Figure 5-1: Data Privacy Overview

As the Company invests in foundational technologies to advance customer offerings and operations, the Company continues to strengthen its commitment to protecting customer data. With the deployment of AMF, the Company's commitment takes on renewed importance.

To that end, the Company has developed a comprehensive, integrated data privacy framework with policies, standards, guidelines, and statements designed to ensure compliance with privacy and information security obligations. This approach centers on three key components: 1) a commitment to core data-privacy principles; 2) regular assessments of the Company's performance in accordance with the principles; and 3) constant vigilance. Such an approach to data privacy and management leaves the Company well positioned to safely and securely implement AMF.

The Company's three-tiered approach tracks across people, process, and technology:

- Setting forth policies and standards intended to ensure the Company works to common security objectives by regularly updating privacy and security guidance (including incident management and reporting) for those with legitimate business needs to access customer data;
- Addressing privacy throughout the data lifecycle, working to prevent accidental misuse/loss/exposure of information; and

- Ensuring cybersecurity controls are implemented, information risks are understood, and technologies are selected to keep pace with threats.

The supporting data privacy program utilizes a cross-functional framework that addresses legal and regulatory requirements, as well as the ever-changing landscape of privacy and identity theft vulnerabilities that can compromise customer and grid data. The framework for compliance, privacy, security, and identity theft prevention incorporates accountabilities, policies, procedures and business practices, and a fabric of technical and operational controls to effectively manage data privacy risks.

Collaboration with all key data privacy stakeholders internally on a frequent basis allows the Company to address the latest technology and regulatory requirements related to customer data, including usage data, and any personally identifiable information (PII). These stakeholders provide guidance and solutions for managing and protecting this information. Stakeholders are members of the Company's Data Privacy Community of Practice and includes senior leaders in the following areas: Legal Counsel, Group Assurance Function (Global Data Privacy), Procurement, IT Services and Technology, and IT Digital Security and Risk (Vendor Assurance Program). Each of these stakeholders provide input to the Company's Data Governance/Privacy infrastructure.

The Company's Legal team has provided guidance related to the laws and regulations of Rhode Island to ensure that the data privacy program addresses all data privacy issues. The Company has processes and solutions in place to achieve compliance with Rhode Island data privacy regulations.

The Company is prepared and ready to support the data governance requirements of the Rhode Island AMF initiative. As requirements change, the Company has a process in place to address the changes with all key stakeholders and will support new solutions and procedures as necessary.

To address the consumer view into data privacy practices, the Company's Legal Department has developed and published a Data Privacy Policy that explains how all customer data is used at National Grid. There is a link to the Privacy Policy on the Company's website.[20]

5.1 Core Data Privacy Principles

National Grid has a commitment to the protection of personal information. The Company has policies, procedures, training, and internal communications intended to ensure employees are aware of their responsibility to protect personal data of employees and customers. The Company's data management standards and data privacy provisions are designed to ensure customer personal data is protected for confidentiality and integrity.

The core principles of the data management standards apply to customer data that is created, collected, held, used, shared, transformed, published, or processed by the Company; regardless of whether the data is structured (*i.e.,* organized and searchable) or unstructured (*i.e.,* not organized and not readily searchable). Moreover, the principles apply at all stages of the data lifecycle, including the Company's use of historical data in business operations.

The Company's commitment to customer data privacy is guided by seven core principles, which build into a data management hierarchy. The principles further define the structure by which the Company's performance requirements are organized. The seven principles are below.

- Data is managed and secure: All data is subject to governance and protection from unauthorized access throughout its full lifecycle (from planning and collection through to retention and disposal).
- Data is fit for purpose: Data should be of the quality required for its intended uses.
- Data is standardized: In terms of its definition, format, content and categorization providing the ability to link differing forms of related data together.

[20] *See* National Grid's Privacy Policy, https://www.nationalgridus.com/Our-Company/Privacy-Policy.

- Data has a single authoritative source: For all data, there shall be a single and identified authoritative (master) source.
- Data is accessible: Business units within the Company should all have the appropriate access to the data they need to carry out their respective roles.
- Data is an asset: It has a purpose, cost value and lifecycle.
- Data publication: Any data that is published should be defined, appropriate, quality assured, verifiable, and, if necessary, aggregated and anonymized.

In support of the seven key principles, the Company is further committed to ensuring that customer data is:

- Processed fairly and lawfully in accordance with customer rights as dictated by relevant legal requirements;
- Obtained for specified business and/or legal purposes and not processed in a way that is incompatible with the purpose(s) for which it was collected;
- Adequate, relevant, and not excessive for the purpose(s) for which it is processed;
- Accurate and, where necessary, kept up to date;
- Not kept for longer than is necessary to fulfil the purpose(s) and then either made anonymous or disposed of securely;
- Appropriately protected against unauthorized, inadvertent, or illegal processing and/or disclosure; and
- Restricted to designated countries unless the rights and freedom of individuals are protected.

5.2 Audits

The Company also conducts annual data privacy assessments of its data privacy control environment for the protection of customer information utilizing an independent third party.

- ***Summary of 2018 findings*:** The review found that leading practices were defined and followed across the organization and a strong control environment was present in all control domains that were reviewed. It was established that National Grid had addressed most findings to which management committed remedial action and seven of the eight domains (Corporate Accountability; Policies, Procedures and Guidelines; Training, Education and Outreach; Credentialing; Network Security; Physical Security; and Incident Response) were awarded a control maturity rating of High.

- ***General Data Protection Regulation (GDPR) Internal Audit -- GDPR readiness:*** All recommendations completed on schedule.

5.3 Lifecycle Data Management

The Data Privacy Policy and framework are designed to provide efficient and systematic control of the collection, processing, and disposition of personal information throughout its lifecycle based on relevant laws and regulations and internationally recognized best practices. In implementing the framework, the Company's employees, contractors, and vendors all have a responsibility to protect personal information throughout the various stages of its lifecycle, as shown below in Figure 5-2.

- ***Collection*****:** Give notice and obtain consent where appropriate to collect information and only collect what is needed for the intended purpose.

- ***Storage*****:** Store personal information securely to protect it from unauthorized or unlawful processing and against accidental loss, destruction, or damage.

- ***Use and disclosure*****:** Only process information for the use specified during collection and disclose on an authorized need to know/have basis.

- ***Access and updating*****:** Provide individuals with access to the information held about them and allow them to make corrections.

- ***Transfers:*** Only transfer personal information to approved companies and/or countries that have or can provide adequate levels of privacy protection through contractual agreements that specify the privacy and security requirements.

- ***Retention:*** Retain personal information only for as long as necessary in accordance with the Company's records retention policies.

- ***Disposal:*** Dispose of personal information safely and securely.

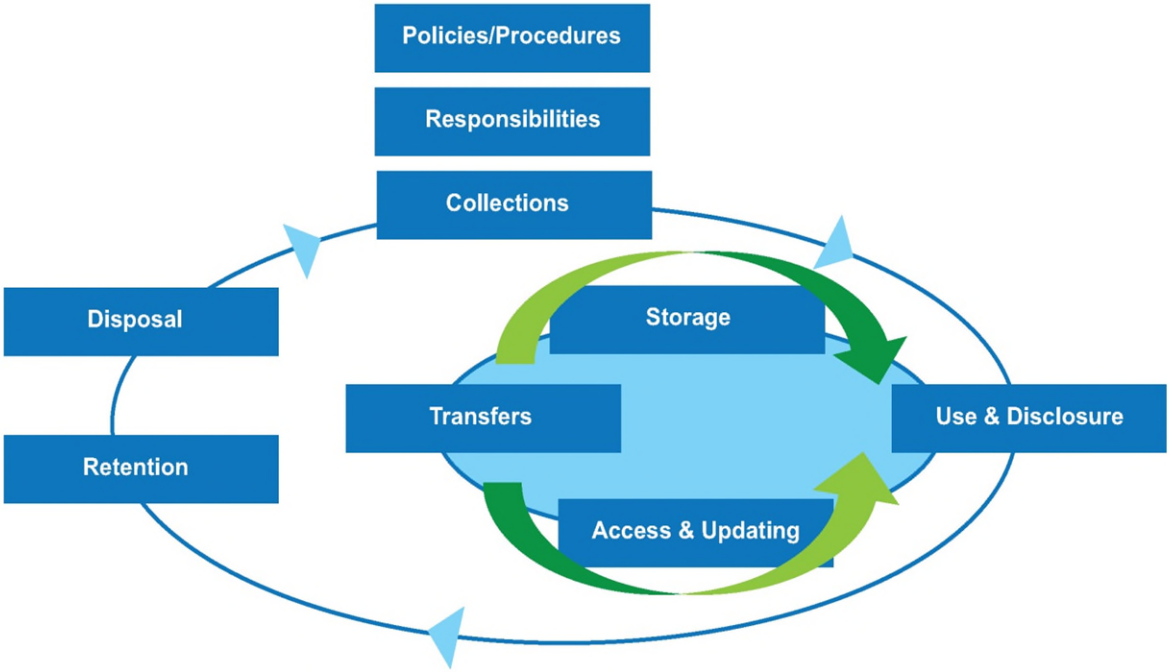


Figure 5-2: Data Lifecycle

The Company's current Data Privacy Policy recognizes that consumption data constitutes personal information and that many of the privacy concerns can be mitigated by limiting the processing of personal information to what is necessary. Limiting the processing of personal information is a key data privacy management principle. Where there is an operational need for personal information, The Company has implemented controls to ensure that the processing of such information is restricted to what is necessary.

5.4 Data Governance and Privacy Program Management

The Company's data privacy program management is led by the Group Assurance Department's Global Information and Records Management (GIRM) team. The GIRM team oversees a network of subject matter experts (SMEs) and members through routine reporting and meetings to track progress and manage delivery of data privacy responsibilities/activities. As shown in Figure 5-3 below, the GIRM team networks include: A Data Privacy Forum; data privacy champions embedded in all business units controlling PII; and a Community of Practice Forum that includes a network of data privacy SMEs and records coordinators in every business area. The objectives of the program include: maintenance and updating of data privacy policies, procedures, training, and communications to ensure the highest level of protection for customer and employee personal information.

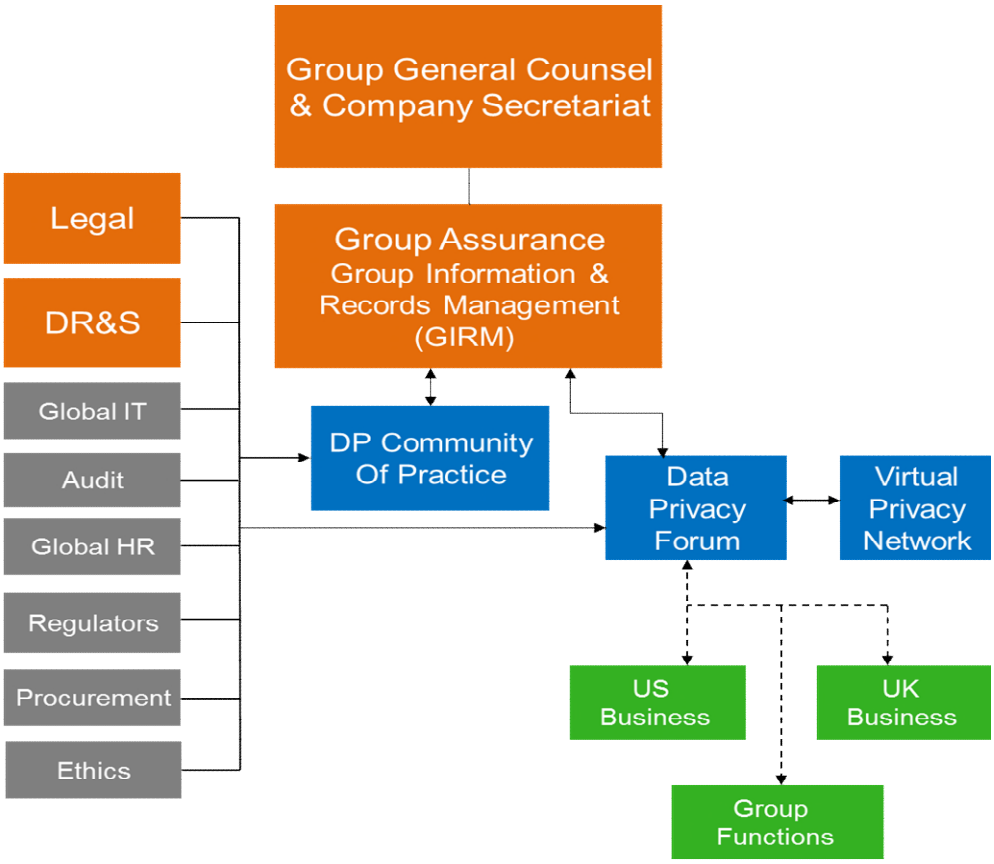


Figure 5-3: Data Privacy Governance

Energy usage data the Company collects is managed in a manner intended to protect the data from unauthorized access. For example, protocols are applied to the Company's Upstate New York affiliates Clifton Park Demonstration project where the Company collects 15-minute interval customer energy usage data. The data is processed by the MDMS, which creates billing determinants and distributes the data to downstream systems (e.g., the CSS, Advanced Analytics and Energy Forecasting Department and the demonstration project's customer engagement vendor). The meters retrieve 15-minute interval information and pass the meter reads to the MDMS. The data is then transferred from the MDMS to the Company's customer billing system, CSS, where the data is combined with the applicable customer information and becomes PII. The Company retains customer billing data on the CSS servers, as well as on vendor servers located in the United States. The energy data flow is generally depicted below in Figure 5-4 and serves as a good conceptual illustration for the collection and internal management of data within a large-scale AMF deployment.

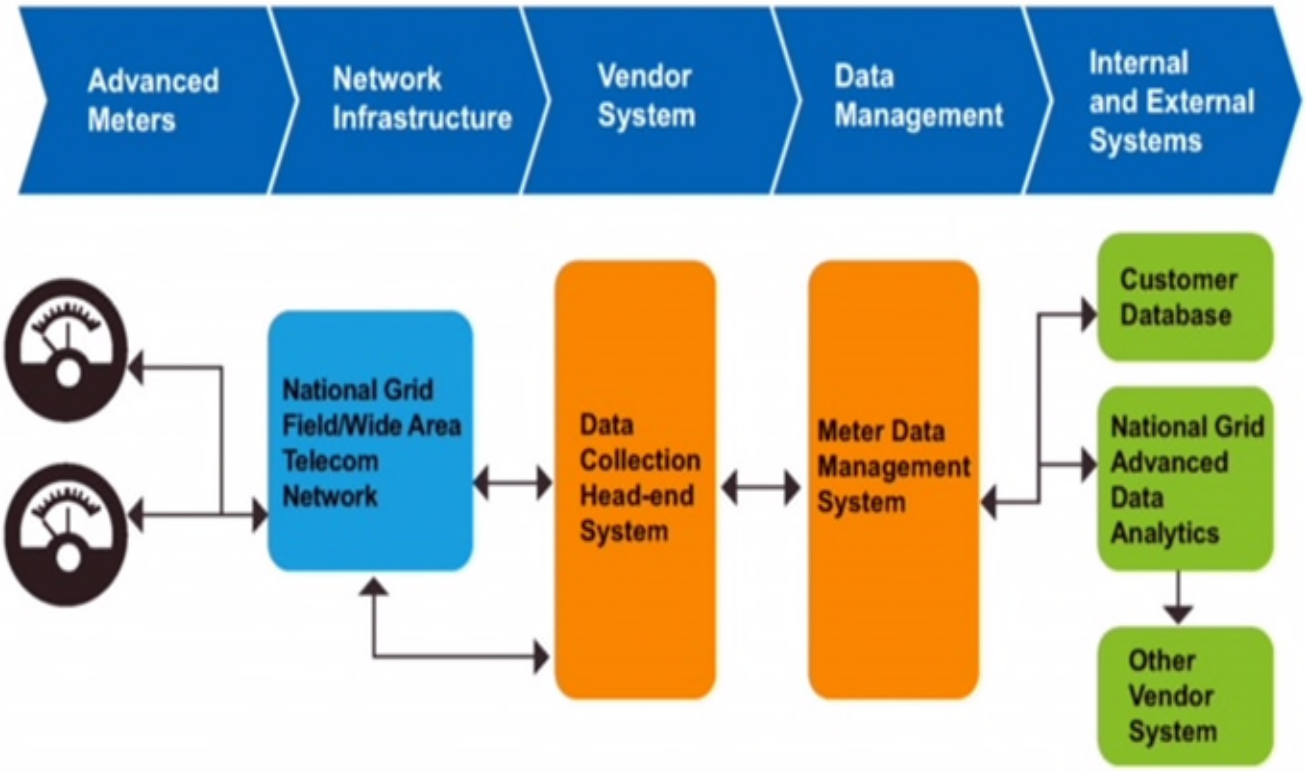


Figure 5-4: Energy Data Flow

5.5 Data Usage

The Company will use energy data only for authorized purposes such as billing, internal data analytics, and to assist customers with managing their consumption and/or lowering their energy bills. Any transfer or use of energy data outside of the Company will only be done with the customer's consent or express approval of the Commission. The Company has developed a customer-facing smart meter privacy statement to specifically inform customers how it collects, stores, utilizes, and protects the smart-meter energy data. The customer-facing smart meter privacy statement will be provided to customers prior to receiving their smart meter and, it will also be made available on the Company's website, and by request at any time. Please see the Smart Meter Privacy Statement (Appendix) for more details.

5.6 Third-Party Data Access

The Company has developed policies, standards, and guidelines that govern data access and the protection of sensitive information that requires information to be classified appropriately and protected in accordance with the classification. This Data Privacy Policy states that personal information will not be disclosed unless:

- The disclosure is fair and lawful and consistent where appropriate, with the notified purpose(s); or
- The individual has given appropriate 'consent;' or
- The disclosure is necessary (e.g., in the individual's vital interest); or
- The disclosure is covered by 'exemption' from any relevant legislation.

Requests requiring disclosure of PII through the judicial, regulatory and/or criminal investigation processes are exceptions and must be referred to legal counsel and/or the data privacy leads for review and approval unless there is an established approved procedure in place. Personal information relating to employees, customers or vendors may only be forwarded to a National Grid business affiliate if applicable legal requirements are met and if:

- The transfer is based on a clear business need and is undertaken securely;
- The receiving business provides appropriate security for the personal information; and
- The receiving business ensures compliance with this National Grid's policy for the transfer and any subsequent processing.

The Company may also be required to transfer PII to select third parties that have been contracted to perform certain services. Transfers to such third parties will only take place if (in addition to the other relevant policy/implementation framework requirements) the third party agrees to:

- Comply with relevant privacy laws and the businesses policies and procedures;
- Process personal information strictly in accordance with the businesses instructions;
- Implement appropriate security measures to deliver the required levels of protection;
- Seek permission from the National Grid for further onward transfers (e.g., to sub-processors);
- Promptly report to National Grid any breaches, risks or issues to personal information;
- National Grid's right to audit the third party for compliance with the data privacy policies and procedures; and
- Either return the personal information or dispose of it securely upon termination of the agreement.

There are two ways in which the Company can provide access to customer usage information. In the event that the Company provides access to customer usage information to an authorized third party vendor, the third party is required to enter into a contractual relationship with the Company. The contract will contain the Company's standard NDA and information security addendum. The NDA sets forth the terms upon which the third party will ensure that energy usage data it accesses will remain confidential and not be disclosed to unauthorized parties. The information security addendum included is consistent with relevant data privacy laws in the states where the Company and its affiliates operate. The addendum contains provisions to ensure that a third party has the necessary policies and infrastructure available to protect the information that it holds on behalf of the Company's and its customers. Further, it contains provisions regarding the obligation of the third party to notify the Company in the event of a breach of the information and to indemnify the Company for any losses that it may incur as a result of the third party's negligence in connection with any breach.

In the event that access to customer usage information is provided to an authorized third party or NPP, the Company requires the third party to enter into a DSA and submit a self-attestation regarding compliance with certain minimum cybersecurity requirements. The DSA sets forth the terms upon which the third party will ensure that customer and energy usage data it accesses will remain confidential and not be disclosed to unauthorized parties. The DSA is required for any third party, such as NPPs, ESCOs, EDI vendors, and certain DER Suppliers. The DSA contains provisions to ensure that a third party has the necessary policies and infrastructure available to protect the information that it holds on behalf of the Company and its customers. Further, it contains provisions regarding the obligation of the third party to notify the Company in the event of a breach of the information and to indemnify the Company for any losses that it may incur as a result of the third party's negligence in connection with any breach. While energy usage data is not statutorily considered PII, the Company's policies and procedures including the requirement of the aforementioned contractual provisions essentially treats it as such.

5.7 Data Retention

The Company retains energy usage data for six years for the collection of the following data types:

- The meter read interval (i.e., the time frame when the meter is read);
- The customer number or account number (depending on the account); and
- The actual meter read.

5.8 Regular Data Privacy Impact Assessments (PIAs)

The Company ensures that an individual's right to privacy is safeguarded, personal data is used only as intended, and that precautions preventing misuse or loss are both effective and appropriate through regular Data Privacy Impact Assessments (PIAs). The PIAs are a mechanism the Company uses to assess its data collection and management practices.

5.9 Privacy by Design

Privacy by Design is a process to identify data privacy concerns before implementing, transforming, upgrading, or replacing a program or system. The Company uses this pre-launch approach to proactively analyze and reduce the risk that PII may be misused when the Company implements the new initiative. The Company assesses the potential impact on an individual's PII throughout the lifecycle of the new program. National Grid already conducts PIAs for projects and change programs that involve the processing of sensitive PII such as credential, financial or health information; such assessments are also an integral part of the Privacy by Design approach. National Grid completed an initial PIA to understand the current strategy and develop a baseline of potential privacy risks. The maintenance of an accurate register of types of personal information used by the business and the adoption of the Privacy by Design approach are critical components of the Company's data privacy strategy and will be carried out as part of AMF implementation.

5.10 Constant Vigilance

The Company reviews its data privacy policies and standards on an annual basis (and more often if circumstances require). For example, new and emerging laws, regulations (and security related intelligence) are continually monitored and the impacts assessed to ensure the Company's privacy practices continue to evolve to meet current and anticipated future obligations and safeguard against emerging privacy threats, vulnerabilities and associated risks. The Company proactively addresses many of the privacy related issues through internal training, such as its mandatory Learning Link curriculum, and it makes the policies available to all employees and contractors through the Company's intranet site. Likewise, the Company works to ensure that vendors who have a business need to work with protected information become familiar with the Company's policies during the on-boarding process.

In addition, the privacy provisions in the Company's data privacy framework, include: annual privacy training and ongoing awareness communications and activities to all employees, contractors, and third parties who have access to PII. National Grid will (in accordance with the Department of Energy Voluntary Code of Conduct) educate consumers and other individuals about the privacy risks associated with the evolution of the grid and opportunities for mitigation.

Education of data privacy and security will be included within each of the three phases of the Updated AMF Business Case's Customer Engagement Plan.

5.11 Augmenting Data Privacy Principles

When this AMF filing is approved by the State of Rhode Island the Company is will consider the incorporation of additional high-level principles of conduct for both utilities and third parties as set out in the DOE's *Data Privacy and the Smart Grid: A Voluntary Code of Conduct (VCC)*.[21] The principles would augment the Company's existing policies, procedures, and statements, in particular those that are customer facing:

- ***Customer Notice and Awareness*:** Develop practices that explain on a recurring basis the data collection policies and procedures to customers, focusing on customer options and responsibilities.

- ***Customer Choice and Consent*:** Develop processes that continue to empower customers to control access to customer specific data for secondary purposes (*i.e.*, to authorize differential access to multiple third parties, limit the duration of access, keep a record of data releases, rescind authorizations, and dispose or de-identify data once authorization or the need for the data has expired). The Company will identify the data types and disclosures that do not require customer consent, including requiring certain data to be obtained directly from the customer.

- ***Customer Data Access*:** Refine procedures that allow customers to access data, identify and correct possible inaccuracies, and include potential fees for non-standard requests.

- ***Data Integrity and Security*:** National Grid's data privacy program includes methodologies for creating aggregated or anonymized data.

- ***Self-Enforcement Management and Redress*:** Establish procedures that customers the opportunity and process to challenge National Grid's compliance with its privacy statement and privacy practices (*i.e.,* compliance with the VCC).

[21] DOE, *Data Privacy and the Smart Grid: A Voluntary Code of Conduct,* https://www.energy.gov/oe/downloads/data-privacy-and-smart-grid-voluntary-code-conduct;

5.12 Incident Responses for PII Breaches

The Company's Information Security Incident Management Policy ensures that a consistent and effective approach is applied to the Company's response to and management of information security incidents, including privacy-related breaches. Privacy-related breaches can involve customer PII. PII is treated as confidential information and any suspected breach triggers an incident management response. Following an investigation by the Incident Response Team, a determination will be rendered by the Legal Department regarding whether a breach of PII has occurred. In the event the investigation reveals that a breach has occurred, customers will be notified as legally required. National Grid has developed a series of playbooks covering a number of breach scenarios, including a Privacy Incident Playbook, which sets out how National Grid would deal with a breach response and a notification event.

The management of incidents involving personal information often requires close coordination among personnel from across the organization, such as the Chief Information Officer, Chief Information Security Officer, group data privacy leads, the system owner, the department responsible for managing the data, legal counsel, and public relations officer. The cyber incident response process defines roles and responsibilities and ensures that the right people are included in the incident.

In addition to a real privacy-related breach, a data privacy breach exercise involving customer personal information is conducted on an annual basis and lessons learned are captured and fed back into the Company's incident response plans. For specific incidents as defined by the incident response process, a post-incident review is performed, and lessons learned are captured. Lessons are either immediately incorporated into response plans, mitigating controls, or any residual risk is logged, tracked and managed. The procedures are regularly tested to identify potential breaches and misuse of personal information including the timeliness of breach notifications when necessary.

6. Conclusion

The Company's comprehensive Data Governance and Management Plan, which in the context of an AMF deployment, provides the standards and principles for data access, privacy, security, management, and sharing. It also details how the Company plans to evaluate new value-added channels, platforms, and means to share AMF-enabled customer and system data in the future. This Data Plan is aligned with the ASA and offers a path forward in developing a robust collaborative forum and framework to discuss and explore new data use cases with key stakeholders and interested third parties. Through this framework, the Company can ensure existing, new, and yet-to-be-created data use cases align with data access principles, as well as privacy and cybersecurity requirements, and that they are delivered in a secure and safe manner for the benefit of all Rhode Island customers.

7. Appendix: Smart Meter Information Privacy Statement

NATIONAL GRID SMART METER INFORMATION PRIVACY STATEMENT

National Grid is committed to protecting our customers' privacy. National Grid offers our customers smart meters, which are modern versions of the analog meter still used in most homes. Smart meters allow for the collection of more accurate and detailed electricity usage data and enable the wireless communication of home energy usage.

National Grid collects smart meter energy usage data for the purpose of servicing our customers' accounts, encouraging our customers to become more energy efficient through providing them with access to smart meter data, and other operational and grid benefits. Smart meters do not store or transmit personal information, this Privacy Statement outlines how and why customers' smart meter energy usage data is collected, used and disclosed by National Grid.

This Privacy Statement applies to the collection, use and disclosure of customer smart meter energy usage data only.

TYPE OF DATA COLLECTED

Smart meters store and communicate customers' electric energy usage data, which includes the meter identification number, the amount of energy used, meter events and alarms and the time interval during which the energy was used. A customer's meter identification number is associated with geolocation; however, geolocation data is not deciphered until encrypted smart meter usage data has been transmitted to National Grid and decrypted on our secure systems.

National Grid only collects smart meter energy usage data: 1) as is reasonably required to provide our utility services to customers; 2) as approved by regulatory agencies; and 3) as required by law. We do not collect any personally identifiable information (such as social security numbers) through our customers' smart meter.

HOW WE USE AND DISCLOSE SMART METER DATA

National Grid will only collect, process, retain, use and disclose smart meter energy usage data for legitimate National Grid utility-related business purposes. Specifically, we use that data for billing purposes, to identify trends in energy usage, develop and promote programs and initiatives to encourage more efficient energy use by our customers, manage demand for electricity, inform customers about their energy usage and the utility programs and services available to customers, and provide quality service. National Grid will only share smart meter

energy usage data with third parties when there is a business purpose and if there is a contractual agreement in place with the third party that includes privacy and security measures to protect the data. We may also use this data for purposes of sending customers communications related to their energy usage.

However, National Grid may be required to disclose smart meter energy usage data to comply with applicable legal processes or requests from government or judicial authorities, or to comply with requirements or directives of our governing regulatory agencies.

We may also disclose customers' smart meter energy usage data to a third party in the event of any reorganization, merger, sale, joint venture, assignment, transfer or other disposition of all or any portion of our business, assets or stock (including in connection with any bankruptcy or similar proceedings).

DATA ACCESS

National Grid collects the smart meter energy usage data as part of its normal course of business and will only use and share that data as set forth herein. In order to effectively render services, maintain safety and reliability, and carry out other business purposes, National Grid must have access and control over the data. However, should you wish to access your data, you may do so by:

- Logging onto your National Grid account online
- Contacting National Grid's Customer Service Center
- By mail by sending in this form
- By email National Grid at USDataPrivacy@nationalgrid.com

SECURING SMART METER DATA

National Grid has implemented reasonable physical, technical and administrative security measures to safeguard smart meter energy usage data. Specifically, National Grid works with a third-party vendor to safeguard the transmission of smart meter usage data across the entire technology infrastructure, which includes the meter itself, the communications network (which transfers meter data via a radio-frequency network) and the system that aggregates and analyzes the data for billing and operational purposes. Further, all data transmitted from the smart meter is encrypted and de-identified. Customers' names and addresses are not tied to the data until it reaches National Grid's secure systems.

National Grid employees and third-party contractors may not (i) access, remove, disclose or use smart meter energy usage data (other than for legitimate business purposes to only those with a need to know this information) or (ii) assist others in such access, removal, disclosure or use. All employees and contractors who have access to smart meter energy usage data are required to

maintain the confidentiality of that information. This restriction applies during employment with National Grid or engagement as a contractor, and after the employment or engagement ends.

RETENTION AND DISPOSAL

National Grid disposes of smart meter usage data in accordance with its record retention and disposal guidelines. National Grid does not retain smart meter usage data for longer than is reasonably necessary to carry out its business functions and services.

CONTACTING US

If there are any questions about this Smart Meter Information Privacy Statement or if a customer would like to request a copy of your energy usage data, please contact:

National Grid
Data Privacy
175 East Old Country Rd
Hicksville, New York 11801
USDataPrivacy@nationalgrid.com;

Effective Date: _____

Attachment C
Time Varying Rates

Time Varying Rates Overview

Table of Contents

Appendices

List of Figures

List of Tables

Executive Summary

Context in the Advanced Metering Functionality and Grid Modernization Plan Filings

This time varying rates (TVR) overview complements Narragansett Electric Company d/b/a National Grid's (Narragansett Electric or the Company) Updated Advanced Metering Functionality (AMF) Business Case (Updated AMF Business Case) and Grid Modernization Plan (GMP). The Updated AMF Business Case presents the results of the Company's Benefit Cost Analysis (BCA) work. This TVR overview provides an in-depth consideration of more theoretical issues surrounding TVR, which helps substantiate the choices modeled in the Updated AMF Business Case. Upon approval of AMF, the Company will continue to work with the Commission and stakeholders to lay out a path forward to leverage AMF to design and implement suitable TVR frameworks for all rate classes.

One of the major benefits that AMF creates is the ability to offer more advanced TVR, which is important for related sets of reasons. First, by more accurately reflecting the costs of producing and delivering electricity, TVR promote economic efficiency, which will lead to a lower-cost system. Second, when the prices consumers pay are more closely aligned with the costs they represent, TVR promote a more fair, equitable allocation of electricity sector costs.

The Company is not making a rate design proposal in the Updated AMF Business Case or in this TVR overview document. Instead of presenting a single proposal, the Company lays out a series of considerations that influence TVR, and develops a suite of options for the Rhode Island Public Utilities Commission (PUC) to consider. The insights from this research apply across all rate classes.

Criteria, Basics and Customer Perspective

The Company uses the principles of rate design adopted in Docket No. 4600 to guide its approach to an assessment of TVR. For the purposes of economic efficiency, in a regulated industry, rates should be set at the level of marginal costs. This section introduces the basic tools of rate design: fixed, volumetric (per kWh) and demand based (per kW) charges. On a typical residential electric bill, almost two thirds of the costs are related to supply. Thus, the first interventions for TVR may start on supply, the largest bill elements.

Recent research conducted by the Company with Rhode Island customers found extremely high (approximately 80%) interest in TVR. The greatest drivers of the group of customers who were interested in TVR were the potential to reduce their bills and gain greater control of energy usage.

Supply and Delivery Rate Design Options

Sections three and four present a menu of supply and delivery rate designs. Each section begins with an assessment of the nature of costs attributable to both supply and delivery before moving on to appropriate rate designs.

The supply spectrum compares today's time invariant flat pricing to real-time pricing with properly allocated time-determined charges for capacity and transmission. Delivery rate designs are presented that span the range from the status quo of flat volumetric pricing to combinations of charges that more accurately capture network conditions at local and system-wide levels.

Modeling Approach in the BCA Analysis

To support the AMF BCA, the Company developed an illustrative rate design that included a time-of-use (TOU) rate to capture the variation in energy prices and a critical peak pricing (CPP) rate that reflects generation capacity costs that are a major driver of the supply (*i.e.*, commodity) charges on customers bills. Given its demonstrated record of success, the illustrative TOU/CPP rate represents a reasonable potential next step for default residential supply rates and thus a viable baseline against which to test any future alternative rate designs. The TOU/CPP rate generates meaningful benefits for customers through bill savings while balancing competing design criteria. The Company would, pending Commission approval of AMF, propose TVR that deliver benefits equal to or greater than those modeled in the Updated AMF Business Case.

Benefits of TVR

Section six focuses on the benefits of TVR. The first subsection discusses the improved economic efficiency of TVR, while the second focuses on equity. Moreover, TVR is consistent with evolving customer expectations and increased demand on the electric system, and consistent with Rhode Island's public policy goals.

Income-Eligible Customers and TVR

Section seven focuses on the experience of income-eligible customers on TVR, and the Company's goal to make sure that all customers benefit from the introduction of TVR.

Studies show that income-eligible customers perform like other customers with similar load profiles and save similar quantities on their utility bills. For the purpose of modeling in the Updated AMF Business Case, the Company did not differentiate between income-eligible and all other customers in terms of response rates. The Company's own research suggests that across customer types, income-eligible customers are among the most interested in TVR and the potential for savings. The Company commits to work to make sure that income-eligible customers share in benefits of TVR.

Emerging Issues: TVR and Retail Choice, TVR as Default Service and TVR as Compensation for Distributed Generation

TVR and Retail Choice

This subsection focuses on Texas, which is the jurisdiction most committed to a full AMF rollout and full retail choice for all residential customers. In Texas, roughly 20% of residential customers now opt into a plan with TVR and the share of customers who chose TVR has increased steadily every year.

TVR as Default

Ontario, Canada became the first jurisdiction, nearly a decade ago, to introduce TVR for its default regulated rates for residential customers. California is in the midst of transitioning most full-service residential customers of its major investor-owned utilities (IOU) to TVR in 2019 and 2020.

TVR as compensation for distributed generation

AMF offers the potential for more accurate rate design for consumption and in reverse, program design for compensation for distributed generation. However, significant quantities of analysis suggest that volumetric TOU for delivery services, if not properly designed, can exacerbate the cost shifts inherent in net energy metering (NEM).

Conclusion

National Grid is committed to delivering a safe, reliable and cost-effective energy system to Rhode Island. AMF is an important part of the update to the technology package the Company needs to meet increasing operational and customer demands. TVR offers the potential to more accurately price energy and energy services. Such rates can lower costs for customers over long time horizons and allocate costs more fairly as soon as they are implemented.

Following the approval of AMF, the Company will propose a set of TVR that deliver benefits to customers that meet or exceed those modeled in the Updated AMF Business Case in the next suitable future filing.

The Company suggests the following priorities for TVR, all of which adhere to Docket 4600 principles:

- Recognition of the importance of the capacity product in driving procurement costs. The capacity element of the rate should carefully reflect how those costs are incurred and be split from variation in the energy market.

- Elements which capture both the seasonal and daily variation that are prevalent in the regional market and which are robust to changing conditions.

- Delivery rates that move from flat volumetric constructs to demand-based rates that reflect system dynamics.

1. Introduction: TVR and Context in the AMF Filing

As an introduction, this section places this report about TVR in the overall package related to Updated Business AMF Case and the Grid Modernization Plan and delineates the structure of the report.

One of the major benefits that AMF offers the Company and the energy system at large, and ultimately and most importantly customers, is the ability to offer TVR that better reflect the actual cost of both supply and distribution service. TVR are simply defined as rates where the price changes over time. TVR may be applied to volumetric or demand-based billing elements. This report focuses on the considerations related to using TVR for residential customers.

TVR are important for two reasons, both of which benefit customers. First, by more accurately reflecting the costs of producing and delivering electricity, they promote economic efficiency which will lead to a lower-cost system. Second, by more closely aligning the prices consumers pay with the underlying costs they represent, TVR promote a more fair, equitable allocation of electricity sector costs to the customers responsible for those costs.

Moreover, TVR are a powerful tool in the fight against climate change. Clean electricity paired with increased electrification of sectors which previously relied on fossil fuels will be a backbone of a more sustainable economy. Under this scenario, which places new demands on the electric sector, it will be even more important that electric services are priced fairly and appropriately. If the variation in carbon emission rates become priced into TVR, thus aligning off-peak periods with the lowest carbon generation, customer behavior response can facilitate a cleaner sector.

In the Updated AMF Business Case and associated attachments, including the related testimony, the Company seeks approval of the AMF program, but does not seek approval or endorsement of a specific rate design or multiple rate designs.

This TVR filing should be read as a complement to the Company's Updated AMF Business Case and GMP. The Business Case presents the results of the Company's Benefit Cost Analysis (BCA) work. In order to facilitate that modeling exercise, the Company selected one set of rates, and ran sensitivity analyses based on customer response to estimate the range of reasonable benefits and serve as a proxy for the calculation of benefits of alternative rate designs. The details of this example rate and how its impacts are quantified in the BCA and appear in the Updated AMF Business Case rather than in this document. Instead, the Company uses this document to present an in-depth consideration of more theoretical issues surrounding TVR which helps substantiate the choices modeled in the Updated AMF Business Case. There are many rate constructs, including those discussed later in this report, which may deliver similar benefits to the rate modeled in the Updated AMF Business Case. AMF and TVR are

complementary to the GMP, which presents activities and investments to provide for more precise management of the distribution electric grid across a range of customer distributed energy resource (DER)[1] adoption levels through the period ending in 2030.

Upon approval of AMF, the Company will propose a set of TVR in the next suitable future filing, subject to the direction of the Commission. There are multiple reasons the Company is taking this step-wise approach, with approval of AMF preceding approval of a specific set of TVR. First, it is the most expeditious way to implement the principles and outcomes from Docket 4600, which shape the Company's approach. There was broad agreement that the Company should adopt TVR; the PUC summarized the consensus of the time as: "Stakeholders all agreed with the adoption of time-varying rates at some future time…"[2] Adopting AMF is a necessary precursor to proceeding with TVR. While the AMF deployment proceeds, the Company and stakeholders can work to develop the TVR framework. Following Commission approval of a TVR structure, the Company commits to implement it in a fashion that delivers greatest benefits to customers. Finally, the Company is following the guidance of the Amended Settlement Agreement (ASA) which stipulates that the Updated AMF Business Case shall contain "Assumptions upon which a proposal to develop time varying rates will be based."[3]

In the Updated AMF Business Case, the Company provides an illustrative rate design which delivers significant benefits to customers. Any TVR design offering comparable benefits, when added to the other quantified benefits in the Updated AMF Business Case, would support the AMF filing as well. The broader treatment here may catalyze the process of consideration of rate design which will occur in a subsequent proceeding. The Company met with the Power Sector Transformation (PST) Advisory Group from late 2018 through late 2020 and discussed this approach with the stakeholders in the first few months of meetings. In general, Stakeholders supported this approach.

The Company is engaged in work on rate design across its operating jurisdictions and can leverage those experiences to the benefit of Rhode Island customers. For example, the Company has conducted multiple rate design pilots in its New York and Massachusetts affiliates whose outcomes have informed the Company's work in Rhode Island. Additionally, the Company has learned extensively from national studies. Finally, in preparation for this AMF work, the Company has undertaken a full study of AMF deployments across North America with a particular focus on TVR implementation and BCA methodologies.

[1] DER is defined here as a resource sited close to customers that can provide electricity generation (e.g., solar PV, wind turbine, CHP) or flexible demand (e.g., energy storage, EVs, electric heat pumps).

[2] *See Investigation Into the Changing Electric Distrib. Sys. and the Modernization of Rates In Light of the Changing Distrib. Sys.,* Docket No. 4600, Report and Order No. 22851 at 10 (July 31, 2017).

[3] Amended Settlement Agreement, Article II, Section 16.B.

Following this introduction, the TVR report consists of eight chapters:

1. Chapter two discusses rate design principles, criteria, and the current state including practices in Rhode Island and customer perspective;
2. Chapter three discusses rate design approaches across supply;
3. Chapter four discusses rate design approaches across distribution;
4. Chapter five describes the illustrative rate which feeds into the BCA model;
5. Chapter six offers a qualitative description of the benefits of TVR, with greater quantitative depth in Appendix B;
6. Chapter seven discusses the relationship of TVR and income-eligible customers, with greater quantitative depth in Appendix C; and
7. Chapter eight discusses other emerging issues on TVR, including the interplay of AMF and retail choice, experiences with default TVR in other jurisdictions, and the interaction of TVR for distribution and net energy metering (NEM).
8. Chapter nine concludes.

The Company is committed to developing a TVR structure that supports Rhode Island's Docket 4600 principles and delivers benefits to customers. Chapters 3 Supply Rate Design Options and 4 Distribution Rate Design Options map a range of rate design constructs against those twelve principles and make the tradeoffs inherent in any choice explicit.

2. Rate Design Basics: Principles, Criteria and Current State

This chapter aims to achieve a baseline understanding of the current state of rate design. First, it introduces fundamental principles before moving to available tools. Then, it focuses the current state on the customer, including the components of the current electricity bill in Rhode Island and customer interest in TVR. Finally, it establishes that the Docket 4600 principles form the basis of the criteria for evaluating rate options.

2.1 Theory of regulated prices

Economic theory suggests that in efficient markets, prices for goods are equal to their marginal cost. The Docket 4600 principles endorse this notion as well. Principle 2 calls for rates that promote "economic efficiency over the short and long term"; Principle 3 calls for rates that provide "efficient price signals that reflect long run marginal cost" and Principle 12 discusses "appropriate investments" which also suggests marginal cost pricing. However, current pricing practices do not approximate marginal cost pricing for either supply or delivery. AMF offers the electricity sector the ability to fix this mismatch.

In the region, including Rhode Island, the presence of the organized market for bulk energy services means that customers receive some services for which there is a functioning market and some for which there is not. In the former case, where there is a market for generation and related attributes, and prices reflect marginal costs, an efficient structure for TVR reflects those outcomes. In the latter case, for network costs, where markets are incomplete, other tools and studies can help produce improvements that approximate marginal costs and can be translated into just and reasonable rates. It is critically important that any TVR properly account for the types of costs it seeks to capture.

For AMF and rates to fulfill the possibility of a lower cost system, the marginal costs that customers see through rates should be aligned with marginal system costs. In complementary fashion, all externalities would be internalized, although such complete pricing is rare in practice. Efficient rates should differentiate between fixed and marginal costs. The distinction is a matter of timing. Fixed describes investments that have already been undertaken or approved or for in-flight projects and activities with set budgets. Marginal costs describe costs to provide the next unit of service, and, by definition, are incurred in the future. Marginal costs are driven by customer behavior, such as the decisions about when and how much energy to consume. Under efficient rate design, customers who lower their costs also lower system marginal costs and in turn deliver lower total system costs. However, there are many costs, notably those in the network or generation capacity, that have already been incurred to build the existing system and thus cannot be reduced by changes in customer behavior. Rates are necessary to recover those costs in an equitable manner. However, when rates are set such that some customers can avoid paying their share of those fixed costs, they necessarily transfer those to other customers who pay more to make up the difference without lowering total system costs.

2.2 Rate Design Tools

Rates in the electric sector have classically relied on three major types of tools: 1) fixed or customer charges; 2) volumetric charges based on the delivery of energy (kWh) in a billing period; or 3) demand charges based on the maximum demand in power (kW) over a given period of time in a billing period. The latter two can be fixed across the entire billing period, in which case they are time *invariant* rates, as they are in most traditional rate designs. Alternatively, they may be the building blocks for more advanced, customer-friendly TVR when the prices per kWh or per kW are different from one period of time to another within the same billing period. Rhode Island's current residential rate design includes a fixed charge and time invariant volumetric rates to recover costs related both to supply and distribution.

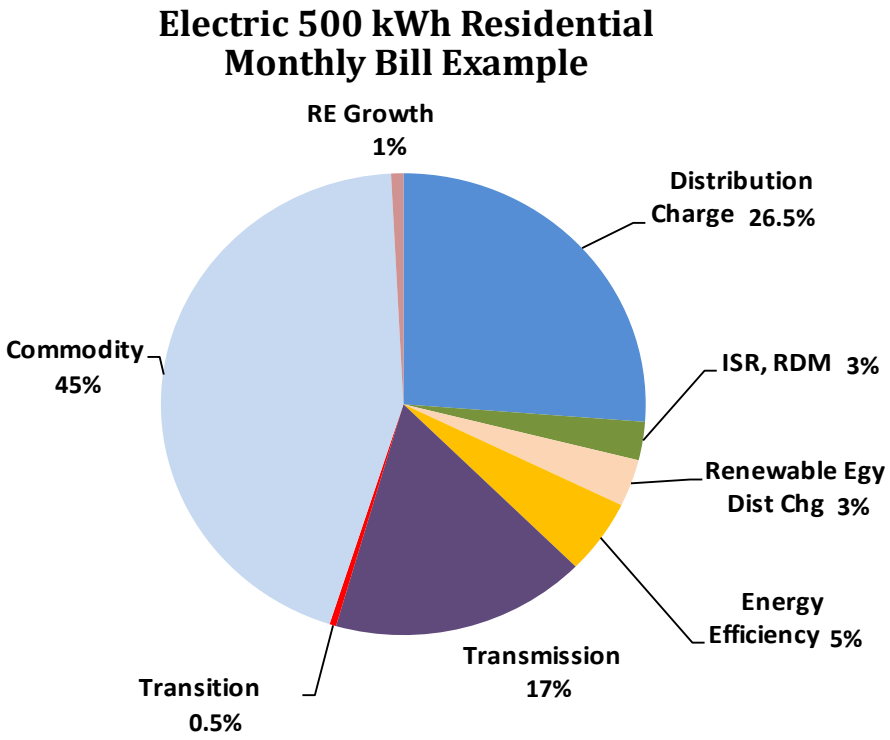
Both volumetric and demand-based rates can be used as time varying elements for different components of the customer bill, notably the supply/commodity, transmission or delivery components. Under volumetric TVR, the customer pays a different price per-kWh depending on when the energy is delivered. For example, a rate may vary by day or vary by time within the

same day. Similarly, demand charges can be priced differently depending on when the demand occurs. Demand charges can also be used for both the supply and distribution components of the customer bill. For example, capacity charges which are set based on a customer's usage during the system peak hour, are a type of demand charges for supply. Capacity charges are time-variant: demand measured in the peak hour is charged at the prevailing rate for capacity, while demand outside that hour is not charged a capacity charge. On the delivery side, the current rate structure for large customers in Rhode Island on the General Service G-32 rate, employs a time-differentiated demand charge where only demands on-peak set the customer's delivery charges. The on-peak periods are 8 a.m. – 10 p.m. June through September, 7 a.m.– 10 p.m. December through February and 8 a.m.– 9 p.m. October through November and March through May for non-holiday weekdays.

2.3 A Typical Bill

The costs on a Rhode Island residential customer's bill may be classified into one of eight categories. Figure 1 presents the share of those costs for a typical residential customer with 500 kWh of usage for a month.

Figure 1: A Typical Residential Bill



Over half of the bill (62.5%) concerns elements of the bulk electrical system, which includes commodity (45%), transition (0.5%), and transmission (17%) charges. Transmission charges include both charges from ISO-NE and more local transmission charges.

Another 9% of the bill includes costs to implement state programs, including Energy Efficiency (5%), long term renewable energy contracts, net metering (3%), and the Renewable Energy Growth Program (RE Growth, 1%).

Finally, those charges related to distribution are represented by the Distribution Charge (26.5%) and include base distribution rates, the Infrastructure, Safety and Reliability (ISR) Plan, the Revenue Decoupling Mechanism (RDM) factor (3%), recovery of low-income programs, and incremental funding to the storm contingency fund, and comprise just under 30% of the total bill.

2.4 Rate Design Criteria

In Docket 4600, a stakeholder working group created twelve rate design principles which the PUC adopted to guide future work on the topic. These rate design principles are included as Appendix A.

The principles indicate that there should be both quantitative and qualitative examination of potential novel rate designs. For example, Principle 2 "promoting economic efficiency over the short and long term" can be modeled quantitatively through the measurement of costs, benefits, and consumer and producer surplus. Similarly, rate designs may be examined for their bill and revenue volatility. In some cases, principles include both quantitative and qualitative elements. For example, Principle 9 that "any changes in rate structures are implemented with due consideration of the principle of gradualism allowing ample time for customers (including DER customers) to understand new rates" posits a series of qualitative tests and calls for "lessening immediate bill impacts" which will be estimated quantitatively.

The Docket 4600 principles clearly recognize that any TVR design must work for all Rhode Island customers. At least three of the principles center the customer: Principle 5, rates must "empower customers to manage their costs"; Principle 8 which states rates must be "transparent and understandable", and Principle 10 which states rates must provide "opportunities to reduce energy burden and address low income and vulnerable customers' needs." The Company will demonstrate how the rate construct it employs in the Updated AMF Business Case meets these and other Docket 4600 principles. Chapters 3 and 4 also introduces other potential rate design packages for future consideration and assesses how they meet Docket 4600 principles. However, no one rate design performs best along all the Docket 4600 principles. Any choice of rate design will involve tradeoffs among the principles.

2.5 Customer Interest in TVR

The company has engaged in two recent research efforts:

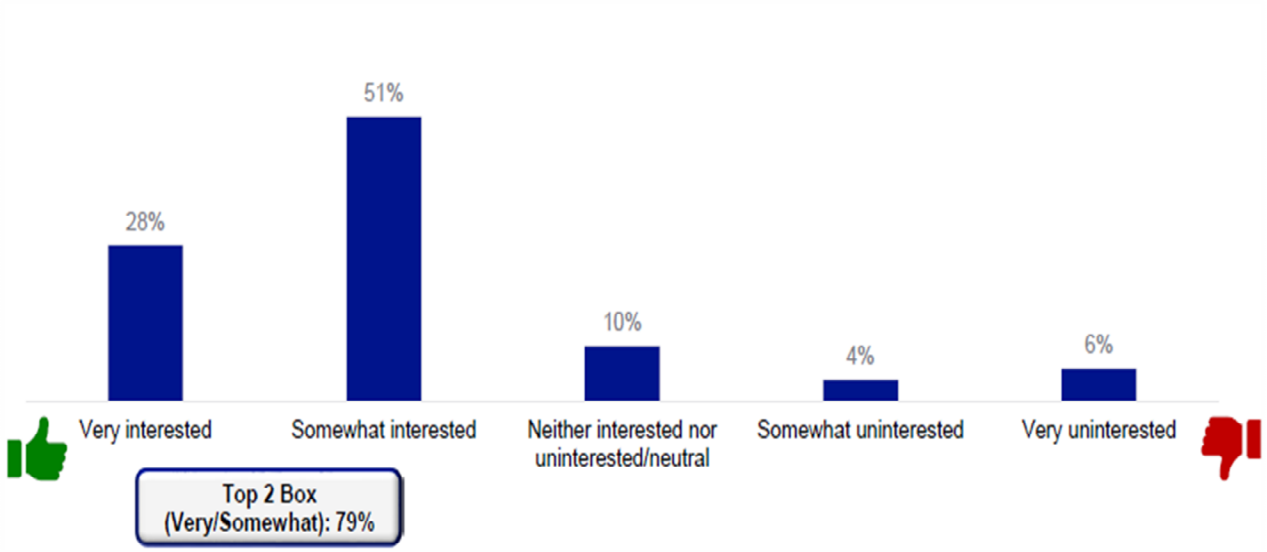
1. A large-scale Customer Strategy project to better understand its customer base and customer needs in an effort to provide better service and,

2. A targeted survey of Rhode Island customers regarding opinions of time-varying pricing.

To implement the latter, in late 2018 and early 2019, the Company conducted an online survey of a sample of its Rhode Island customers to learn about their interest in and understanding of TVR. Almost 80% of customers surveyed suggested they would be interested in TVR. The biggest drivers for the group interested in TVR were the potential to reduce their bills and the concept of greater control. More hesitant customers expressed concern about rates rising. The common

refrain among customers of all types was that they will need to understand how any TVR will affect them given their current usage patterns. Figure 2 presents a summary of responses to the question, "Are you interested in time varying rate plans?"

Figure 2: Customer Interest in TVR



Source: National Grid Survey of Rhode Island Customers

The Company's recently completed Customer Strategy project, described in more detail in Section 2.2 of the Customer Engagement Plan, provides a deep needs-based customer segmentation of the Company's residential and commercial customers. The segments were compiled by gathering feedback from the Company's customers through an extensive online survey, combining the survey data with existing database information, and applying a quantitative cluster analysis to arrive at the differentiated segments. The segments are supported with in-depth profiles of energy-related customer attitudes, including what is most important to them; their preferred method of communication; and products and services of most interest to them. Each segment has its own unique tendencies, such as level of satisfaction with National Grid, engagement preference, and favored means of interaction. Notably the segment most interested in new National Grid products and services, had both the lowest average household income, and the highest interest in time-varying rates.

The Customer Strategy research also offers insights into customer response to TVR. First, the two primary drivers of customer satisfaction are reliability and bill clarity. While TVR is not likely to impact the former, the latter is a clear indication that customers will need to understand TVR and their bills will need to present TVR as clearly and transparently as possible.

3. Supply Rate Design Options

This chapter discusses the treatment of supply costs including those related to the production of electricity and the merits of rate designs for supply.

3.1 Supply Costs

In the context of rate design for supply or commodity, costs are driven by the outcomes from the competitive markets of the Independent System Operator New England (ISO-NE) which in turn drives the costs for the Company's Standard Offer Service. The market outcomes in price, quantity, and timing are transparent for all participants and stakeholders including the Company, third-party suppliers, generators, customers, and regulators.

ISO-NE uses competitive markets with multiple product-types, including energy, capacity, and ancillary services to economically dispatch the lowest cost set of resources that maintains a stable system. A lengthy review of the ISO-NE tariff is beyond the scope of this filing, but the ISO charges customers for the costs associated with each product (energy, Regional Network Load (transmission), capacity, and ancillary services) are based on consumption in different temporal periods. The largest of these is the energy market, which resolves to produce a lowest cost dispatch mix that allocates costs to customers based on their usage in terms of both location (zone and node) and timing down to the five-minute interval. Likewise, transmission costs which are allocated by ISO-NE, are assigned to customers based on the Regional Network Customer's hourly load in "Monthly Peak" hour in the ISO.[4,5] The capacity product, which ensures resource adequacy, is a three-year forward market, allocates costs to participants based on their usage in

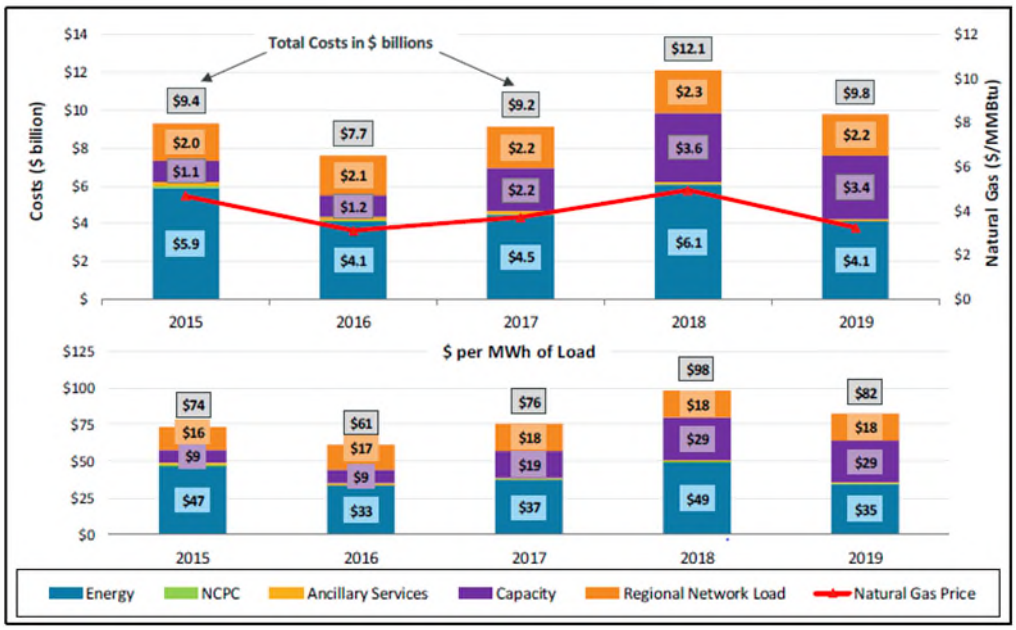
[4] ISO-NE OATT II.21.2 https://www.iso-ne.com/static-assets/documents/regulatory/tariff/sect_2/oatt/sect_ii.pdf

[5] Transmission costs are theoretically network costs and separate from generation costs, to produce electricity. However, under the current construct, generators bear the cost of transmission creating some co-optimization between generation and network costs. To the extent that transmission costs are assigned by ISO-NE as part of the costs of generating electricity and running the wholesale markets, they may be included as a subset of supply.

the top load hour of the year.[6] Ancillary Services and Net Commitment Period Costs (NCPC), also referred to as uplift payments, are approximately 1% of total market costs are mentioned here only for completeness rather than as foundational criteria for future supply rate designs.

In 2019, out of the three major market products, energy accounted for 42% of market costs, with capacity second at 35% and transmission third at 22%. In absolute terms, energy cost customers $4.1 billion, capacity $3.4 billion and transmission $2.2 billion with ancillary services adding about $114 million and NCPC $30 million. As Figure 3 illustrates, the relative importance of the different products in the overall cost of the markets has shifted over the last half-decade with capacity and transmission rising at the expense of energy. All of these costs eventually flow through to customers.

Figure 3: ISO-NE Wholesale Costs



Source: 2019 Annual Markets Report [7]

[6] In June 2018, ISO-NE introduced the pay-for-performance (PFP) for Forward Capacity Market (FCM) resources to incentivize reliable operations during scarcity conditions. In the Fall of 2018, PFP charges totaled $8.8 million, "largely due to rules that exempt energy efficiency resources from performance charges" (See: Fall 2018 Quarterly Markets Report, https://www.iso-ne.com/static-assets/documents/2019/03/2018-fall-quarterly-markets-report.pdf). The Winter 2019 Quarterly Markets Report suggests that increased participation in Secondary Capacity auctions may reflect resources' willingness to reduce their capacity base payments to avoid PFP penalties, https://www.iso-ne.com/static-assets/documents/2019/05/2019-winter-quarterly-markets-report.pdf at 32).

[7] Internal Market Monitor, *2019 Annual Markets Report* (June 9, 2020), https://www.iso-ne.com/static-assets/documents/2020/05/2019-annual-markets-report.pdf

The Company's customers currently pay these market driven costs, but not directly. Instead, for customers receiving Standard Offer Service (SOS), the Company procures load-following service under contracts to provide energy for SOS customers' load. The winning bidders in the competitive solicitation manage the costs of energy in the ISO-NE market, and then pass them along to the Company, which designs SOS rates based on the underlying costs of the contracts and in turns charges those rates to its SOS customers. The Company has begun pricing capacity independently from the energy prices resulting from the competitive solicitations for energy to mitigate the risk premium for customers. Any TVR package for SOS customers must work in tandem with the Company's procurement practices.

3.2 Supply Rate Options

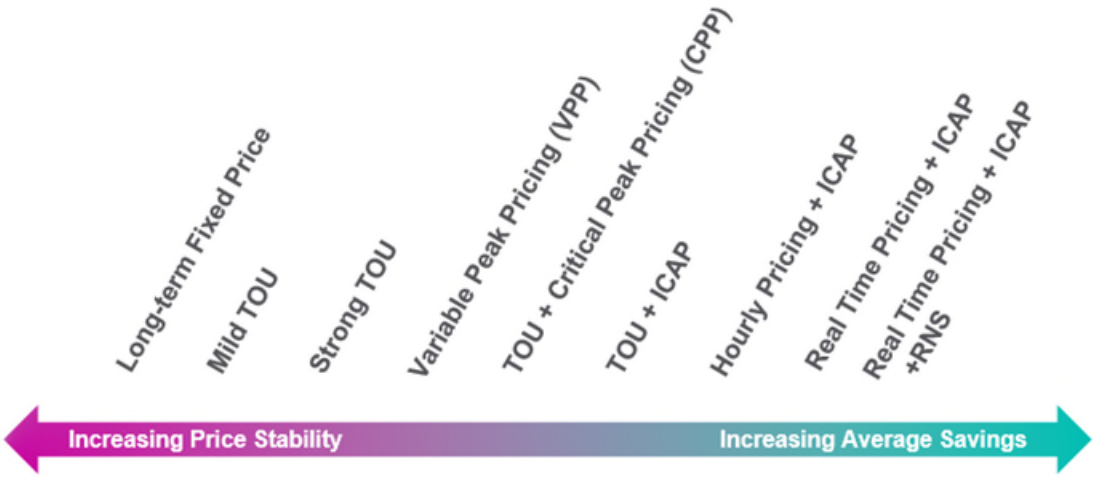
There are many ways to allocate the costs of electric supply. The Company has organized these rates along a spectrum. The spectrum, moving left to right, moves from completely time invariant, to increasingly dynamic and cost-reflective, with the highest efficiency and greatest potential for customer savings aligned with system cost. The spectrum supports the AMF filing because it demonstrates that AMF offers important benefits to customers through different TVR designs. Under present conditions, many of the benefits develop from lowering costs associated with the peak load. In the future, as clean variable generation will likely compose a larger share of the generation mix that will in turn prompt changes to the volatility and patterns of energy prices. TVR will need to be flexible to adapt to such changes as they manifest in energy markets.

Placing rates along a spectrum from least to most cost-reflective facilitates comparisons among TVR designs and makes the tradeoffs among them explicit. For example, University of California Berkeley economist, Severin Borenstein (2012) describes rate designs along a spectrum. Under the current construct, the vast majority of residential customers saw prices for electricity that did not vary within a billing period, but Borenstein noted that at the "opposite end of the spectrum would be a real-time pricing structure in which the price varies hour to hour (or even more frequently) reflecting changes in the wholesale price of electricity."[8]

In Figure 4, the Company presents a range of options, all of which have been deployed in some form, for consideration for future TVR. In Figure 4, "ICAP" refers to "installed capacity" rates which properly align retail rates with the ISO-NE Forward Capacity Market and "RNS" refers to Regional Network Service, for transmission. Figure 4 is not exhaustive but any other potential rate designs could be mapped along the same spectrum.

[8] Borenstein, Severin, *Effective and Equitable Adoption of Opt-In Residential Dynamic Electricity Pricing*, NBER Working Paper Series: Working Paper 18037 (2012).

Figure 4: Supply Rate Design Spectrum



Long-term fixed price

The Company's residential and smaller business customers today have a long-term fixed SOS rate as their price per-kWh, which does not vary over a six-month pricing period. Other jurisdictions have fixed prices that vary in length. In New York, for example, the Company's affiliate has a fixed per-kWh rate for supply that varies by month.

Fixed rates perform well against half of Principle 8 from Docket 4600 that states rates should be "transparent and understandable to all customers," in that they are simple for customers to understand. However, they fail at the other half of Principle 8, transparency, since they combine all of the costs of supply, including energy, capacity, transmission, and the per-kWh cost of the state's Renewable Energy Standard, into one price. Similarly, flat prices do not meet the objectives of Principle 2: "promote economic efficiency over the short and long term, nor do they enable "consumers to manage their costs" (Principle 5) nor do they provide "opportunities to reduce energy burden" (Principle 10) because they maintain a complicated set of cross subsidizations between customers.

Mild TOU

Instituting Mild time-of-use (TOU) periods begins the process of transmitting some of the temporal variation in wholesale energy market costs to retail customers but does so in a muted fashion. One might also describe this as a "Simple TOU" period. The Mild TOU would not differentiate between the multiple wholesale products and the important temporal differentiation among them. Nor would a mild TOU vary by season. Rather, customers would see the same on-peak period for all months of the year.

A Mild TOU period might cover a wide on-peak period of 7 am to 11 pm. Alternatively, recognizing that increased solar generation may reduce daytime power prices, a more modern on-peak period might cover the hours of 4 pm – 9 pm.

A Mild TOU likely has relatively little variation between the peak and off-peak prices, with peak-to-off peak ratios no more than 1.5.

As with current time invariant rates, Mild TOU periods do not perform well against the Docket 4600 Principles 2 and 3 that value economic efficiency. As the smallest change from today's flat rates, Mild TOU period would meet the Docket 4600 Principle 9 which emphasizes gradualism.

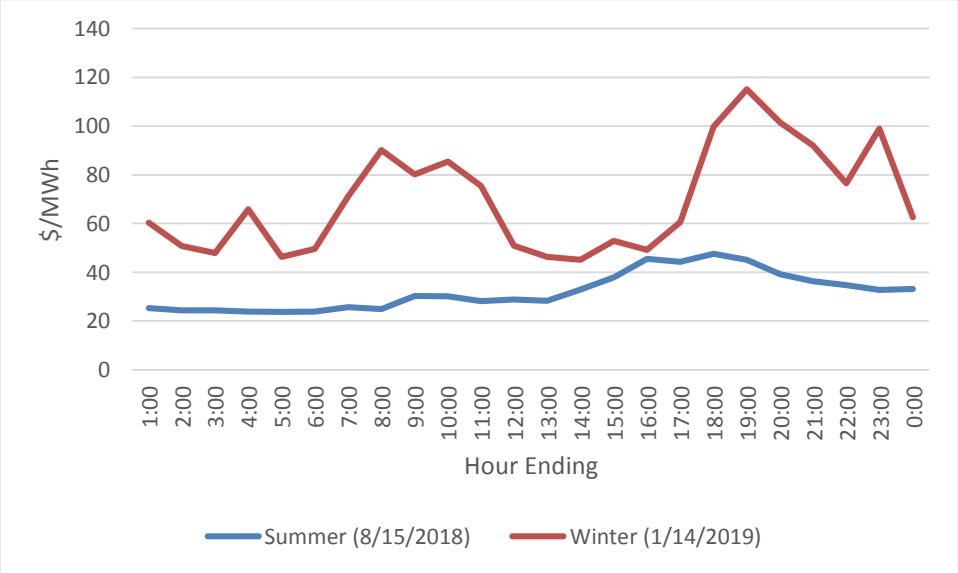
The example rate design in the Company's BCA includes a Mild TOU element used to collect energy supply costs.

Strong TOU

A Strong TOU improves on the Mild TOU by increasing the fidelity of the market prices to customers. Strong TOU may divide up the day into multiple segments such as a high, medium, and low period and may also vary by season. For example, it might recognize that in New England, prices are highest during winter in the early mornings and in the evenings, and moderate in the midday. By contrast, in the summer, prices rise over the course of the day, and peak as the sun goes down and solar generation drops, but the morning peak is absent. These varying daily or seasonal factors can be taken into account when creating a Strong TOU.

Typical days by season are illustrated in Figure 5.

Figure 5: Energy Prices on Typical Summer and Winter Days



Source: ISO-NE [9]

As compared to a Mild TOU, a Strong TOU likely has higher variation between the peak and off-peak price, with ratios of the highest peak periods to the lowest periods of at least two.

Both types of TOU rely on setting the peak and on-periods *and* prices ahead of the billing period.

In terms of performance against Docket 4600 principles, a Strong TOU is similar to a Mild TOU. It performs well in terms of gradualism while improving incrementally upon a Mild TOU along principles related to economic efficiency. It is unlikely that either TOU would perform well on Principle 12 that would "encourage or discourage appropriate investments that enable the evolution of the future energy system."

Peak Time Rewards

Peak Time Rewards (PTR) are a form of demand response in which customers' energy provider makes a payment to customers for reducing their usage during designated peak times. As with other demand response products, customers earn payments, bill credits or rewards, based on the change in their usage from an established baseline. The peaks events may be based on energy or capacity. Events are usually called on a day ahead basis.

[9] ISO-NE, Real Time Maps and Charts, https://www.iso-ne.com/isoexpress/

PTR is distinct from other rate designs presented in this section because it includes a payment from the energy provider to customers rather than payments from the customer to their energy provider. As with other demand response products, PTR make up for otherwise incomplete pricing mechanisms. PTR may be combined with other pricing mechanisms in Figure 4. If customers saw more complete pricing mechanisms that corresponded with the cost of their actions, they could internalize the actions that are otherwise incorporated in demand response actions.

PTR performs poorly across the Docket 4600 principles related to efficiency (Principles 2, 3, 7, and 12). PTR does better in gradualism (Principle 9) because customers have the option not to participate and takes an initial step towards empowering consumers to manage their costs.

Variable Peak Pricing (VPP)

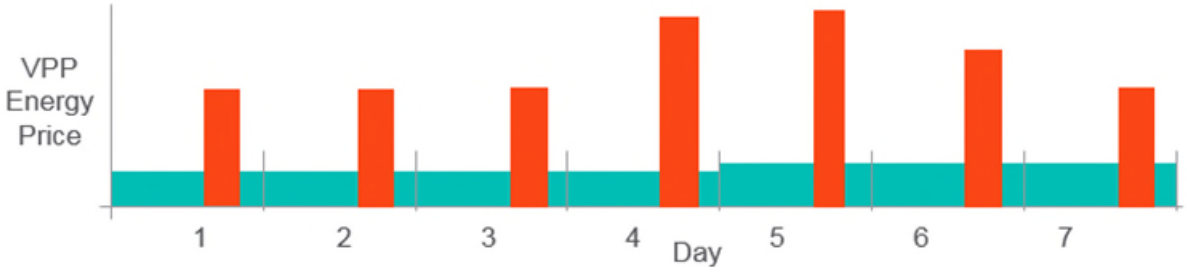
Variable Peak Pricing describes a broad class of rate designs in which the on-peak price varies. Classically, under Mild or Strong TOU rates, the price in the on-peak period is fixed. Generally, like TOU, VPP fixes the on-peak hours.

VPP has been implemented in different regions, including by Eversource in Connecticut and Oklahoma Gas and Electric (OG&E) in Oklahoma. Eversource has a peak period from noon to 8 pm daily. The price of the on-peak period varies daily.[10] Similarly, OG&E runs a VPP program for the hours of 2 pm to 7 pm on non-holiday weekdays during the summer season of June through October. OG&E also runs a Critical Peak Pricing (CPP) structure of up to 80 hours as an override on their VPP program for residential customers.[11] OG&E notifies customers of the prices by their chosen method (email, text or phone) on a day-ahead basis.

[10] Eversource, Variable Peak Pricing History, https://www.eversource.com/clp/vpp/vpphistory.aspx

[11] OG&E, Standard Pricing Schedule: R-VPP; Residential Variable Peak Pricing, https://www.oge.com/wps/wcm/connect/c41a1720-bb78-4316-b829-a348a29fd1b5/3.50+-+R-VPP+Stamped+Approved.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-c41a1720-bb78-4316-b829-a348a29fd1b5-mhatJaA

Figure 6: VPP Illustration



VPP is a flexible tool. VPP events may be used to capture variations in energy prices or capacity costs. Generally, VPP has not differentiated between which underlying market products are responsible for the peaks which are transmitted to end use customers. In some cases, VPP are used to capture variations in energy prices and some of the costs of generation capacity. VPP may be overlaid over flat rates or TOU structures. For example, in Figure 6, the teal bars representing the off-peak period rise slightly in Days 5-7 to illustrate a higher off-peak energy price than in Days 1-4. This shows a VPP overlaid on a TOU rate.

VPP offers improvements from the status quo along principles related to efficiency, however, the variable nature of the peak price may be challenged by Docket 4600 Principle 8 that rates be "transparent and understandable to all customers."

Critical Peak Pricing (CPP)

CPP allows the utility or entity which is pricing supply the ability to dynamically respond to changing pricing patterns by creating critical peak periods, or events. All CPP events have the same prices across a pricing period. CPP may be overlaid over flat rates or TOU structures. On the spectrum in Figure 4, CPP is combined with a TOU structure, as is most common.

Both CPP and variable peak pricing (VPP) are flexible tools and events may be used to capture variations in energy prices or capacity costs, although CPP is most commonly used for generation capacity costs. As used henceforth, CPP will refer to a rate design that captures capacity costs. The length of CPP events may be fixed or vary.

CPP represents an important step forward from TOU periods or VPP in that it can separate out the costs of capacity, a distinct market product, into separate events. The utility or energy provider can initiate CPP events to communicate the possibility of setting a capacity hour. CPP events spread capacity costs, which are determined in a single hour of the year, over multiple events. CPP thus balances a strong signal with a customer-friendly smoothing. Also, where the capacity hour is set based on the annual ISO-NE peak hour in ex-post fashion, CPP offers

customers ex-ante notification for events. Unlike TOU periods, the timing of CPP events may vary. For example, Monday may not be a CPP day, but if Tuesday has a chance to set the ISO-NE peak hour, the Company may call a CPP event. Thus, communicating that CPP events are occurring are an important element of their success. CPP events can be communicated to customers in multiple ways, depending on customer preference. Options include posting CPP events online, or more active methods such as alerts to customers via email, text, smart phone application or phone consistent with customer preferences. Finally, CPP may support automated responses by certain programmable devices which could help customers manage their energy bills.

CPP is distinct from VPP because the prices charged during VPP events may vary event to event while in a CPP, the prices are the same in events. As a matter of practice, VPP is usually used for variations in energy, while CPP is more commonly associated with capacity.

By separating out high-priced hours for energy or capacity, relative to flat rates, consumers who manage their energy usage in those hours have a powerful tool to manage their costs, consistent with Principle 5. CPP events also perform well against Principle 3 regarding efficient price signals and with notifications, attempt to meet Principle 8 regarding transparency to customers. However, by spreading capacity costs across more hours than those in which they are incurred, CPP mutes the precise way in which capacity costs are allocated, and some consumers may want the ability of more granular designs to further manage their costs.

The example rate design in the Company's BCA includes a CPP element used to collect capacity costs.

ICAP/RNS

As used in Figure 4, ICAP refers to the practice, common among larger customers, of charging customers with the costs associated with capacity based on their actual usage in the annual peak hour. In a simplified analysis, ISO-NE calculates a market participant's capacity cost based on their contribution to their capacity zone's load in the peak period. The market participant may be a load-serving entity (LSE) or large customer participating in the market directly. In the case of an LSE, it then allocates the capacity costs charged to it by ISO-NE across its own customers. A charge, abbreviated here as ICAP, based on a retail customer's demand in the annual peak hour on which those capacity costs are calculated is most aligned with cost causation. Using an ICAP charge for capacity is incomplete because it does not account for the time-variant nature of energy. The spectrum in Figure 4 first presents ICAP paired with TOU periods for energy, and then with more accurate Hourly Pricing moving further right.

In slight contrast to capacity obligations which are set annually, ISO-NE allocates transmission costs for Regional Network Service (RNS) based on demand in the monthly peak hour. The distribution company, functioning as the LSE, presently merges ISO-NE transmission costs with other local transmission costs and then allocates those charges to each customer class based on its contribution to peak load. However, an unbundled rate for ISO-NE costs allocated based on peak load to the distribution company's customers is, like ICAP, a second example where a demand charge more precisely captures the responsibility for cost causation rather than rolling those charges into volumetric rates. Since both the costs for capacity and those for RNS (transmission) are incurred in a single hour, rates that spread them into a greater number of hours will result in a quantifiable loss of efficiency where prices are too low on-peak, and too high off-peak, leading consumers to consume more than is economically efficient on-peak.

Under an efficient rate, customers would pay for their generation capacity based on their consumption in the ISO's peak load hour. Similarly, the customer would pay for transmission charges based on their load in the monthly peak hour. Such efficient charges offer significant opportunities for savings and managing energy costs. However, when the hours are known only after the event, this may prove complicated for residential customers as a default rate. While AMF enables such efficient rates, for residential and small commercial customers, rate design must balance the constant tradeoff between efficiency gains and costs of implementation and challenges of increased complexity.

Demand charges for ICAP and RNS that match costs accrued based on peak hours perform well on efficiency grounds. By matching the timing of charges to customers to the underlying market elements which drive those costs, customers also have ample opportunity to manage their bills (Principle 5) and such measures can help reduce energy burden (Principle 10). ICAP and RNS charges can be well understood and transparent when enabled by AMF and customers are provided visibility into real-time information about their demand (Principle 8). However, such focused hourly charges will be novel for residential classes (Principle 9).

Hourly Pricing/Real Time Pricing (RTP)

Hourly Pricing and Real Time Pricing describe plans where the clearing prices for energy in the ISO-NE markets are transmitted directly to customers. ISO-NE runs a multi-stage market where generators and suppliers submit day ahead bids, which resolve into hourly bids. These hourly prices for energy could become the rate that end customers pay. Using the hourly price would capture far more of the variation in energy prices on both an intra and inter-day basis than even a well-designed TOU rate which must anticipate the behavior of the markets.

Where the output of the day ahead market is an hourly price, the "real time market" resolves at five-minute increments. In theory, energy providers could provide a plan to charge customers the real time clearing prices. In the case of the plan where customers pay day-ahead market prices, since there is usually a difference between the day ahead and real time prices, there would need to be a small true-up mechanism to account for those differences.[12]

RTP is maximally efficient with respect to energy prices and thus fulfills Docket 4600 principles two and three. By varying prices precisely, RTP allows consumers the choice to manage their costs as they see fit (Principle 5) and communicates value most accurately (Principle 6). By encouraging dynamic response, RTP also meets criteria regarding appropriate investments (Principle 12). RTP would not perform well under criteria related to gradualism (Principle 9).

3.3 Supply Rate Designs and Docket 4600 Principles

By way of summary, Figure 7 maps the major supply rate designs against the Docket 4600 principles. For the purpose of Figure 7, the VPP includes variation in energy and capacity costs in the same product. CPP overlays capacity on a flat rate. TOU/CPP is the rate that National Grid models in the AMF BCA with a CPP overlaid on a TOU structure.

[12] In August 1994, the Company proposed an experimental Flexible Time-of-Use Pricing (G-50) tariff that provided bundled hourly energy prices based on the Company's marginal cost of service for purchased power from its affiliate New England Power Company. The PUC approved a settlement with the Division of Public Utilities and Carriers on the Company's proposal in April 1995. *See* Docket No. 2229. The G-50 tariff provided for up to 20 larger customers to be service pursuant to this tariff that provided for four price schedules which, under pre-established rules, would be called to be in effect the day before the day of service. The G-50 tariff was terminated in 1998 with the unbundling of the Company's rates and the restructuring of the electric markets in New England.

Figure 7: Supply Rate Designs Mapped to Docket 4600 Principles

	Principle	Flat Rates	TOU	VPP	CPP	TOU + CPP	TOU + ICAP	RTP + ICAP
1	Ensuring safe, reliable, affordable, and environmentally responsible electricity service today and in the future	●	●	●	●	●	●	●
2	Promoting economic efficiency over the short and long term;	○	◔	◐	◐	◕	◕	●
3	Providing efficient price signals that reflect long-run marginal cost	○	◔	◐	◐	◕	◕	●
4	Appropriately address "externalities" that are not adequately counted in current rate structures	○	◔	◔	◔	◐	◐	◕
5	Empowering consumers to manage their costs	○	◔	◐	◐	◕	◕	●
6	Enabling a fair opportunity for utility cost recovery of prudently incurred costs and revenue stability	●	●	●	●	●	●	●
7	Fair compensation for value and services received and fair compensation for value and benefits delivered	○	◔	◐	◐	◕	◕	●
8a	Being transparent …	○	◔	◐	◐	◕	◕	●
8b	… understandable to all customers	●	●	◕	◕	◐	◕	●
9	Changes …implemented with due consideration … of gradualism, ample time for customers to understand new rates and lessening immediate bill impacts	N/A	◕	◐	◐	◐	◐	◔
10	Providing opportunities to reduce energy burden and address low income and vulnerable customers' needs	○	◔	◐	◐	◕	◕	●
11	Consistent with policy goals such as environmental protection, addressing climate change and the Resilient Rhode Island Act, energy diversity, competition, innovation, power/data security, and least cost procurement	○	◔	◐	◐	◕	◕	●
12	Encourage … appropriate investments that enable the evolution of the future energy system	○	◔	◐	◐	◕	◕	●

3.4 TOU/CPP: The Company's Illustrative Rate for BCA modeling

After analyzing the spectrum of rate design options, the Company chose to create an illustrative TOU/CPP rate for utilization in the AMF BCA. The supply rate is comprised of TOU periods which capture the current variation in energy market prices. The CPP events account for the variability in capacity costs, but spread costs accrued in one hour into 70. This rate would live in the middle of the spectrum as presented in Figure 4. This combination of concepts takes an important conceptual step towards identifying capacity costs as distinct from those in the energy market and pricing them separately for customers. Such an approach is consistent with the Company's most recently approved procurement plan for full service load which unbundles the pricing of capacity costs from energy costs.

The TOU/CPP pairing is supported by the Company's experience, those of utilities around the country, and academic study. The Company's Worcester Smart Energy Solutions (SES) pilot in Worcester, Massachusetts used a default TOU/CPP and was successful along a number of dimensions and thus can be used as a baseline against which to test other rate designs. First, the TOU/CPP design helped deliver peak load reductions, especially during critical peak pricing events, that produced demonstrable customer savings. The average savings for customers who

engaged with the pilot through the customer portal and an in-home display (also known as level 2 participants) was $786 per customer over the four years from 2015 through 2018.[13] Second, customers responded favorably: the vast majority remained enrolled throughout the duration of the pilot. Consistent with other TVR pilots, customers liked the rate: 69% of participants in the SES pilot rated their satisfaction at a level of five or greater on a seven point scale.[14] Other utilities have continued to refine TOU/CPP designs, so they are now relatively well-vetted across the country. Finally, in a virtuous feedback loop, there is a developing academic literature on the strengths, weaknesses, and design considerations to create a TOU/CPP rate that delivers benefits for customers.

The TOU/CPP rate is middle of the road from an efficiency perspective. There will be rates that produce fewer customer savings, while there are other rate designs that produce more customer savings and more benefits. Thus, choosing the TOU/CPP is a realistic and conservative choice that respects the principle of gradualism by introducing changes only to one segment of customers' bills.

The Company's BCA model analyzes the benefits to customers when the TVR supply rate is deployed as the new default (opt-out) and when it is presented as an "opt-in" with no change to the current default rate structure.

The rate that is used in the BCA model is detailed more fully in the Updated AMF Business Case.

4. Distribution Rate Design Options

This chapter is parallel in structure to Section 3. Section 4.1 discusses distribution costs that feed into the delivery section of customers' bills. Section 4.2 then compares different TVR and their applicability to delivery costs.

4.1 Distribution Costs

The delivery section of the bill is different from the supply section of the bill in a few important ways. First, the costs related to energy supply are almost all marginal. On the other hand, costs related to delivery to the size of the network and other programs, are largely fixed by regulatory proceedings. Second, the manner in which costs vary is different temporally. While energy costs can vary on 5-minute increments, the costs associated with running a network do not change multiple times within a single hour, rather, they vary over longer time horizons.

[13] *See Massachusetts Elec. Co. and Nantucket Elec. Co. d/b/a National Grid, Smart Energy Solutions Program Final Evaluation Report*, Dockets D.P.U. 16-149 and 10-82 (September 9, 2019).

[14] *See Id.*

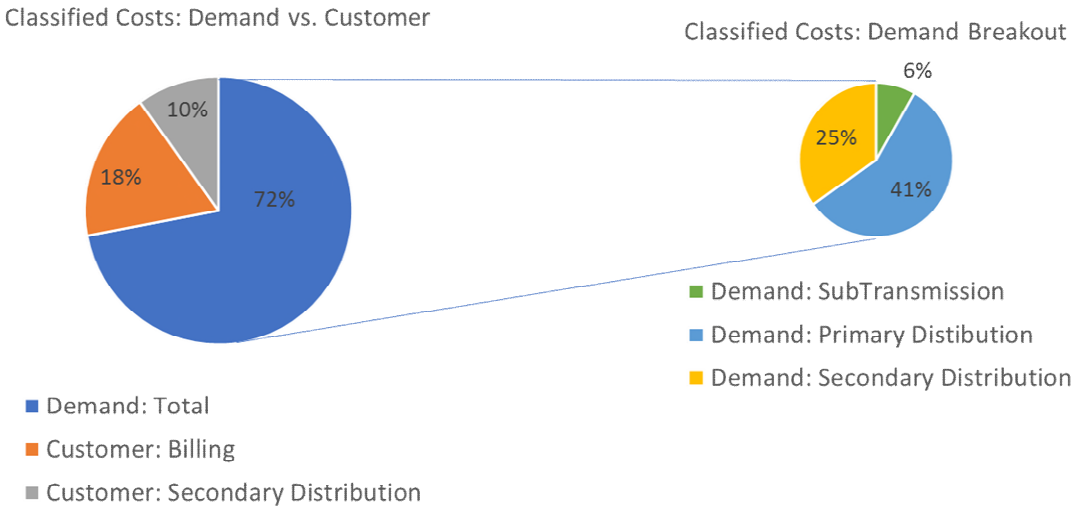
On the distribution system, the system itself and the thousands of components of which it is comprised are usually measured in terms of peak capacity ratings in kW. At other times, the system can be measured in the number of customers served. Thus, if the system is largely measured in capacity and number of customers, cost-reflective rates should reflect that accounting.

The Company's allocated cost of service study is a key tool to apportion the Company's overall revenue requirement which includes the return of and return on rate base (consisting predominantly of net plant investment), along with expenses such as operation and maintenance expenses, administrative and general expenses, and payroll, property, and income taxes into rate classes in a manner reflective of cost causation. The three steps in the allocated cost of service are: (1) functionalization, (2) classification, and (3) class allocation. Functionalization defines the element's purpose between sub-transmission, primary distribution, secondary distribution, and billing. Those functionalized elements are then classified into corresponding units of demand, energy, or customer. Phrased another way, the classification step assigns causative factors to distribution costs. Finally, in the allocation step, the functionalized and classified costs are allocated to individual rate classes.[15]

Figure 8 presents the cost allocations for the residential class based on the Company's last rate case filing. The costs allocated to Customer – secondary distribution and billing – on the left side of the chart compose 28% of the costs for the class. On the other hand, the allocated cost of service study designates the majority of the costs, 72%, to demand. The demand costs are further subdivided into sub-transmission, primary, and secondary distribution. These parts of the system may peak at the same time or more likely different times depending on where they are located, but in all cases, the Company must size equipment to serve the largest peak. None of the costs are allocated to energy.

[15] Docket No. 4770, Testimony of Howard Gorman, Book 12 of 17 (November 27, 2017).

Figure 8: Narragansett Electric Residential Cost Functionalization and Allocations



The heart of the issue in designing distribution rates is allocating a fixed quantity of costs determined by a rate case or other regulatory proceeding across customers fairly. The priorities of equity and economic efficiency are further defined by the Docket 4600 principles.

4.2 Distribution Rate Options

Fixed Charge

The logic that nearly 30 percent of costs are properly allocated to customer and unrelated to the quantity of demand on the system provides strong rationale for a fixed charge recovered on a per-customer basis. Further discussion of setting a customer charge, the costs which it recovers and the rate at which it is set, is beyond the scope of this report on TVR.

Subscription Rate

Most readers are likely familiar with subscriptions for services. Such a construct is the common method of designing distribution in Europe, where customers pay a flat rate based on the maximum size of their connection. American consumers often have subscription plans for their cell phones, streaming services, or even gym memberships. From an analytic perspective, subscription rates look rather similar to contract demand charges, which are more commonly used for standby or other large customers. In general, subscription rates do not vary temporally. However, if for example, a customer's usage in a peak period set the subscription rate for the next year, a subscription rate could begin to adopt the principles of TVR, in a rather stable form.

A subscription rate would perform well on the second half of Principle 8 – being understandable to all customers – and the second half of Principle 6 – providing revenue stability. Subscription rates are likely efficient in the short run (Principle 3) as the size of the network changes little year-to-year. However, over longer time horizons, when the size of the network changes more, they are less likely to be efficient. Subscriptions do not empower consumers (Principle 5) to manage their delivery bills.

TOU Volumetric

In theory, volumetric TOU periods, CPP, or VPP could be used for the distribution system. However, on the principle that rates should reflect costs, the rationale for using time of use periods for delivery costs should be supported by analytic work that assigns network costs first to volumetric components, and then breaks those components into temporal periods.

Volumetric TOU rates for delivery are not widespread, but some jurisdictions offer them as opt-in rates. The Company's upstate New York affiliate offers a voluntary TOU rate which has both a volumetric TOU period for supply and delivery. Adoption has been rather modest.

A major concern with volumetric TOU for delivery costs is the changing relationship between customers' total energy consumption and the demand-based costs they impose on the system. Technologies such as distributed generation, electric vehicles, and electric heat with controllable loads change their users' overall load profile from other members of the class. Volumetric TOU rates for delivery would fail the Docket 4600 principles related to efficiency (two, three, and twelve). They may help customers (Principle 5), including vulnerable populations (Principle 10) manage their costs. However, TVR which rely on volumetric constructs on delivery may well challenge customers to understand a new structure (second half of Principle 8), and designing them to meet the goal of gradualism (Principle 9) may also be a challenge.

Coincident Peak and Non-Coincident Demand Charge

In general, costs related to demand should be recovered through charges related to demand denominated in kW increments, rather than energy or throughput denominated in kWh. For residential classes today, demand-based costs are instead turned into volumetric-based kWh rates. This process distorts the price customers pay for both network service and energy. As to energy, it artificially increases the price per unit of energy consumed. As for network costs, it overstates the correlation between network size and total throughput.

Demand charges have also generally been used to determine the distribution charges for larger classes of customers to reflect their impact on distribution system capacity, but their use has not extended to residential classes. In Rhode Island, electric customers in the G-02 and G-32 rate classes are assessed largely on distribution demand with a portion of distribution costs left in

volumetric charges. These demand charges assess customers based on their highest demand in a given period. Traditional demand charges are assessed based on the customer's highest usage in a billing period, and thus are "non-coincident" to system peaks. By contrast, a demand charge based on a customer's usage while the system peaks, or over a peak period may be defined as "coincident" demand charges. These qualify as time-varying rates because demands outside the peak period are charged at a lower rate, possibly zero. The peak period may be broadly defined, i.e. non-holiday weekdays from 8 am – 9 pm, or tightly scoped, i.e. non-holiday weekdays on summer afternoons between 3-7 pm. While the current metering set up does not facilitate TVR for demand charges, there are likely efficiency gains which could be realized by utilizing the transparency afforded by AMF to align demand charges with system peak conditions making them more coincident.

System vs. Local Coincident Peak Charges

The electric system is a network with many sub-networks. It is the case that local areas will exhibit different loading patterns than the whole system. Thus, it may be desirable to think about whether peak charges should be aligned to the total system or to local peaks. In the distribution rate design spectrum presented in Figure 9, as the spectrum moves to the right, to become further granular, different demand charges may vary in time to reflect the variance between system and local peaks.

4.3 Distribution Rate Designs and Docket 4600

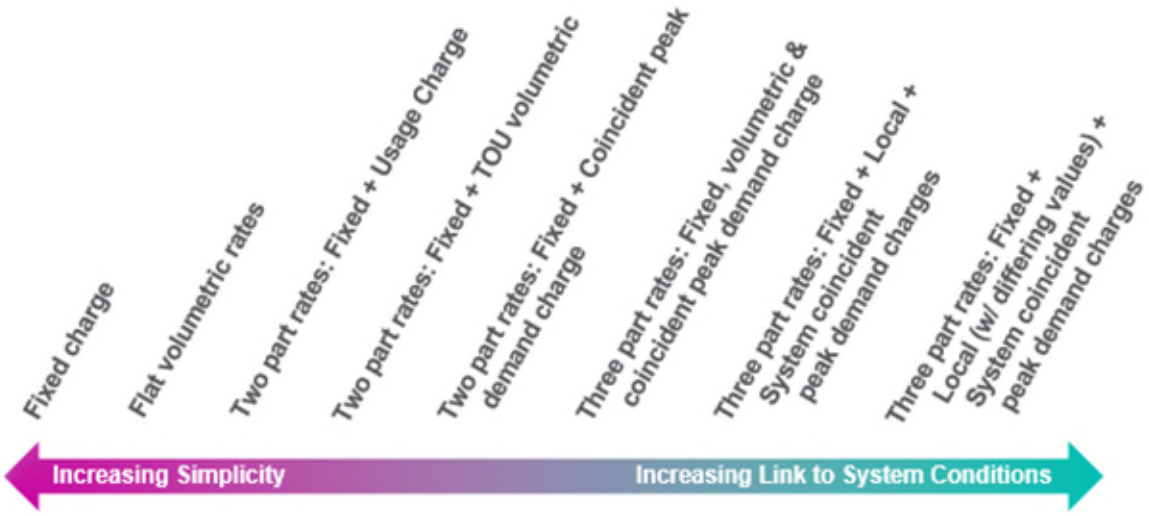
Applying the Docket 4600 principles to demand-based distribution rates is insightful. Demand-based rates for distribution costs would be a major improvement to those Docket 4600 principles related to economic efficiency (Principles 2, 3 and 12). Demand charges also, by concentrating charges, facilitate customers' ability to manage their costs (Principle 5), including for low-income and vulnerable populations (Principle 10) and are consistent with competition, innovation and environmentally friendly usage of the system (Principle 11). Demand charges are simple conceptually, meeting the first half of Principle 8, but as with any change customers will need time to adjust, meeting the second half of Principle 8. The biggest challenge with respect to the Docket 4600 principles, to shifting to demand-based distribution rates, is Principle 9, which emphasizes gradualism. However, this may be overcome through a well-designed implementation plan or bill guarantees. The Customer Engagement Plan presents a framework for customer engagement success.

There is growing recognition here and across the country that demand charges are an efficient, equitable rate structure for all customers. As the Docket 4600 Working Group wrote, "changes to customer charges and demand charges (e.g. specific time blocks when a customer's demand could cause additional charges) warrant investigation. This recommendation applied to both

small and large customers."[16] Utilities around the United States offer demand-based rates for residential customers. For example, Arizona Public Service has over 100,000 customers on their residential demand rates.

New York is in the midst of a proceeding to develop an opt-in demand-based delivery rate, known as the Standby rate, for all customers, including residential customers. In describing the Standby rate structure, which applies separate demand charges for local and "shared" infrastructure costs, the New York Public Service Commission wrote that the principles underpinning these designs were "clearly superior to existing rates in aligning customers' rates to their contributions to system costs, [and that] providing this option to mass market customers as expeditiously as possible advances REV objectives."[17] In response to Commission direction, each utility in New York submitted draft tariffs for opt-in demand-based rates for all residential customers by September 23, 2019 in case 15-E-0751. The proceeding is currently analyzing the methods companies used to allocate costs between shared or local facilities. These opt-in rates include a customer charge, a contract demand charge to capture local costs and two demand charges to capture shared costs: a daily as-used demand charge and a daily-as-used super-peak demand charge that applies on non-holiday weekdays in the summer period.

Figure 9: Distribution Rate Design Spectrum



[16] Raab Associates, Ltd., *Docket 4600: Stakeholder Working Group Process, Report to the Rhode Island Public Utilities Commission* at 16 (April 5, 2017) [hereinafter the Stakeholder Report].

[17] NYPSC Case 15-E-0751, Order on Standby and Buyback Service Rate Design and Establishing Optional Demand-Based Rates (May 16, 2019).

While some stakeholders asked about the placement of "Distribution LMP" or "D-LMP," that is more properly a supply cost in which energy is priced at a level of granularity on the distribution grid. It is not a distribution service concept in that it does not respond directly to the allocation and pricing of the distribution network and related services.

As a summary, Figure 10 presents the different distribution rate designs mapped to the Docket 4600 rate design principles. For the purposes of the figure, TOU volumetric refers to any of the TOU concepts discussed at more length in the supply section, including simple TOU periods, CPP or VPP products. CPDC refers to a Coincident Peak Demand Charge based on the Narragansett Electric Company system peak. Local CPDC describes a demand charge oriented to a subsection of the system.

Figure 10: Distribution Rate Designs Mapped to Docket 4600 Principles

	Principle	Fixed + Flat Vol	Fixed + TOU Volumetric	Fixed/ Subscription	Fixed + CPDC	Fixed + CPDC + Local CPDC
1	Ensuring safe, reliable, affordable, and environmentally responsible electricity service today and in the future	●	●	●	●	●
2	Promoting economic efficiency over the short and long term;	○	○	◐	◔	◔
3	Providing efficient price signals that reflect long-run marginal cost	○	◔	◐	◔	●
4	Appropriately address "externalities" that are not adequately counted in current rate structures	○	◔	○	◔	◔
5	Empowering consumers to manage their costs	○	◔	○	◐	●
6	Enabling a fair opportunity for utility cost recovery of prudently incurred costs and revenue stability	●	●	●	●	●
7	Fair compensation for value and services received and fair compensation for value and benefits delivered	○	○	◐	◔	●
8a	Being transparent …	○	◔	◔	◔	●
8b	… understandable to all customers	●	◐	●	◔	◐
9	Changes …implemented with due consideration … of gradualism, ample time for customers to understand new rates and lessening immediate bill impacts	N/A	◔	◐	◐	◔
10	Providing opportunities to reduce energy burden and address low income and vulnerable customers' needs	○	◔	○	◐	◔
11	Consistent with policy goals such as environmental protection, addressing climate change and the Resilient Rhode Island Act, energy diversity, competition, innovation, power/data security, and least cost procurement	○	◔	○	◔	●
12	Encourage … appropriate investments that enable the evolution of the future energy system	○	◔	○	◐	◔

5. Modeling Approach in the BCA Analysis

For the purpose of the AMF BCA, the Company has prepared an illustrative TVR rate structure where all of the variation is related to supply costs. The TVR consists of a TOU period to capture the variation in energy costs and a CPP construct to capture the variation in wholesale capacity costs. The on-peak, off-peak, and CPP rates used for this illustrative design and assumptions pertaining to customer response to the rate are given in the Updated AMF Business Case.

As discussed with PST advisory group members, the Company does not model any changes to distribution rates in the Updated AMF Business Case for two reasons. First, the largest single category on the bill is electric supply which includes energy and capacity. This category offers the largest opportunity for customers to reduce their bill. The Company expects an initial proposal for TVR to focus on the supply component of the bill. Second, for the purposes of the BCA, to show as a benefit, a change would have to save customers money. In the short term, the Company's distribution revenue requirement is established for the three years of the multi-year rate plan approved in Docket 4770. While changing distribution rates could create improvements in the allocation of manner in which costs are recovered from customers, they would not produce a reduction in the total cost of providing distribution service. The BCA, which only counts total costs, does not address allocative improvements. In the longer term, TVR that reflects distribution costs more accurately can be an effective tool to control costs for customers. The Company's Grid Modernization Plan (GMP) begins to develop a framework for assessing the potential benefits to customers through avoided infrastructure development that may be enabled by TVR. Such analysis is not common in the industry so the Company's work in this sphere is on the leading edge.

The supply TOU rate that the Company models is fairly simple in that it only contains two prices every day, an on-peak rate and an off-peak rate. The Company divided up the year by season to capture distinct pricing trends in the wholesale market, with a separate on and off-peak period by season. This was an important analytic step which determined that March's pricing patterns looked more like a winter month than the spring months of April and May. In all, the Company used a four-month summer, a four-month winter, and two two-month shoulder periods of spring and fall. For each season, the Company took an average of wholesale energy prices across each hour. Then, to facilitate the creation of TOU periods, each of those hours is ranked, where 1 denotes, on average, the most expensive hour of the day, and 24 would be the least expensive hour of the day. These daily pricing rankings are illustrated in Table 1. Across all seasons, the hours from 5 pm through 9 pm are some of the highest-priced of the day. In the Summer, prices consistently rise from around mid-day through the early evening to reach the peak. However, in the Fall and Winter, when heating demand is a prominent feature of load, there are significant morning price rises.

Table 1: Daily Average Price by Season and Hour

	Hour Ending																							
Ranks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Winter (Dec - March)	18	21	22	23	20	16	11	3	5	7	9	8	12	14	17	15	10	1	2	4	6	13	19	24
Spring (April-May)	18	20	23	24	22	21	16	15	10	11	9	13	14	12	8	6	4	2	5	3	1	7	17	19
Summer (June-Sep)	17	18	21	24	23	22	20	16	14	13	12	10	9	7	5	3	2	1	4	6	8	11	15	19
Fall (Oct-Nov)	18	20	22	24	23	19	12	4	7	9	6	10	14	13	15	11	5	2	1	3	8	16	17	21

The Company then created TOU periods that reflect this seasonal variation. For modeling purposes, which reflect the state of the ISO markets in calendar year 2018, the periods are given below. Ultimately, when a proposed TOU rate structure is developed, the selection of TOU periods may also incorporate forward-looking analyses to adapt to changing energy market characteristics while adhering the Docket 4600 principles.

The modeled On-Peak Periods are defined as the following:

- Winter: 7am-12pm; 4pm-9pm
- Spring: 5pm-10pm
- Summer: 11am-9pm
- Fall 7am-12pm; 4pm-9pm

National Grid's survey of Rhode Island customers found relatively broad support for seasonal variation in pricing plans. Over half of participating customers 58% found seasonal variation in pricing plans "somewhat reasonable" (31%) or "very reasonable" (27%). Only 23% were opposed with 19% undecided. The potential rate schedule presented to customers in this survey was structurally very close to the one National Grid modeled in the BCA analysis but exhibited minor variations in the timing of the peak and off-peak periods.

All of the costs of generation capacity are rolled into the CPP periods. In response to Stakeholder feedback the Company adopted a more tightly focused CPP structure into its modeling similar to the structure its affiliate proposed in New York. On an annual basis, capacity costs are allocated into 70 hours. When ISO-NE has a chance to set a peak-load hour, based on the day-ahead forecast, the Company would call a CPP event. The events can vary in length, although a likely duration is between four and six hours. Such a length would imply that the Company would call 12 to 15 events corresponding to the region's peak load days per year. This schedule strikes a reasonable balance between predictability, ability for customers to respond, and is modest enough to avoid response fatigue.

In the AMF BCA model, the Company also models the impact of offering the TOU/CPP product as a default versus an opt-in rate. As discussed in more detail in the Updated AMF Business Case, generally, peak savings are higher per customer in an opt-in case because only the most motivated customers opt-in. However, when TVR is used as a default, the overall benefits are far

higher because, even if the savings are lower on a per-customer basis, the far higher share of customers on the TVR dominates the lower savings per customer. Simply put, opt-out TVR generates far higher benefits than opt-in structures.

6. TVR Benefits

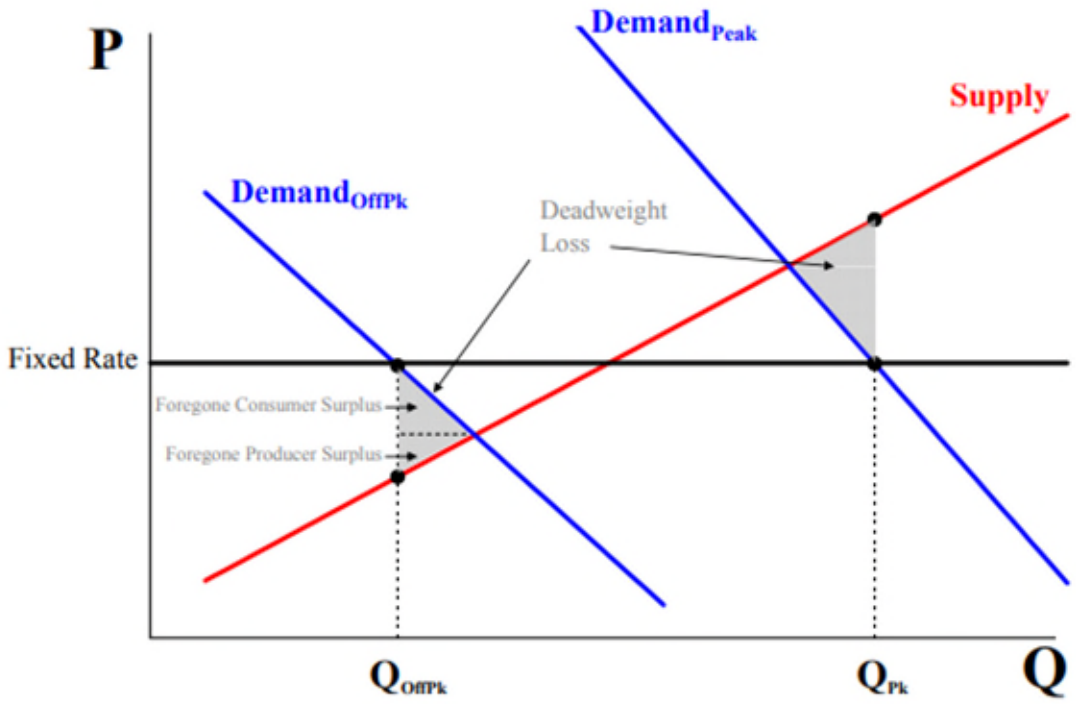
This section explores the types of benefits TVR offers customers and the Rhode Island energy system.

The benefits of TVR fall into three broad categories: economic efficiency, allocative equity, and supporting climate change goals.

6.1 Economic Efficiency and TVR

Flat rates for electricity, including both supply and distribution, do not convey accurate prices to customers about the cost of producing or distributing that energy. Thus, if customers have a certain demand function that varies by price, when the real price is above the price they see through inaccurate rates, they consume relatively too much, as in the case in peak periods. By contrast, when the actual price is below the price customers see, they consume too little. This leads to the “wrong” or inefficient quantity consumed, known as the deadweight loss. The costs to society from inefficient consumption quantities is illustrated in Figure 12.

Figure 11: Deadweight Loss from Flat Pricing



Source: Newell and Faruqui (2009)

The literature on the economic inefficiency of flat rate pricing for electricity is broad. Simshauser and Downer trace the identification of the inefficiency of time-invariant pricing in the electric system as far back as seven decades.[18] However, technological advances in metering, communications and data processing combine to make solutions, which were previously out of reach, attainable. Berger et al (2019) find that while there are significant efficiency gains from improving supply rates, moving away from volumetric rates for network cost recovery offers even larger gains to consumer welfare. A brief synopsis of some of the relevant work from the economics literature is included in Appendix B.

Many of the costs of the electric system are driven by the need to serve peak demands. Pricing that reflects these peak costs will ultimately lower the need for capacity to serve those peaks and in time, save customers money by avoiding building out parts of the system used only rarely.

[18] Simshauser, Paul & Downer, David, *On the Inequity of Flat-rate Electricity Tariffs*, 37[3] The Energy J. Vol (2016).

6.2 A more equitable system

Current flat rate or time invariant tariffs create a certain type of inequity where some customers subsidize other customers. Customers who use a greater share of their energy when it is more expensive or whose use drives system capacity expansions for both the network and generation fleet, are subsidized by those who use a greater share of their energy in less expensive periods or where the system has ample capacity. This is increasingly important as technology evolves and customer usage patterns, especially those with local generation or beneficial electrification technologies, including heat pumps and electric vehicles, start to diverge from other customers. Thus, TVR offers the potential to make electricity pricing fairer to all customers. However, the BCA does not capture improvements in allocation, but only counts total costs.

6.3 Supporting Electrification & the State's GHG goals

The Resilient Rhode Island Act and the Rhode Island State Energy Plan are the backbone of a robust state climate policy. The outcomes offered by TVR of economic efficiency and increased equity take on increased importance when confronting one of the biggest challenges in front of society in the earlier 21st century: combatting climate change. The improved price signals created by well-designed TVR can support efficient integration of renewable generation, the adoption of electrification technologies that support GHG goals, and limit the costs to the system of widespread electrification.

TVR and default supply and delivery rate reform can also enable this transition by getting the prices right. A cleaner electricity sector will rely on a different generation mix than the status quo. As clean, variable renewable generation becomes a larger share of supply in the coming years, supply pricing patterns are likely to change. TVR can help customers consume energy when it is least costly to produce as the system evolves. Moreover, TVR is an extremely effective method of controlling capacity cost increases which may become likelier in an era of increased electrification and increased demands on the system. And as demonstrated by Newell and Faruqui (2009) and others, the gains to consumer surplus in moving to TVR increase further in an era of increasing capacity costs.

National Grid's Pathways Report[19] laid out the Company's vision to help meet the region's 80x50 targets. The Report laid out ambitious targets for electrifying heat and transportation, which would be enabled by both TVR and a shift away from volumetric recovery of network costs, including delivery charges. Technologies like heat pumps and electric vehicles, will require increased electricity consumption in kWh. Thus, charging network costs on each of those increased kWh, as in current practice, impedes the adoption of those cleaner technology choices.

[19] National Grid, *Northeast 80x50 Pathway* (June, 2018), https://www.nationalgridus.com/news/assets/80x50-white-paper-final.pdf

In concert with the Grid Modernization Plan, the Company is investigating how TVR can be an effective tool in managing the distribution system. If customers on TVR have lower peaks in the aggregate, it may help avoid costly upgrades, in effect saving customers money. Conversely, in a future state, the combination of GMP and TVR can help manage a dynamically evolving load curve to reduce costs for customers. To demonstrate this effect, the GMP uses an illustrative load curve to demonstrate some of the benefits that TVR can produce in managing system capacity and a more efficient use of generation and network resources.

7. Income-Eligible Customers and TVR

This section provides a brief overview of some of the issues regarding income-eligible customers and time-varying rates.

The impact of TVR on income-eligible customers (described elsewhere as low and moderate income or LMI) and other vulnerable populations has been studied in both academic and applied settings. Study after study finds that income-eligible customers perform like other customers with similar load profiles and save similar quantities on their utility bills. For the purpose of modeling in the Updated AMF Business Case, the Company did not differentiate between income-eligible and all other customers in terms of response rates. The Company's own research suggests that across customer types, income-eligible customers are among the most interested in TVR and the potential for savings they offer.

In general, the academic literature with respect to income eligible and other vulnerable populations follows a similar pattern. First, the authors select a tariff to study and marry that to actual customer data from a utility's service territory over a given time period. The authors then test the impacts of that tariff under the assumption that customers do not respond to the new pricing structure in what is sometimes referred to as the structural impact "no behavior change" or the inelastic demand case. In a subsequent step, the authors apply an elasticity of demand to model the impacts of price and quantity changes over the selected population. Whether income-eligible customers are likely to be structural winners depends on the geography studied, their load profile, and the details of a rate.

The Company's experience has shown that income-eligible customers may require extra outreach. In the Worcester SES pilot, income-eligible customers were statistically identical to other customers in the CPP and peak time rewards (PTR) groups for the default technology package.[20] As part of the SES pilot, customers were offered an enhanced technology package, with, for example, an in-home display. The Company's affiliate also conducted focus groups that found that income-eligible customers had relatively low awareness of the full suite of rates and technologies on offer in the pilot (50% of all customers were not aware of technology offerings in the SES pilot). An important lesson from SES was the value of providing information multiple

[20] Navigant Consulting, *National Grid Smart Energy Solutions Pilot – Final Evaluation Report*, at 11.

times via multiple channels. The Customer Engagement Plan provides more information on the Company's outreach plan for all customers.

As a matter of practice, the Company will work to make sure that income-eligible customers share in benefits of TVR. This can include structural design considerations with respect to rate design, expanded bill guarantees, income-eligible discounts or other programs. The specifics of bill guarantee design or low-income discounts are beyond the scope of this work on time-varying rates but are useful tools to help customers with a TVR rollout. Similarly, the Company may implement other programs or expand existing ones to provide income-eligible customers with the information or tools to benefit directly from TVR through lower energy bills. In summary, the performance of income-eligible customers on TVR will be a priority for the Company.

Appendix C contains a more detailed summary of the current literature on the experience of income-eligible and other vulnerable populations and TVR.

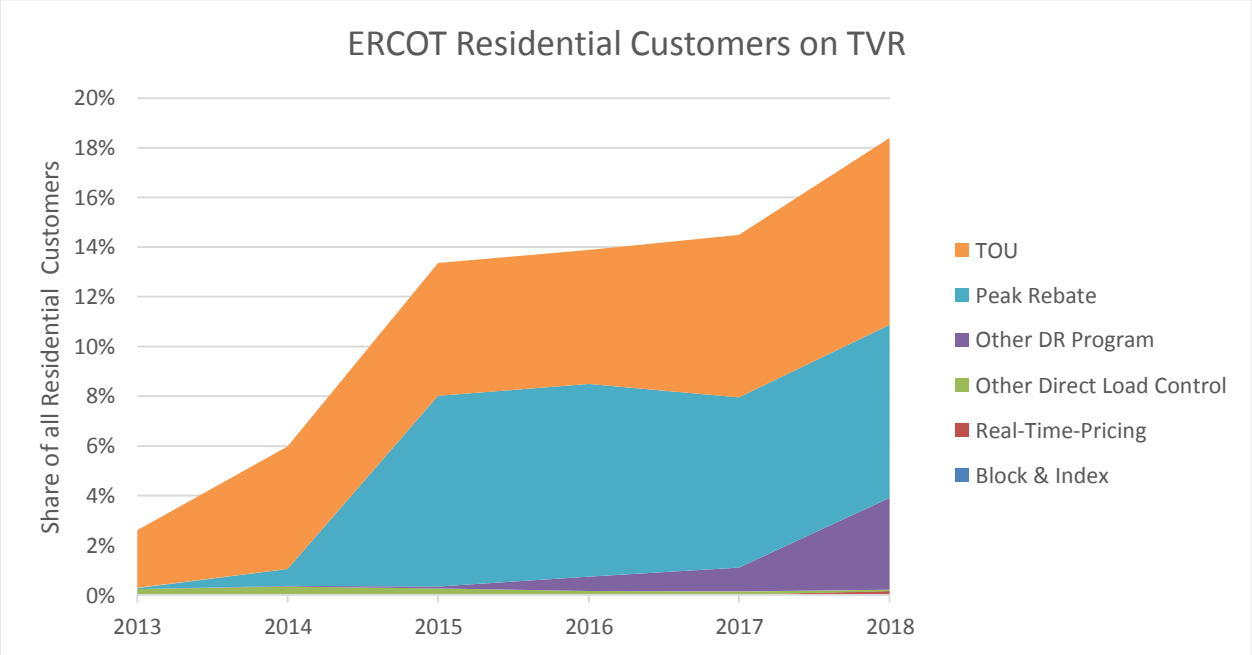
8. Emerging Issues

This section examines the interaction of TVR with other sets of issues facing the electric sector, in particular, the distribution system: retail choice, TVR as a default rate choice, and compensation for distributed generation.

8.1 TVR, Retail Choice, and AMF

Texas provides useful lessons about the symbiotic benefits of a state-wide AMF rollout and retail choice. Texas completed its AMF deployment by the distribution utilities in 2012, becoming the first state to pair the technology with an open market structure for retail customers. In the intervening years, as demonstrated by Figure 12, the number of residential customers on TVR has steadily grown. By 2018, five years after AMF, 18% of residential customers had opted in to some variety of TVR.

Figure 12: ERCOT Residential Customers on TVR



Source: ERCOT (via email correspondence)

The Energy Reliability Council of Texas (ERCOT), which runs the Texas wholesale market, performs an annual study of competitive suppliers and the TVR which indicates that that competitive suppliers have refined their offerings over time based on customer preferences. For example, the percentage of customers on TVR who participate in Direct Load Control (DLC) programs has shrunk steadily. Customers in DLC programs composed 9% of those on TVR in 2013 but declined to 0.31% in 2018 as the number of DLC participants declined from 13,606 in 2013 to 3,583. Over time, a steadily increasing number of customers have chosen rates with simple TOU periods, as indicated by the TOU slice in Figure 13. More interesting perhaps were the dramatic increases in two categories from 2017 to 2018. First, the 2018 TVR census found that nearly 10,000 residential customers were on a real-time-pricing rate, a 503% increase over 2017. Second, in 2018, 234,515 customers, an increase of 291% from 2017, were on what ERCOT classifies as "Other DR Program" which is the generic category for TVR which covers the range of plans beyond simple TOU periods that are not rebates nor real time pricing. This catch-all category would include structures similar to the TOU/CPP construct the Company modeled in the Updated AMF Business Case.

To summarize, almost one-fifth of Texas customers now choose various types of TVR, with greater numbers opting in every year, which is the same percentage that the Company modeled as the opt-in rate in the BCA and Updated AMF Business Case.
However, Rhode Island has a policy lever that Texas does not. In Rhode Island, the Company offers a standard offer service option. In Texas, distribution companies are no longer responsible for procuring electrical supply for their customers. In essence, almost all customers affirmatively select among the competitive suppliers. Thus, in Rhode Island, the Company could offer the standard offer service as a TVR product which could materially catalyze the market for TVR products by exposing more customers to TVR more quickly.

Texas' combination of full retail choice and AMF has helped empower customers to express their preferences to find their "goldilocks plan" that is just right for them. On the other hand, a default TVR option could lead to broader benefits with higher proportions of customers on such designs.

This section does not take a position on the relationships that go into fostering the competitive market found in Texas. Such matters including, but not limited to, data transfers and consumer privacy, consolidated billing and cost allocation, are beyond the scope here. In short, the Company views AMF as a necessary enabling technology to support a robust competitive market for electricity supply. Other enabling policy and regulatory decisions to support can proceed after the approval of AMF.

8.2 TVR as Default Service

8.2.1 **Ontario, Canada**

Ontario became the first jurisdiction in North America with full retail competition and default TOU rates for standard offer service, known as the "regulated price plan" (RPP) almost a decade ago. The Ontario legislature passed the Energy Conservation Responsibility Act on February 27, 2006 and created a smart metering program under which all distribution companies would install smart meters for all customers by 2010.[21] The Board mandated that the RPP for all customers with eligible meters would become a TVR product on August 4, 2010.[22]

Most residential customers took service under the RPP when it was a flat rate before TOU periods were introduced in 2007. As of 2018, a decade after the introduction of TOU rates, more

[21] Ontario Energy Board Act, 1998, Decision with Reasons (March 21, 2006).

[22] Ontario Energy Board, Determination Under Section 1.2.1 of the Standard Supply Service Code to Mandate Time-of-Use Pricing for Regulated Price Plan Consumers Board, File No. EB-2010-0218 (August 4, 2010).

than 90% of customers have remained on the RPP.[23] Ontario allocates over 85% of supply costs though the "global adjustment" (GA). Thus, only 15% of the supply bill is available for retail competition, which has likely been a major barrier to a retail competition in the province. Appendix D contains a further discussion of Ontario's experience with TVR.

8.2.2 **California**

California will become the first state to use TVR as the default for all residential customers taking full service (delivery and generation) from an investor-owned utility by 2020. The California Public Utilities Commission (CPUC) approved territory wide deployment of AMF for the three largest IOUs who provide electric distribution service to the vast majority of the state in three separate rulings between 2006 and 2008.[24] Of those IOU, San Diego Gas and Electric Company (SDG&E) began moving customers to TVR in March 2019, while the California Public Utilities Commission (CPUC) has allowed Southern California Edison (SCE) and PG&E (PG&E) to wait until October 2020 to update their billing systems.[25][26]

The California legislature initiated the TOU rate process with Assembly Bill 327 (AB 327) in 2013 which was implemented by the CPUC through rulemaking R.12-06-013, the Residential Rate Reform Order Instituting Rulemaking. The CPUC adopted 10 principles, enumerated in Appendix E, many of which are similar to Rhode Island's Docket 4600 principles.

As it was the first utility to transition customers, CPUC approved SDG&E to proceed to a default TOU rate with a peak period, an off-peak and a super-off-peak period, an approach which is consistent across the three companies. The Commission holds default TVR to two threshold criteria: whether the designs are will result in measurable benefits to the grid, and whether the rates will be accepted and understood by residential customers.[27] CPUC found it reasonable to allow the utilities to use different methods to set the relationship between peak and off-peak period: SDG&E and SCE use a ratio between the peak and off-peak periods to set their rates,

[23] The 90% number is widely used by the Ontario Energy Board and refers to all customers. *See* https://www.oeb.ca/rates-and-your-bill/electricity-rates and https://www.oeb.ca/sites/default/files/backgrounder-london-rpp-pilot-20180323.pdf.

[24] *See* CPUC, The Benefits of Smart Meters, https://www.cpuc.ca.gov/general.aspx?id=4853

[25] *See* Trabish, Herman K., *California utilities prep nation's biggest time-of-use rate rollout* (December 6, 2018), Utility Dive, https://www.utilitydive.com/news/california-utilities-prep-nations-biggest-time-of-use-rate-roll-out/543402/

[26] *See* CPUC, Phase I Decision Addressing Timing of Transition to Residential Default Time-of-Use Rates, Decision 18-05-0111 at 12 (May 10, 2018).

[27] *See* CPUC, Phase IIA Decision Addressing Residential Default Time-Of-Use Rate Design Proposals and Transition Implementation, Decision 18-12-004 at 20 (December 13, 2018).

while PG&E has a fixed difference between the peak and off-peak period.[28] However, the Commission did not express a preference for either method on a global basis.

While most of the variation in the rate is a result of variation in energy costs, CPUC also approved time-differentiated delivery for the two largest IOU, SCE and PG&E. For example, for PG&E, CPUC found that the summer peak price should be at least one cent per kWh higher than the off-peak price and the winter price should be 0.23 cents per kWh higher to capture the marginal distribution costs.[29] The total premium on the summer and winter periods is 6.3 cents per kWh and 1.7 cents per kWh. Thus, the delivery rates account for under 15.8% of the variation in the bundled rate in the summer and 13.5% in the winter. PG&E's study found that the *bundled* actual marginal cost difference was 11.5 cents per kWh in the summer, but that trimming that in half was consistent with the Commission's guidance to start with a "TOU-Lite" rate.

The Sacramento Municipal Utility District (SMUD), despite working outside the jurisdiction of the CPUC, will began default TOU rates for residential customers in the fall of 2019. SMUD had success with a CPP construct in a well-designed and well-studied pilot. SMUD's plan for default TVR, as articulated in a 2017 filing, focused on the price of power[30] in the wholesale market. In the eight months a year from October through May, SMUD uses a two-period off-peak period of 8 pm – 5 pm and a three-hour on-peak period from 5 pm to 8 pm. For the four-month summer period, SMUD uses the same peak of 5 pm – 8 pm, but surrounds it with a mid-peak that runs noon-5 pm and 8 pm-midnight. The off-peak covers the 12 hours from midnight to noon.[31]

The combination of interval metering and a move to default TVR has helped spur CCAs to choose to offer TVR rates that mimic those of the incumbent utilities. CCAs' rates are beyond CPUC jurisdiction, but the ability of CCA to offer TVR and the necessity of the IOU implementing billing processes to enable TVR by the CCAs is a matter of substantial engagement. Some, but not all CCA are making the move to default TVR. For example, Marin Clean Energy began offering a time of use rate that was very similar to that of the incumbent distribution utility PG&E in 2018.[32]

[28] *See* CPUC, Phase IIB Decision Addressing Residential Default Time-Of-Use Rate Design Proposals and Transition Implementation, Decision 19-07-004 at 51 (July 11, 2019).

[29] *See Id.* at 61.

[30] SMUD. "Chief Executive Officer and General Manager's Report and Recommendation on Rates and Services." March 16, 2017. P24-25. https://www.smud.org/-/media/Documents/Corporate/About-Us/Document-Library/2017-GM-Rate-Report-Vol-1.ashx?la=en&hash=7A245A4333EEAB695A3934ADBF6D5F08DD4374A8

[31] *See* SMUD, Residential Rates, https://www.smud.org/en/Rate-Information/Residential-rates (Accessed April 19, 2020).

[32] Time-of-Use Peak Pricing 4-9 p.m. Every Day (EOTOU-C).

8.3 Compensation for Distributed Generation

The framework for compensating customers with onsite generation includes net energy metering (NEM) which is administered under RI PUC 2207. Under this scheme, customers with on-site generation who inject electricity to the distribution system are compensated at the full retail rate less the renewable energy and energy efficiency surcharges. Because almost all residential customers across the country take service under flat rates for both supply and delivery, most applications of NEM have been implemented in a time invariant manner. However, NEM can be overlaid on TVR in complementary fashion. For example, if customers pay a higher rate during a peak period for consumption, injections could also be compensated at that higher rate.

There is interest in expanding net metering to allow more community (or virtual) net metering from some parties in the state. However, this is not strictly a matter of retail rate design. Rather, community net metering is a form of compensation for distributed generation. Regardless of program evolution AMF will allow for accurate reporting of net generation under net metering or total generation under RE-Growth (REG) to the ISO-NE so that wholesale revenues can accrue to the Company and would be used to offset the costs of either program.

The AMF deployment envisioned in this proposal is robust to future program design changes. Over-the-air software and firmware updates will allow for remote re-programming of the meters to accommodate program changes. In addition, the use of raw interval data can be manipulated by the meter data management system (MDMS) to allow for numerous billing scenarios, including time varying credit payments on customer bills to match TVR for usage. In addition, virtual bills for multiple off-takers from a solar or wind farms (community renewable energy applications) can be constructed if the need arises with the use of the raw data from an AMF meter.

Volumetric time of use rates for delivery have the ability to exacerbate an undesirable cost shift created by NEM. Under NEM, when network costs are recovered volumetrically, but customers still use and rely on the network to export their excess generation and consume energy in periods when their local systems are not generating, they still may exert the same strain on the network as they did before installing the generation. However, because they consume few kWh overall, when delivery costs are denominated in kWh, they pay less toward the cost of maintaining the network. This transfers network costs to other customers. Given that customers who have installed onsite generation tend to be able to afford the high upfront costs for such systems, transferring network costs to customers without on-site generation is regressive. When peak periods for a volumetric time of use rates for delivery are aligned with periods of solar production, customers with PV shift even more network costs to other customers than under flat volumetric rates. In Rhode Island, small customers may choose between traditional NEM and

REG as a mechanism for compensating distributed generation.[33] REG, which separates out the compensation for PV production from retail rates, does not suffer from this issue.

Jurisdictions in the northeast have approached the problem of customers with distributed generation avoiding paying their fair share of network costs in a variety of ways and are at different steps in settling on solutions. In 2015, as per R.I. Gen. Laws § 39-26.6-24, there was a requirement to establish a framework for facilitating and promoting the installation of grid-connected DG and supporting and encouraging development of DG systems in Rhode Island, including Section 24 that required the PUC determine the appropriate cost responsibility and the fair and equitable contributions toward the operation, maintenance, and investment in the distribution system that is relied upon by all customers. To accomplish this, the Company filed a revenue neutral rate case (Docket 4568) that requested changes in customer charges for residential net-metered customers, via a graduated customer charge based on usage prior to installing a net metering system. In addition, it proposed an 'access fee' for large standalone solar farms. Both of these actions were designed to assure fair allocation of the costs of operating, maintaining, and investing in the electric distribution system from all customers, not allowing those customers who installed net metering system to 'zero out' their electric bill and pay nothing towards the operation, maintenance, and investment in the electric distribution system.

The reception of this revenue neutral rate proposal was not widely accepted, with many commenters suggesting their desire to instead have TVR available that would provide the appropriate incentives for DG while assuring these customers would also pay for their use of the electric distribution system. To meet the requirements of R.I. Gen. Laws § 39-26.6-24, the Company agreed to withdraw its revenue neutral rate proposal and move to a stakeholder process run by the RI PUC which became known as the Docket 4600 process in 2016. Throughout the Docket 4600 stakeholder process, virtually all parties agreed with the need to offer TVR in lieu of the proposals in docket 4568 which would require an AMF deployment to accomplish.

In Massachusetts, the legislature has permitted electric distribution companies to propose a Minimum Monthly Reliability Contribution (MMRC) to "ensure that all … customers contribute to the fixed costs of … the electric distribution system."[34] The MMRC is an additional fixed charge per billing cycle, but no MMRC has yet been implemented. New York is addressing the matter in the Value of Distributed Energy Resources (VDER) Rate Design Working Group, which considered the impact of volumetric TVR for delivery.

[33] *See* RE Growth Statute, R.I. Gen. Laws §39-26.6-12, http://webserver.rilin.state.ri.us/Statutes/TITLE39/39-26.6/39-26.6-12.HTM

[34] *See* Mass.gov. Net Metering Guide, https://www.mass.gov/guides/net-metering-guide#5-minimum-monthly-reliability-contribution

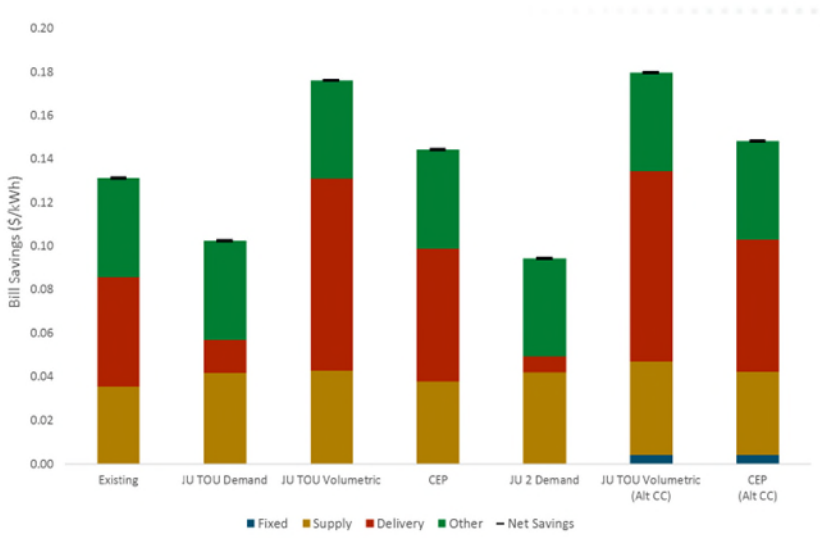
In the VDER process in NY, the New York Department of Public Service Staff has engaged in a broad stakeholder process and compared many types of rate designs to use as the compensation for future rooftop solar installations. In May 2018, Stakeholders submitted rate designs for analysis. Two of those rates collected the delivery revenue requirement exclusively through a customer charge and time-based demand charges, these are labeled "JU TOU Demand" and "JU 2 Demand"[35] in Figure 14. In both cases, there was a demand charge in a peak period to capture times of high distribution system utilization. The "JU TOU Volumetric" uses similar peak periods as the JU demand-based rates but relies on *volumetric recovery* of delivery revenue. Similarly, the rate labeled "CEP rate"[36] has a separate set of peak hours, from the "JU TOU Volumetric" rate, but also uses volumetric TVR rates for delivery. Finally, the alternative customer charge (Alt CC) cases lower the customer charge and use TOU volumetric rates to recover the revenue that is in the customer charge today.

DPS staff engaged the consulting firm E3 to provide analytic support regarding the impact of alternative rate designs. Figure 14 presents bill savings from the perspective of a residential customer with on-site photovoltaic (PV) generation. The gold is the savings to the customer from the change in supply costs, while the red bar is the savings that customer would experience through reducing their delivery bill. Under all four volumetric rate designs E3 modeled, as evidenced by the increased size of the red bars relative to existing rates, shown in the farthest left column, customers with PV reduced their delivery bill more than under current flat rates, increasing the undesirable cost shift of *network costs* onto other customers. On the other hand, the demand-based rate structures reduced this cost shift as customers with rooftop solar paid their fair share of network costs.

[35] In New York, the six different IOU distribution frequently file comments together in generic dockets under the moniker the Joint Utilities, commonly abbreviated "JU."

[36] CEP stands for Clean Energy Parties. For the purpose of the rate design submitted on May 29, 2018 in Case 15-E-0751 are the members of CEP were: Coalition for Community Solar Access, Natural Resources Defense Council, New York Solar Energy Industries Association, Pace Energy And Climate Center, Solar Energy Industries Association and Vote Solar.

Figure 13: Residential Bill Savings by Component[37]

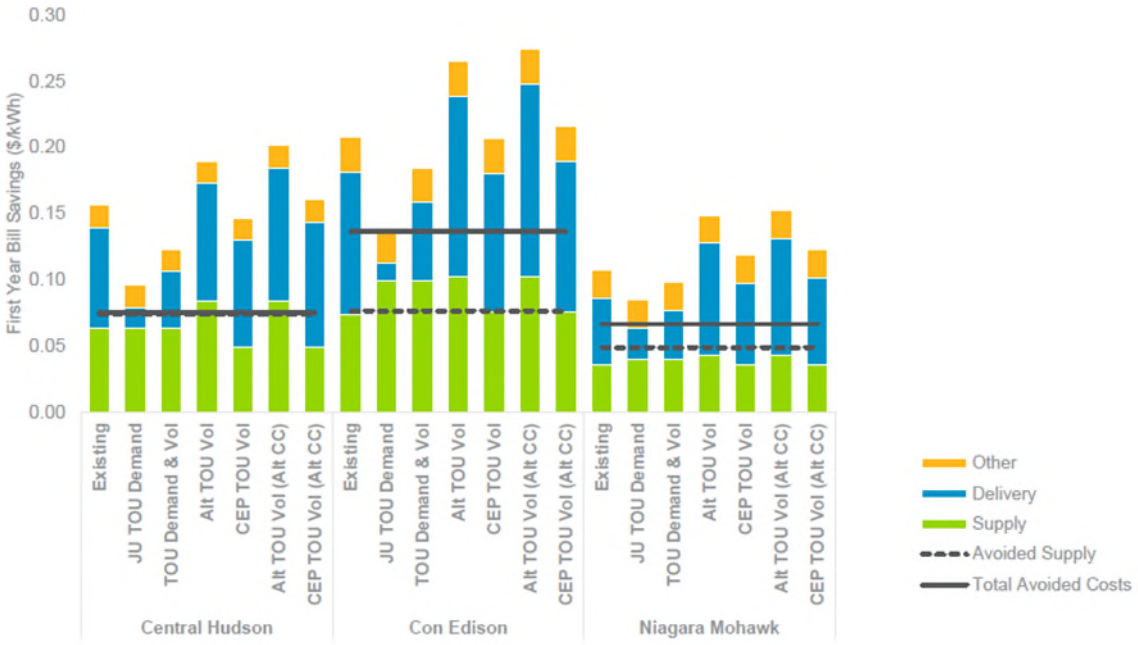


The subsequent step of the analysis then compared the savings to individual customers to the value that they create for the electric system through the lens of avoided costs. Also on behalf of DPS Staff in New York, Navigant Consulting conducted a follow-up analysis to that of E3's and divided the avoided costs into supply and delivery components. These results for the Company's New York affiliate, Niagara Mohawk are presented in Figure 15 alongside the results for two other New York utilities. The dotted black line represents avoided supply costs. The solid black line represents total avoided costs. The difference between the two solid and the dotted dark lines is avoided distribution costs. In a case where compensation to customers was fair, the dotted line of avoided supply costs would line up with the top of the light green bars for supply savings, while the solid black line would align with the top of the blue bars for delivery savings. The JU TOU Demand rate comes closest to achieving this objective of accurate compensation. However, for each of the volumetric TOU rates – the four on the right side for each utility - the blue bars, which represent customer savings, far exceed the solid black line, and by more than the status quo, represented again by "existing." In short, volumetric TOU rates can make the cost shift from participating to non-participating customers under NEM worse. Only one of the two proposed demand rates from Figure 14 appears in Figure 15, but the preparing consultant noted in a Working Group meeting on April 15, 2019, that the two performed almost identically in providing fair compensation.[38]

[37] Energy + Environmental Economics, *E3 NEM Successor Rate Design Analysis Final Updated*, Case 17-01277 at slide 42 (October 9, 2018), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={BD8C45C1-28F2-4544-AFD1-A8E7B53A134D}

[38] Navigant Consulting, *Mass Market DER Tariffs Presentation*, Case 17-01277 at slide 12 (April 15, 2019), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={5741BD28-7780-452A-AF48-F05C7E39106C}

Figure 14: Savings vs. Avoided Cost by Bill Component



9. Conclusion

National Grid is committed to delivering a safe, reliable and cost-effective energy system to Rhode Island. AMF is an important part of the update to the technology package the Company needs to meet increasing operational and customer demands. TVR offers the potential to more accurately price energy and energy services. Such rates can lower costs for customers over long time horizons and allocate costs more fairly as soon as they are implemented.

Following the approval of AMF, the Company will propose a set of TVR that deliver benefits to customers that meet or exceed those modeled in the Updated AMF Business Case at the next juncture as directed by the Commission, but no later than in its next rate case filing. When the Commission approves a suite of TVR, the Company will work closely with stakeholders and customers to make sure that the TVR rollout is a success from a customer adoption perspective and that the TVR deliver benefits to all customers. In particular, as explored more fully in the Customer Engagement Plan, the Company will provide a special focus on vulnerable customers and communities to make sure that they share in the benefits TVR offer through more control of their energy bills.

The Company suggests the following priorities for TVR all of which adhere to Docket 4600 principles:

- Recognition of the importance of the capacity product in driving procurement costs. The capacity element of the rate should carefully reflect how those costs are incurred and be split from variation in the energy market.

- Elements which capture both the seasonal and daily variation that are prevalent in the regional market and which are robust to changing conditions.

- Delivery rates that move from flat volumetric constructs to demand-based rates that reflect system dynamics.

10. Appendix A: Docket 4600 Rate Design Principles

In the Docket 4600 Order, the Commission adopted the principles in Section 3.1 of the Stakeholder Report.[39] These 12 principles are reprinted below:

(1) ensuring safe, reliable, affordable, and environmentally responsible electricity service today and in the future;

(2) promoting economic efficiency over the short and long term;

(3) providing efficient price signals that reflect long-run marginal cost;

(4) identifying future rates and rate structures that appropriately address "externalities" that are not adequately counted in current rate structures;

(5) empowering consumers to manage their costs;

(6) enabling a fair opportunity for utility cost recovery of prudently incurred costs and revenue stability;

(7) ensuring that all parties provide fair compensation for value and services received and receive fair compensation for value and benefits delivered;

(8) being transparent and understandable to all customers;

(9) ensuring that any changes in rate structures are implemented with due consideration to the principle of gradualism, allowing ample time for customers (including DER customers) to understand new rates and lessening immediate bill impacts;

(10) providing opportunities to reduce energy burden and address low income and vulnerable customers' needs;

(11) being consistent with policy goals such as environmental protection, addressing climate change and the Resilient Rhode Island Act, energy diversity, competition, innovation, power/data security, and least cost procurement; and

(12) evaluating rate structures on whether they encourage or discourage appropriate investments that enable the evolution of the future energy system.

[39] *See Investigation Into the Changing Electric Distrib. Sys. and the Modernization of Rates In Light of the Changing Distrib. Sys.*, Docket No. 4600, Report and Order No. 22851 at 22 (July 31, 2017).

11. Appendix B: Selected Literature Review on the Efficiency of TVR

Over time, a more economically efficient electrical system offers the opportunity for lower total costs. Selected examples from the literature regarding the efficacy of TVR for residential customers follow.

Newell and Faruqui[40] find that dynamic pricing has the potential to lower peak loads in New York by 10-14 percent and thus reduces total installed capacity. This reduction in capacity results in savings of $143 million in a base case or $352 million annually depending on the types of accompanying technology. This logic of reduced peak consumption, translating into customer savings, underpins the Company's BCA of the CPP/TOU construct. Newell and Faruqui point out that including overall consumer surplus, drives the value of such peak savings even higher. Subsequent studies echo this approach.

Different research comes to different conclusions about the most effective and realistic way to implement dynamic pricing. Hogan examines the losses in efficiency that come from "well-designed" TOU periods in which he creates TOU rates based on an average price across each hour in a month in PJM, and notes that even with perfect foresight, such rates, which are more granular than the vast majority of TOU rates only capture 18% of the variation in real-time pricing. He argues that where RTP is available, as in ISO-NE, "it seems worth the effort to remove obstacles to going all the way to RTP."[41]

Mays and Klabjan complement Hogan's suggestion about real time pricing for energy by arguing that passing through capacity costs optimally is the most important element of well-designed time-varying rates. In the presence of capacity costs, a demand charge to mimic capacity costs is a necessary addition to RTP. However, they find that a CPP structure captures roughly two thirds of the benefits of RTP with a demand charge for capacity. As they note, the right TOU windows, the right number of CPP days and the right hours for the mechanism, can all play important roles in determining their impact.[42]

Jacobsen et. al make an important contribution to the literature by connecting the degree of inefficiency in pricing to consumer welfare. They argue that under certain conditions, "the R^2 and the sum of squared residuals from a regression of true externalities on policy variables measure relative welfare gains from policies." Simply, they argue that one can use those measures of variance to compare any pricing structure from optimal pricing (real time with

[40] *See* Newell, Sam & Faruqui, Ahmad, *Dynamic Pricing: Potential Wholesale Market Benefits in New York State, NYISO* (October 27, 2009), https://www.nyiso.com/documents/20142/1394052/Case_09M0074_NYISO_Supp_Cmmts_Report_12_17_09.pdf/9b9fc46c-9678-7187-84e4-1e359de7b743

[41] Hogan, William W, *Time-of-Use Rates and Real-Time Prices* (August 23, 2014).

[42] *See* Mays, Jacob & Klabjan, Diego, *Optimization of Time-Varying Electricity Rates*, 38 [5] The Energy J. (2017).

accurate capacity tags) in the case of electricity to determine the loss of consumer welfare. For example, if a simple TOU structure captured 5% of the variation in energy pricing, the cost of the policy is that consumer welfare misses out on the remaining 95% efficiency improvement.[43]

Borenstein finds that incorporating demand elasticity with a CPP design makes roughly three quarters of customers better off across the territories of the two largest California investor-owned utilities.[44] He also suggests that CPP events should be flexible, and that the utility should not be mandated to call a set number of days' worth of events, but the CPP rates should be constructed in such a way that they adapt to actual conditions in a given year. National Grid's modeled CPP construct of events of varying length and frequency adopt this approach.

Burger et al [45] provide the most comprehensive look at the economic efficiency improvements of applying TVR to the distribution vs. supply sections of the electric bill using interval data from more than 100,000 customers of Commonwealth Edison (ComEd) in 2016. The move away from volumetric recovery of network costs to a combination of fixed and coincident peak demand charges has, generally, larger welfare gains for consumers than adjusting supply rates only. Similar to the finding from Mays and Klabjan, they find that maintaining a flat volumetric recovery of capacity costs severely reduces the beneficial impact of the various types of TVR.

They analyze four alternatives to the current flat, volumetric cases, with the numbers corresponding to the column numbers in table 2:

1. Default flat rates with volumetric recovery for supply.
2. A flat rate for supply and policy costs with a non-coincident demand charge for network costs, which include transmission and distribution.
3. A critical peak price setup for which the CPP events cover the top 18 highest electrical priced days in the ComEd territory and flat volumetric charges for network costs, including those commonly understood as delivery charges. Capacity costs are recovered in flat volumetric rates. This rate differs from that National Grid models in the Company's AMF BCA, presented in column six below, because it uses CPP for energy, rather than capacity.
4. Real time pricing for energy with flat volumetric charges for capacity and for network costs, including those commonly understood as delivery charges.
5. Real time pricing for energy with a Coincident Capacity Charge (CCC) for generation capacity with fixed charges for network (delivery) charges.

[43] *See* Jacobsen, Mark R, et al., *The Use of Regression Statistics to Analyze Imperfect Pricing Policies,* 128 [5] J. of Political Economy (2020).

[44] *See* Borenstein, Severin, *Effective and Equitable Adoption of Opt-in Residential Dynamic Electricity Pricing,* NBER Working Paper 18037 (2012).

[45] *See* Burger, et. al., *The Efficiency and Distribution Effects of Alternative Residential Electricity Rate Designs,* NBER Working Paper No. 25570 (February 2019).

Table 2: Comparison of Burger et. al Cases and National Grid BCA Modeled Case

		1	2	3	4	5	6
		Default	Flat NCDC	CPP-10	RTP-Vol	RTP-CCC	NGrid (Modeled)
Energy (Market)	Energy	Flat-Vol	Flat-Vol	CPP	RTP	RTP	TOU
	Capacity	Flat-Vol	Flat-Vol	Flat-Vol	Flat-Vol	CCC	CPP
Network	Transmission	Flat-Vol	NCDC	Flat-Vol	Flat-Vol	Fixed	Flat-Vol
	Distribution	Flat-Vol	NCDC	Flat-Vol	Flat-Vol	Fixed	Flat-Vol
Policy		Flat-Vol	Flat-Vol	Flat-Vol	Flat-Vol	Flat-Vol	Flat-Vol
Other Delivery	Customer & Metering	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

The CPP scenario the Company analyzes in the AMF BCA model is different than the one Burger et. al label "CPP-10" in its treatment of both energy and capacity, but similar in its treatment of network costs. As Table 3 makes plain, while such scenarios deliver significant value to customers through improved consumer surplus, the CPP rates with no change to distribution is fundamentally a conservative modeling estimate of benefits.

Table 3 presents the increase in consumer surplus under the various modeled scenarios indexed to RTP-Volumetric set to 100, with the largest gains from network costs moving to a coincident demand charge and real time pricing, following by flat pricing for volumetric with a non-coincident peak demand charge. The authors do not present this case to argue for non-coincident demand charges, but rather to illustrate the efficacy of moving away from volumetric cost recovery to any demand-based instrument.

Table 3: Comparison of Change in Consumer Surplus by Rate Design

Elasticity Case	Flat NCDC	CPP-10	RTP-Vol	RTP-CCC
-0.1	786	356	100	8,018
-0.3	2,501	1,181	312	23,356

12. Appendix C: Equity and TVR

Borenstein (2012) examines the distributional impacts of a CPP program using interval data from two largest California utilities, Pacific Gas and Electric (PG&E) and Southern California Edison (SCE). He finds first that neither a TOU nor a CPP approach would "substantially alter the average electricity bills of households in the lowest income brackets" before accounting for the elasticity of demand/behavior change. In the SCE territory, he finds that low income customers would be advantaged by CPP, saving on average 1.5-2.5% more than wealthier customers, a result that is statistically significant.

Shirowitz and Lave (2014) analyze customers in the ComEd territory with data from 2007 and 2008 for the switch between a flat tariff and a RTP with a demand charge for capacity based on the customer's usage in 10 highest hours of system usage. The first result is that applying the RTP pricing to the customer usage profile and assuming zero price response, offers savings to 36% of customers, while 70% of customers would see bills within 10% of their flat rate bills. Second, customers with the smallest loads and bills, on average, are less likely to be structural winners. As pertains to low income customers, defined as any customer receiving one of a number of means tested programs, their usage patterns are "statistically indistinguishable at the 95% confidence interval" from other similarly sized customers. Under the elastic demand case, where customers respond, *but only when the price rises a certain amount*, customers net out ahead in all cases, but larger customers are most likely to see savings. The authors find that under increasing capacity costs, RTP benefits significantly larger numbers of customers. Because the response to capacity rather than energy only variation plays such a significant role in the total benefits and distribution of benefits, the authors suggest a CPP as a solution which prioritizes periods when capacity is likely on the margin, as a customer-friendly approach to realizing much of the benefit of RTP. This study examined only changes to the supply portion of the bill.

Simshauser and Downer (2016) study Australian consumers under a CPP construct. Trials in Australia found that peak load reductions under CPP were 19.2%, rising to 21% with enabling technology, while another study by Energex & Ergon found the same 19%, a response of 24% among low income households. The same report found that only 8% of customers found responding to CPP events difficult, while "71% found it easy." Simshauser and Downer apply a novel tariff, a TOU + CPP structure in place of residents' flat price. Among all cohorts, it "Hardship" cohort, defined as those who were on a special low income rate who are most likely to be structural winners (65%) and see the largest savings. After applying a demand response, and rebalancing the tariff to maintain network revenue equivalency, they find that 79% of Households in Hardship experience bill savings. Consistent with other studies, the authors find that before rebalancing, 96% of households experience annual bill changes of +/- 10%. In this study, network costs account for roughly 50% of the whole bill in the flat rate context, and the CPP and TOU structure appears to be applied to the entire bill rather than just the portion accounting for supply/commodity.

Hledlik and Greenstein use data from Vermont for a calendar year spanning 2014 to 2015 to assess the impact of the distributional impact of residential demand charges. These authors took the existing two-part tariff of a fixed charge in addition to a flat volumetric charge of $0.11/kWh and divided that into a three-part tariff with an identical customer charge, a volumetric charge of $0.68/kWh and a $7.00/kW demand charge. They applied this demand charge to the customer's highest demand between 2 and 6 pm each month, which aligned with the system's peak loading. They established a threshold of 150% of the Federal poverty level to qualify as "low income" for the purposes of study. In comparing the bills of customers before and after the application of the new rate, low income customers, were affected, on average, identically to other customs. The insight, as was the case in Simshauser and Downer, was that customers with a flatter profile did better under the demand charge as compared to those with "peakier" loads. Notably, a majority of customers experienced a decrease in bill volatility under the three-part rate. While this study did not explicitly account for the distinction between supply and delivery on customers' bills, the level of the volumetric charge in the three-part is *roughly* consistent with supply costs, so in essence they moved all of the variable costs of the delivery bill out of a volumetric structure into one predicated on demand.

By separating network from energy market costs, Burger et al. (2019) offer the most realistic impact on low income customers. They find that maintaining the status quo of volumetric time-invariant network charges, but moving towards increasing granularity in energy charges, "benefits low-income customers on average" in their sample in the inelastic demand (no change in quantity). Adding demand elasticities increases the improvement in consumer surplus. They find that increasing the fixed charge to recover all network costs, which may be largely economically efficient has regressive effects. They propose remedies including a progressive fixed charge based on income, geography or peak usage, all of which mitigate the harm to low income customers. The latter case, is, in effect rather shifting distribution costs into a combination of today's customer charge and demand-based rates.

Cappers et al (2016) study the effect of critical peak pricing on three sets of vulnerable customer populations, low income, the elderly and the chronically ill.[46] While there is a growing literature on the experiences of low-income customers, or the potential impact for low income customers of TVR, other subpopulations have received less attention. This work builds on the Smart Grid Investment Grants and isolates the results from two utilities which were robust enough for further analysis: Green Mountain Power (GMP) and SMUD.

Cappers et al offered five broad observations. First, vulnerable populations looked largely like other customers, or where variations existed, they "were very small in magnitude and not always statistically significant." For example, elderly customers (GMP) and low-income customers (SMUD) had lower peak period usage than others, while the chronically ill (GMP) were higher.

[46] *See* Cappers, P., C.A. Spurlock, A. Todd, & L. Jin., *Experiences of Vulnerable Residential Customer Subpopulations with Critical Peak Pricing,* Lawrence Berkeley National Laboratory, LBNL-1006294 (2016).

Second, vulnerable populations were slightly less likely than other customers to choose a CPP rate, but once enrolled, stayed on the rate at similar rates as their non-vulnerable counterparts. Third, vulnerable populations were usually just as responsive to price signals as other customers. Fourth, vulnerable populations benefited financially proportionally to non-vulnerable groups. Vulnerable groups did not report any increased difficulty relative to other customers in changing their behavior to adapt to TVR and exhibited high degrees of satisfaction (91-100% suggesting that they would stay on the rate). In fact, low-income customers in SMUD exhibited significantly higher levels of satisfaction than higher-income customers.

Faruqui et al (2010) surveys early dynamic pricing pilots for the behavior of low-income customers. They find that low-income customers do respond to dynamic rates. However, they also find a mixed responsiveness, of low-income customers as compared with the average customer, with response rates that in some cases differed by 50% and in others not at all. They also find that due to structural load factors, even without shifting, some 65 to 79% of low-income customers could benefit from TVR, strongly suggesting that TVR is advantageous for the majority of low-income customers.[47]

[47] *See* Faruqui, Ahmad, Sanem Sergici, and Jennifer Palmer, *The Impact of Dynamic Pricing on Low Income Customers*, IEE Whitepaper (September 2010).

13. Appendix D: Default TVR and the Competitive Market in Ontario

Competitive providers in Ontario offer three main types of rate plans for residential customers: (1) fixed rates with long-term (3-year or 5-year) contracts; (2) real-time pricing based on wholesale market prices plus a small markup (CA$0.01/kWh), with 1-year and 3-year contracts; (3) the mid-peak price from the TOU RPP rate minus a small amount (CA$0.005/kWh) with shorter (1-year) and longer (3-year) term contracts.[48] Most of these plans appear to have CA$50 cancellation fees that providers may waive if customers interact with them directly.[49]

Comparing TOU RPP and fixed price plans is difficult because retailers do not report the all-in cost of supply when marketing their fixed price plans.

In addition to its market-based "hourly Ontario energy price" (HOEP), the province also creates a separate and significant "global adjustment" (GA) charge, whose structure seems to be a major barrier to retail competition in the province. The GA covers capacity (investment) costs of new and existing generators and the cost of demand side management (DSM) programs. The GA appears as a separate line item in non-utility rate plans and is calculated based on a suppliers' aggregate load profile on a load ratio share in the province and varies across months and years. In 2017 it accounted for the bulk (86%) of wholesale supply costs in Ontario.[50]

To estimate the effect of the GA, Figure 15 compares the winter TOU RPP to a fixed rate offered by a competitive supplier and illustrates the impact of the GA. The yellow line is the fixed rate is CA$0.0359, from MyRate,[51] while the red line adds in the 2017 average GA (CA$0.0997), as reported by the Independent Electric System Operator (IESO). The actual GA charge for competitive retailers will likely be less than the average GA, so this is probably an upper bound, but nevertheless all-in fixed rates are likely to be closer to on-peak prices than off-peak prices.

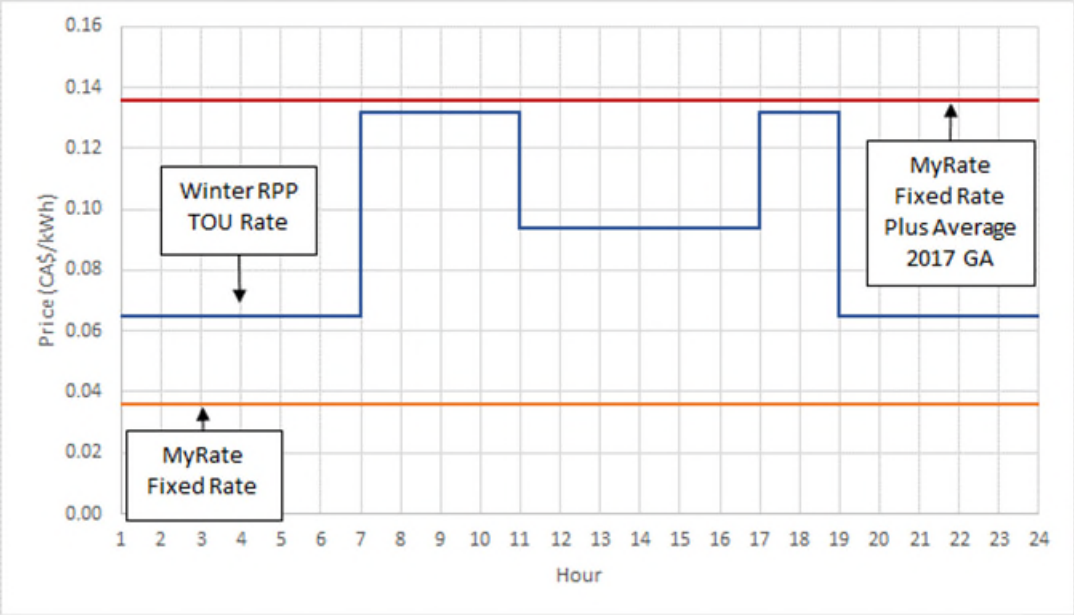
[48] Based on rates for the Toronto and Ottawa areas, *see* https://energyrates.ca.

[49] Cancellation fees can be waived via direct registration with the provider.

[50] GA rates are reported by the IESO at http://www.ieso.ca/power-data/price-overview/global-adjustment.

[51] From http://myrateenergy.ca.

Figure 15: Ontario RPP, Fixed MyRate and GA Adjustment



Customers on RPP and customers with competitive suppliers all pay a fixed monthly charge ($/mo) for distribution service and the same variable charge ($/kWh) for transmission service.

14. Appendix E: CPUC Rate Design Principles

In the Phase Two Order,[52] issued June 19, 2014, CPUC adopted the following 10 principles to use to evaluate potential rate design proposals.

1. Low Income and medical baseline customers should have access to enough electricity to ensure basic needs (such as health and comfort) are met at an affordable cost;
2. Rates should be based on marginal cost;
3. Rates should be based on cost-causation principles;
4. Rates should encourage conservation and energy efficiency;
5. Rates should encourage reduction of both coincident and non-coincident peak demand;
6. Rates should be stable and understandable and provide customer choice;
7. Rates should generally avoid cross-subsidies, unless the cross-subsidies appropriately support explicit state policy goals;
8. Incentives should be explicit and transparent;
9. Rates should encourage economically efficient decision making;
10. Transitions to new rate structures should emphasize customer education and outreach that enhances customer understanding and acceptance of new rates and minimizes and appropriately considers the bill impacts associated with such transitions.

[52] CPUC, Decision On Phase 2 Rate Change Proposal Settlement Agreements Of Pacific Gas And Electric Company, Southern California Edison Company, And San Diego Gas & Electric Company For Summer 2014 Rate Reform, Decision 14-06-029, Rulemaking 12-06-013 (Issued June 19, 2014), http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M096/K546/96546788.pdf

Attachment D
Metrics & Performance

Metrics and Performance Incentive Measures Roadmap

Table of Contents

1. Overview

The Company recognizes that the realization of benefits from AMF deployment is essential to Rhode Island customers, regulators, and stakeholders, and is committed to enabling and delivering these benefits. Development of an appropriate incentive framework will reinforce that commitment and ensure that the Company's interests remain aligned with maximizing the value of AMF deployment for the benefit of customers. The Company believes that *delivered benefits* and *enabled benefits* should be considered separately in developing an incentive framework. Toward this end, the Company is proposing an incentive structure that will directly provide 80 percent of the Non-Outage Management System (OMS) Avoided O&M benefit to customers through an adjustment to the revenue requirements in the first rate period following AMF approval. With this commitment, customers are guaranteed to realize benefits and a reduction in bill impacts earlier than they otherwise would. Traditionally, such operational savings would not be reflected until they are captured in base distribution rates resulting from a future rate case proceeding. The commitment also provides an incentive for the Company to ensure the benefits are delivered in a timely manner, as failing to achieve the benefits, which are included as a reduction to the revenue requirement, will result in the Company's expenditures exceeding its cost recovery.

For enabled benefits, the Company proposes to work with stakeholders to develop and propose performance incentive mechanisms (PIMs) in subsequent proceedings, with an expectation that these incentives will focus on key outcomes directly tied to customer and societal benefits, as well as new use cases. This effort will require further consideration of the existing landscape for performance incentives in Rhode Island. In particular, the Company recognizes that all new incentive proposals must be evaluated for consistency with the PIMs principles adopted by the Commission in *Docket 4943 – Guidance Document Regarding Principles to Guide the Development and Review of Performance Incentive Mechanisms.* Finally, the Company is proposing a set of tracking metrics spanning both benefit categories (i.e., delivered and enabled), in order to ensure the Company is progressing in the delivery of AMF program elements and is on track to deliver core benefits for customers.

This Metrics and Performance Incentive Measures Roadmap provides an overview of the following:

1) Discussion of the Company's approach to building delivered benefits into the revenue requirement presented in the pre-filed joint testimony of the Revenue Requirements and Pricing Panel, and an assessment of this approach for consistency with the PIMs principles adopted by the Commission;
2) The interaction of AMF with the existing landscape of performance incentives in Rhode Island relevant to enabled benefits;

3) Key considerations and potential paths forward for PIMs or utility revenue opportunities that encourage the Company to utilize AMF in support of enabled benefits and creating value for customers; and

4) A comprehensive set of metrics the Company proposes to track during implementation of its AMF program that align with the primary benefit drivers of the Updated AMF Business Case.

2. Incentive Framework for Delivered Benefits

The Updated AMF Business Case classifies benefits into six modified categories to reflect the levels of control over achieving the of benefits:[1]

- Non-OMS Avoided O&M Costs;
- Avoided OMS Costs;
- Avoided automated meter reading (AMR) Costs;
- Volt-VAR Optimization (VVO) Benefits;
- Non-VVO Customer Benefits; and
- Societal Benefits.

The Company will have the greatest control over achieving those benefits in the Non-OMS Avoided O&M Costs category. These benefits, along with Avoided OMS Costs, Avoided AMR Costs, and VVO Benefits are characterized by the Company as *delivered benefits*, because they are achieved directly through the Company's successful deployment of AMF. Non-VVO Customer Benefits and Societal Benefits, on the other hand, are referred to as *enabled benefits*, as they are enabled by AMF and can be influenced by the Company, but ultimately achieving such benefits depends on customers changing their behavior. Figure D-1, which is the same as Figure 8-13 in the Updated AMF Business Case, summarizes benefits by category and level of Company control over achieving the benefit (i.e., delivered or enabled). The benefits are represented in 20-year net present value (NPV) numbers.

[1] The categories generally align with the four categories used throughout the Benefit Cost Analysis (BCA) in the Updated AMF Business Case. The only exceptions being the respective separations of VVO and OMS benefits from the Customer Benefits and Avoided O&M Costs categories.

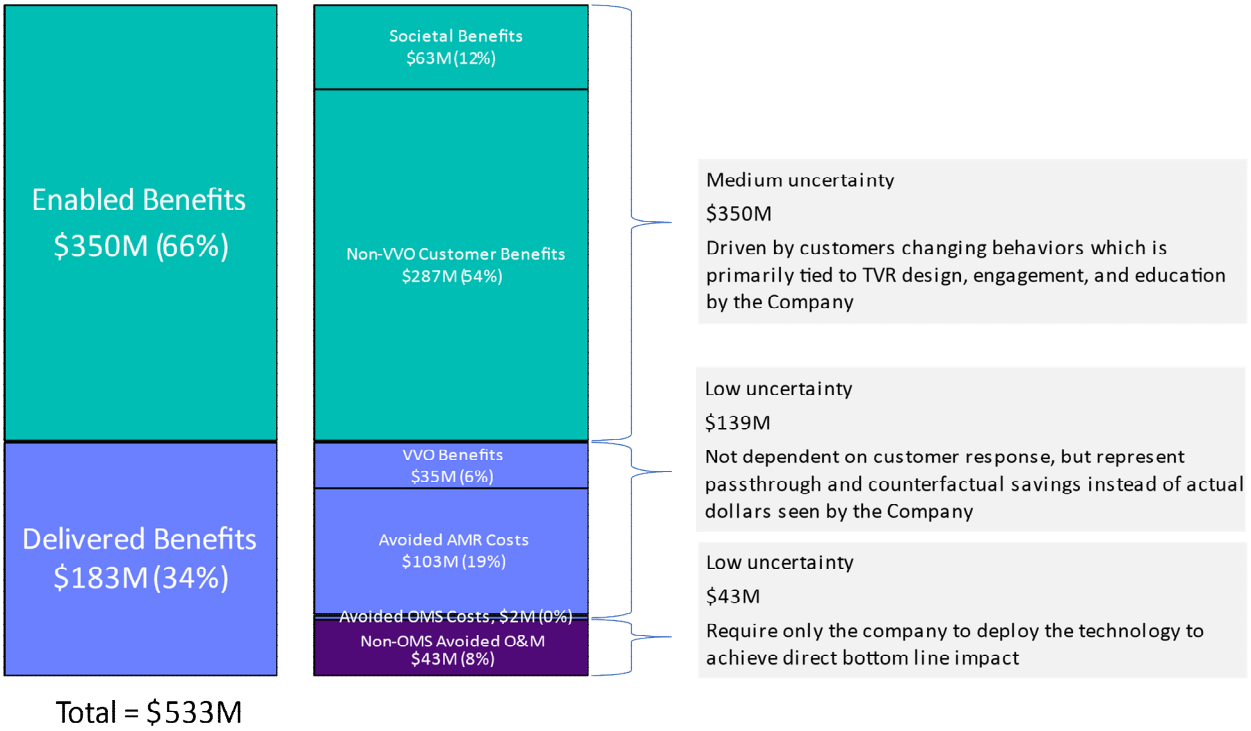


Figure D-1: Benefit amounts (20-year NPV, Opt-out case)

Savings of the categories within delivered benefits manifest in different ways. Non-OMS Avoided O&M Costs impact the Company's bottom line. VVO Benefits are pass-through benefits to customers, though they require no customer action. Avoided AMR & OMS Costs are based on counterfactual costs that would be incurred without AMF.

The Company recognizes that some stakeholders are concerned about achievement of the full suite of benefits identified in the Updated AMF Business Case. As a first step to ensuring the achievement of benefits for Rhode Island customers, the Company is proposing an incentive structure that will directly provide a portion of the Non-OMS Avoided O&M Cost benefit to customers by adjusting the revenue requirement in the first rate period following AMF approval to capture 80 percent of the savings. This commitment provides an incentive for the Company to ensure the benefits are delivered in a timely manner, as failing to achieve the benefits will result in the Company operating with expenditures in excess of revenue requirements. For customers, the value of this approach is guaranteed cost savings, realized sooner than would otherwise occur. Traditionally, such operational savings would not be reflected until base rates are set during a future rate proceeding. Such benefits would therefore not be realized until the rate plan following AMF network deployment.

The Company is committing to include 80 percent of the Non-OMS Avoided O&M benefit in the revenue requirements as a reduction in operating costs. The benefits include those from reduced AMF operational costs, remote meter capabilities, and mitigation and/or reduction of damage claims, among others. Non-OMS Avoided O&M cost benefits that exceed the 80 percent reflected in the revenue requirement would be retained by the Company until the next rate proceeding when new base rates are set; providing an incentive for the Company to maximize benefit realization for customers.

As discussed in the following sections, the Company is committed to tracking its overall performance and its progress in advancing the full suite of customer benefits. The Company expects that performance metrics and additional incentives around outcomes tied to enabled benefits will further align the Company's interests with the interests of stakeholders and regulators in maximizing the full value of the AMF deployment. The Company proposes to work closely with stakeholders to develop and propose appropriate PIMs in subsequent proceedings.

2.1 Evaluation of Delivered Benefits Incentive Framework for Consistency with PIMs Principles

The Company has assessed the delivered benefits incentive framework described above against the PIMs principles adopted by the PUC under Docket No. 4943. This assessment is summarized in Table D-1, below.

Table D-1. Evaluation of Delivered Benefits Framework against PIMs Principles

Principle	Discussion
A PIM can be considered when the utility lacks an incentive (or has a disincentive) to better align utility performance with the public interest and there is evidence of underperformance or evidence that improved performance will deliver incremental benefits.	This incentive is intended to ensure alignment of utility performance and the public interest, by providing an upfront guarantee to customers of a large portion of the expected benefits in advance of when they are schedule to be achieved.
Incentives should be designed to enable a comparison of the cost of achieving the target to the potential quantifiable and cash benefits.	This incentive is a shared savings incentive where the Company would retain Non-OMS Avoided O&M Cost benefit above the 80% is provided directly to customers through an adjustment to the revenue requirement in the first rate period following AMF approval. The costs of achieving this target are the costs of AMF deployment, and the benefits of AMF expand beyond the Non-OMS Avoided O&M Cost benefit that are the focus of this proposal. There is a clear net benefit to customers in that they are provided savings in advance of when they would otherwise be reflected in rates.
Incentives should be designed to maximize customers' share of total quantifiable, verifiable net benefits. Consideration will be given to the inherent risks and fairness of allocation of both cash and non-cash system, customer, and societal benefits	Customers will be guaranteed 80% of the Non-OMS Avoided O&M Cost benefit in the first rate period following AMF approval, regardless of whether the Company delivers them as scheduled. Customers will receive the full value of the benefits when rates are reset after the new MRP. The Company incurs the risk of non-delivery of expected benefits, and the customer will receive 80% of these benefits in advance of when they would be reflected in rates.
An incentive should offer the utility no more than necessary to align utility performance with the public interest.	The incentive level attached to this proposal is modest and tied to the level of savings achieved. If the Company does not achieve 80% of the expected savings, the Company forgoes the revenue requirements associated with the differential between achieved savings and the 80% threshold.
The utility should be offered the same incentive for the same benefit. No action should be rewarded more than an alternative action that produces the same benefit.	The Company does not currently have another incentive related to the delivery of these benefits.

3. Performance Incentive Mechanisms (PIMs) in Support of Enabled and Novel Benefits

As the Company discussed in Docket No. 4770, a shift toward performance-based regulation is foundational to achieving the ambitious energy policy goals articulated in Docket No. 4600, the Resilient Rhode Island Act, and Governor Raimondo's executive order.

Well-designed performance incentives provide utilities with a clear signal and economic rationale to pursue innovation in support of regulatory and policy goals, and can create significant new value for customers by encouraging the Company to meet and exceed the evolving and increasing needs and expectations of its customers. They do so by better aligning utility regulation with the sort of incentives firms face in competitive markets, such as incentives for innovation, cost efficiency, and customer value. The value of incentives is explicitly recognized in the Docket No. 4600 goals: "Align distribution utility, customer, and policy objectives and interests through the regulatory framework, including rate design, cost recovery, and incentives."[2]

The Company believes performance incentives can provide broad new benefits to customers and help advance Rhode Island's energy policy goals. Specifically, such incentives are most likely to be appropriate and effective when: 1) there is a demonstrated market failure or a unique strategic role that can be served by the utility; 2) there is an opportunity to produce significant benefits to customers and/or promote Rhode Island's energy policy goals; and 3) the distribution company plays a distinct and clear role in bringing about the desired outcome.

With respect to AMF, performance incentives can help to ensure that the Company's financial interests remain aligned with the interest of stakeholders and regulators in maximizing AMF-enabled benefits. However, the Company believes the specific components of such PIMs should be addressed in a separate proceeding for three reasons. First, as the Updated AMF Business Case discusses, the implications of AMF are widespread, affecting the Company's operations, existing programs, future programs, and opportunities for new third-party services. Given the extensive reach of AMF, the Company believes designing appropriate and effective PIMs will require careful consideration and analysis, informed by future Company proposals that will further enable AMF-related benefits (e.g., time-varying rates (TVR)). Second, as discussed in the next section, development of performance incentives around AMF must also recognize that AMF deployment will affect existing performance incentives; as such, the Company will need to understand and avoid potential redundancies, as well as unintended consequences. Third, the PUC issued principles and guidance for PIMs under *Docket No. 4943 – Guidance Document Regarding Principles to Guide the Development and Review of Performance Incentive Mechanisms*, and that any future PIMs will need to be consistent with the Commission's

[2] *Pub Util. Comm'n Guidance on Goals, Principles and Values for Matters Involving the Narragansett Elec. Co. d/b/a National Grid*, Docket 4600-A at 4 (October 27, 2017[Docket 4600 Guidance Document].

principles. The Company provides more discussion of the existing landscape for performance incentives in Rhode Island, Docket No. 4943, and potential next steps below.

3.1 Current Landscape of PIMs in Rhode Island and Implications of AMF

The Company currently has performance incentives in a number of key areas of regulatory and policy importance. These include:

- Shareholder incentives for the Company's electric and gas Energy Efficiency (EE) programs;
- Incentives for procurement of long-term renewable energy contracts from wholesale power providers, and (under the Renewable Energy Growth Program), contracts from eligible distributed-generation projects;
- Under System Reliability Procurement (SRP), incentives tied to completion of specific programmatic actions, as well as savings-based incentives tied to savings from qualifying installed distributed energy resources;
- Under its Service Quality Plan, performance standards for reliability and customer service, associated metrics, targets, and penalties, with the potential to earn offsets that can be applied against future penalties;
- Under the Amended Settlement Agreement in Docket No. 4770 (ASA), a PIM for Megawatt (MW) Capacity Reductions, as well as a suite of reporting metrics, and the opportunity to re-propose certain metrics related to vehicle electrification as PIMs for Rate Year 2.

In addition, under Docket No. 4857, the PUC is evaluating an incentive mechanism to encourage efficient capital spending under the electric Infrastructure, Safety, and Reliability Plan (ISR). AMF deployment has implications for some of these incentives, most notably MW Capacity Savings and the EE shareholder incentives.

3.1.1 MW Capacity Savings

The deployment of AMF will support the implementation of TVR, which will directly support both peak-demand reduction and the efficient integration of new load from electrification of heat and transportation. For the current rate period, the Company has a PIM tied to MW Capacity Savings, intended to reflect the avoided capacity coincident with the ISO New England ("ISO-NE") peak hour. Eligible resources for the Company's Annual MW Capacity Savings include: 1) demand response, which will not be eligible for an incentive under the existing EE shareholder incentive; 2) incremental net-metered behind-the-meter photovoltaic (PV) distributed generation in excess of Company forecast levels; 3) incremental installed energy storage capacity; and 4) any additional actions that the Company can identify to reduce peak demand, including non-wires alternatives expected to influence system peak that are not captured already under this or

other metrics, and partnerships with third parties to provide peak reduction solutions. The addition of TVR will warrant consideration of how to best expand or modify the MW Capacity Savings PIM to account for reductions attributable to TVR and the interaction of these rates with ongoing demand response programs. The Company expects to address this question in more detail in its next rate filing.

3.1.2 Energy Efficiency (EE) Shareholder Incentive

As discussed throughout the Updated AMF Business Case, the availability of AMF-enabled interval usage data offers immediate incremental benefits for the Company's long-standing EE programs in service of its residential, income-eligible, small business, and large commercial and industrial customers, primarily in the form of more personalized targeting, action-based and programmatic recommendations, and potential enhancements to future evaluation, measurement, and verification (EM&V) processes.[3] In addition, apart from program offerings, immediate savings are expected to occur by virtue of the visibility and enhanced energy insights that a smart meter provides to customers. In other words, the addition of AMF implies both the establishment of new baselines, as well as the ability to offer more innovative program delivery in support of more challenging targets. As the Company notes in the Updated AMF Business Case, the Company will address its vision for the deployment of AMF supporting future delivery of EE programs, while mitigating concerns of double counting and/or recovery in its EE Plan. Any new PIMs linked to AMF will also require thoughtful consideration of this interaction.

3.2 Docket No. 4943 and Key Considerations for PIMs in Rhode Island

As reflected in the summary above, the PUC has assessed performance incentives in a number of contexts and dockets. Most recently, the Commission developed PIMs principles and guidance as part of its work in Docket No. 4943. The Commission will review all incentive proposals for consistency with these principles, which are included in Table.

Docket No. 4943 raised a number of themes that the Company believes should remain a focus as incentive proposals are developed in Rhode Island. Rationalization of incentives across dockets, to avoid the potential for duplicative earning for a single outcome or action;

- Avoiding differently sized incentives for the same action or outcome in different dockets;[4]
- Movement toward incentives focused on key outcomes and benefits, rather than actions or programs; and

[3] The Company does not estimate any EM&V-related benefits as part of its AMF BCA, although it recognizes that such a benefit may exist in the long-term.

[4] The Company did note in its comments in Docket No. 4943, however, that in certain circumstances, ancillary benefits might warrant differently sized incentives.

- Ensuring benefits of incentives exceed costs to customers and limit the risks to customers.

The Company believes that PIMs in Rhode Island should be consistent with the above, and also recognizes that any PIMs proposal will need to be consistent with the principles and guidance document issued under Docket No. 4943. As discussed in the next section, the Company anticipates working closely with stakeholders to consider how PIMs might most effectively advance regulatory and policy objectives in light of the new functionalities and opportunities presented by AMF and the Company's Grid Modernization Plan ("GMP").

4. Next Steps on PIMs and Utility Revenue Opportunities in Support of Enabled and Novel Benefits

As discussed above, the Company recognizes that regulators and stakeholders have an interest in ensuring that the Company deploys AMF in a manner that is cost-efficient, while maximizing benefits to customers. On the cost side, the Company has a built-in incentive to be cost-efficient through the inclusion of the costs of AMF deployment in base rates under the ASA. On the benefit side, the deployment of AMF, in combination with the Company's GMP, provides an opportunity for the Company, stakeholders, and regulators to consider how to effectively design new PIMs for a universe with AMF and grid modernization, recognizing that these capabilities and functionalities will play important roles in supporting achievement of key regulatory and policy goals. For example, AMF, in conjunction with broader Company efforts, can support achievement of the following key objectives that might form the basis for future PIMs:

- Peak reduction, which avoids generation capacity costs;

- CO_2 reductions, which will be driven by peak and energy reductions, as well as beneficial electrification; and

- Other avoided costs (*e.g.*, avoided distribution system investments) and customer savings.

In addition, the Company recognizes that providing access to and utilizing data from grid modernization functionalities, including AMF, is foundational to realizing customer value from these investments, and that the current regulatory framework would not inherently encourage innovation and outperformance in this area. Toward that end, PIMs linked to the Company's provision of data access and sharing to third parties, as well as the Company's innovative use of AMF data to create system/customer benefits, may also be appropriate.

Further, the Company is committed to evaluating new functionalities that might deliver benefits to customers, as well as enable products and services by third-party providers, beyond what is currently captured in the Updated AMF Business Case. For example, as is discussed in

Section 5.3.3 of the Updated AMF Business Case, the AMF communications network and back-office systems can be leveraged over time to integrate other end-point sensor devices to provide additional customer value. An example of potential functionalities includes offering "metering-as-a-service" to water utilities, metering and remote control of street lights, "smart" gas meters, "smart" residential methane detection, and gas TVR and demand response. Additionally, this leveraging can also extend to newly developed customer engagement/enablement functionalities, originated from either the Company or third parties, that are identified and evaluated for future possible integration into the Customer Energy Management Platform (CEMP).

The Company is committed to exploring these functionalities and others in ongoing and/or future forums with the PUC and interested stakeholders. For example, the Company could file an annual report on its evaluation of potential use cases. As the Company evaluates new capabilities and functionalities, PIMs would be appropriate to reward the Company for executing new functionalities that demonstrate ongoing utilization of the AMF network and are BCA positive, thereby contributing to customer benefits and/or state policy goals. Under such a framework, the Company would be entitled to recovery of costs required to execute any approved business cases, as well as a performance incentive that would allow the Company to retain a percentage of the value created for customers. The Company expects to consider a proposal of such PIMs within its next rate case, and will be reflective of the formal guidance issued by the Commission in Docket No. 4943.

It is also possible that third-party use of the platform established by AMF could provide an opportunity for platform service revenues (PSRs), which would be collected by charging third-party users a fee for the services provided. While efforts to develop such revenue opportunities in New York have had very limited success, it is possible that such revenues could potentially serve as a complement, or possibly in select cases a substitute, to PIMs for execution of new use cases. Although PSRs were discussed during the Power Sector Transformation (PST) GMP and AMF Subcommittee meetings, the Company and stakeholders agreed that the design and development considerations relevant to PSRs are beyond the scope of the AMF proposal and would best be considered as a separate matter in the future.

In addition, as discussed earlier, in the next rate case the Company plans to address how the MW Capacity Savings performance incentive might be modified to reflect AMF and the existence of TVR, and the Company's EE Plan will consider the interaction of AMF with EE program benefit and cost attribution.

In the longer term, the Company expects to work closely with stakeholders and regulators in order to transition toward broader outcome-based metrics geared toward key benefits and objectives, such as those discussed above. The Company looks forward to collaborating with stakeholders toward a broader PIMs framework that supports beneficial outcomes for customers and advancement of state energy policy goals.

5. Proposed Metrics to Track Performance

The Company expects to begin realizing both customer and operational benefits in year three of the AMF program as meters are deployed. The benefits will continue to grow as the Company and third-party market participants leverage the capabilities of AMF. The Company is committed to tracking its overall performance and its progress in delivering benefits during deployment and as part of the ongoing AMF operations (e.g., as new services are enabled for customers). The Company is proposing to report on performance in metrics across the following broad categories, noted below, which align with the most critical elements and drivers of the overall Updated AMF Business Case.

With respect to the frequency of metric reporting, the Company intends to align with the plan described in *Section 9* (*Reporting and Risk Management*) of the Updated AMF Business Case, which identifies a semi-annual fiscal year filing of an AMF Program Report with the Commission, as well as semi-annual meetings with the Commission and the Division to review the AMF Program Report. The suite of proposed metrics includes the following categories:

1) **Cost Efficiency and Program Implementation**: metrics focused on progress related to deployment and program cost efficiency;

2) **Customer Focused**: customer engagement metrics that target key drivers of enabled customer benefits;

3) **Operations**: metrics targeting drivers of operational benefits; and

4) **Third-Party Engagement**: metrics focused on progress to enable and encourage the access and participation of third parties, such as non-regulated power producers.

This suite of metrics is intended to measure and enable a transparent assessment of the Company's progress and effectiveness of AMF implementation in key areas of interest to customers, regulators, and stakeholders. The proposed metrics considered the Company's affiliates' Worcester, Massachusetts Smart Energy Solutions Pilot (Worcester Pilot) and Clifton Park, New York Demand Reduction Reforming the Energy Vision (REV) Demonstration Project (Clifton Park Demonstration) experiences, as well as the inventory of AMF program metrics reported by other U.S. utilities, including the comprehensive set of metrics proposed by the Company's upstate New York affiliate in its 2018 AMF filing.

For the metrics described in Table D-2 the Company will track progress in one of two ways, either by tracking against program milestones or by measuring against established baselines in specific areas. Metrics tracked against program milestones will utilize milestones that have been defined as part of the Company's Updated AMF Business Case, or that will be defined as part of the initial detailed design phase to show progress. For metrics where a baseline needs to be

established, the Company will take the appropriate steps during the initial detailed design phase to establish a baseline (e.g., by conducting customer surveys at different points during the program) and a target, and then showing progress toward the target.

In tying Table D-2 to the Company's Updated AMF Business Case (*see Section 8.4.1 on Realization of Benefits),* the Company purposefully sought to connect the benefits it believes it can appropriately *deliver* to specific metrics with established targets (upon setting a proper baseline). This approach is contrasted against those *enabled* benefits by which the Company believes would focus primarily on a cadence of tracking and reporting (e.g., milestones).

Lastly, the Company is also proposing metrics in its GMP that will enable tracking of its progress in the deployment of grid modernization capabilities, as well as in areas of overall system performance. The Company has designed the AMF and GMP metrics to be complementary.

Table D-2: Performance Metrics

Predominant Benefit Category	Metric Description
Cost Efficiency and Program Implementation	1) Percentage of AMF equipment (electric meters and network communications devices) installed and commissioned in comparison to targets established by the AMF deployment schedule.
	2) Percentage of AMF gas communication modules installed business-as-usual in comparison to targets established by the AMF deployment schedule.
	3) Measure the percent of customers who opt out of AMF meter installation and track reasons why, as available.
Customer	4) Inclusion of a TVR proposal in the Company's next rate case, or, if appropriate, a TVR-specific proceeding.
	5) Creation of a stakeholder collaboration schedule related to the TVR proposal, with plans to share a minimum of one draft of the proposal ahead of the filing with stakeholders.
	6) *Customer knowledge of AMF* – Measure customer awareness of AMF technology, features, and benefits through surveys, focus groups, and interviews; including specific measures for income-eligible and commercial and industrial (C&I) customers.
	7) *Targeted Energy Forum Presentations* – Define the number and types of forums that will be utilized to provide AMF information to customers. Track the attendance and efficacy of events.
	8) Measure customer satisfaction of meter deployment through post-installation surveys.
	9) Delivery of the CEMP features identified within the Updated AMF Business Case established by the AMF deployment schedule.
	10) Measurement of customer satisfaction with the CEMP via surveys; measurement of the effectiveness of the AMF awareness campaign to drive desired customer actions; tracking of specific customer groups' understanding of CEMP functionalities and associated benefits.
	11) Measure the number of customers who engage with specific features of the CEMP in the six months after installation of the AMF network solution.
	12) *Billing accuracy* – Percentage of bills that were estimated (at varying tiers) for accounts with AMF meters at during an established reporting period.

Predominant Benefit Category	Metric Description
Operations	13) Number of feeders with AMF deployed that have implemented volt/VAR optimization (VVO).
	14) Kilowatt hours (kWh) savings attributed to VVO.
	15) Number of false storm-related outages that were found through AMF that the Company did not have to send a crew or call to confirm.
	16) Reduction in avoided O&M costs due to reduction in truck rolls.
	17) Fuel consumption savings and corresponding emissions reductions due to reduction in truck rolls.
	18) Number of non-communicating meters per billing cycle.
Third-Party Engagement	19) Progress against a predefined schedule for the delivery of Green Button Connect.
	20) Measurement of third-party enrollment and participation in Green Button Connect.
	21) Development of, and execution against, a communication and engagement plan for third parties around customer data access.

Attachment E
BCA Model

AMF BCA Model

AMF BCA Model

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The Company provided AMF BCA Model as an Excel version.

As permitted by the Public Utilities Commission Rule 810-RICR-00-00-1-1.3(H)(3) and Rhode Island Gen. Laws § 38-2-2(4)(A), -(B), the Company is seeking confidential treatment of the AMF BCA Model Excel file.