National Grid

Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid

2022-2025 Grid Modernization Plan

Testimony and Exhibits of the Advanced Metering Infrastructure Panel - Exhibits NG-AMI-1 through NG-AMI-8

July 1, 2021

Submitted to:
Massachusetts Department of Public Utilities
D.P.U. 21-81

Submitted by:

nationalgrid

INDEX OF EXHIBITS AND WORKPAPERS

Massachusetts Electric Company and
Nantucket Electric Company
d/b/a National Grid
D.P.U. 21-81
July 1, 2021
H.O. _____

Exhibit NG-AMI-1

Pre-Filed Direct Testimony of the Advanced Metering Infrastructure Panel

Massachusetts Electric Company and
Nantucket Electric Company
d/b/a National Grid
D.P.U. 21-81
Exhibit NG-AMI-1
July 1, 2021
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Pre-Filed Direct Testimony

of the

Advanced Metering Infrastructure Panel

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I. Introduction and Qualifications

Q. Mr. Kiefer, please state your name and business address.

A. My name is Kristoffer P. Kiefer. My business address is 300 Erie Boulevard West, Syracuse, New York 13202.

Q. By whom are you employed and in what capacity?

A. I am employed by National Grid Service Company, Inc. ("NGSC"), a subsidiary of National Grid USA ("NGUSA"), and I currently hold the position of Director, Advanced Metering Infrastructure ("AMI") Regulatory and Compliance. My responsibilities include leading the development of implementation plans/business cases and supporting materials as part of NGUSA's effort to deploy AMI for its operating companies, including Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid (the "Company").

Q. Please describe your educational background and professional experience.

A. I received a Bachelor of Arts in Political Science from the University of Rochester in 2002 and a Juris Doctor from Syracuse University College of Law in 2005. I began my career working for the law firm Snell & Wilmer LLP as an associate attorney from 2005 to 2010. From 2011 to 2016 I served as Legislative Counsel and General Counsel for two members of the United States Senate. In 2016 I began working for NGSC as Senior Counsel I in the Legal Department. I began my current role with NGSC in 2020.

Q. Have you previously testified before the Massachusetts Department of Public Utilities ("Department") or any other regulatory commissions?

A. I have not testified before the Department; however, I presented the Company's position regarding AMI at four technical sessions on November 17 and 20 and December 3 and 4 in D.P.U. 20-69. In addition, I have testified before the New York Public Service Commission ("NYPSC") on behalf of the Company's affiliate, Niagara Mohawk Power Corporation ("NMPC"), in its rate case filed on July 31, 2020, in NYPSC Case Nos. 20-E-0380 and 20-G-0381, and before the Rhode Island Public Utilities Commission ("RIPUC") on behalf of the Company's affiliate, The Narragansett Electric Company ("NECO"), in its Updated Advanced Metering Functionality ("AMF") filing on January 21, 2021, in RIPUC Docket No. 5113.

Q. Ms. Briggs, please state your name and business address.

A. My name is Stephanie A. Briggs. My business address is 40 Sylvan Road, Waltham Massachusetts 02451.

Q. By whom are you employed and in what capacity?

A. I am employed by NGSC as Director of Revenue Requirements for Massachusetts.

Q. Please describe your educational background and professional experience.

A. I received a Bachelor of Arts in Accounting from Bryant College in 2000. In 2004, I was hired by NGSC as a Senior Analyst in the Accounting Department. In this position, I was responsible for supporting the books and records of the Company's New York affiliate, NMPC. In 2009, I was promoted to Senior Analyst in the Regulatory Accounting Group. In this capacity, I supported the accounting of regulatory assets and deferrals in accordance with National Grid's rate plans and agreements. In 2011, I was promoted to Lead Specialist for Revenue Requirements responsible for supporting New York revenue requirements. In 2017, I was promoted to Director of Revenue Requirements for New York. In 2020, I assumed my current role as Director of Revenue Requirements for Massachusetts.

Q. Have you previously testified before the Department or any other regulatory commissions?

A. Yes. I submitted testimony in the Company's Storm Cost Recovery Rebuttal Filing, D.P.U. 19-113, and pre-filed direct testimony to support the Company's revenue requirement calculations in its annual Solar Cost Adjustment Factor reconciliation filing for 2020 (D.P.U. 21-07) and in its Geothermal District Energy Demonstration Program filing (D.P.U. 21-24). I have also testified before the NYPSC in a variety of proceedings, including on behalf of NMPC in Case Nos. 17-E-0238 and 17-G-0239, as well as on behalf of the Brooklyn Union Gas Company and KeySpan Gas East Corporation in Case Nos. 16-G-0058, 16-G-0059, 19-G0309, and 19-G-0310.

II. Purpose of Testimony

Q. Please describe the purpose of your testimony.

A. The purpose of our testimony is to: (1) request the Department's approval of a new reconciling mechanism reflected in the proposed Model AMI Tariff included as Exhibit NG-AMI-6, which would allow for the recovery of costs associated with the Company's full-scale deployment of AMI; (2) describe the needs that are driving the Company's transition from its outdated Automated Meter Reading ("AMR") metering technology to AMI; (3) set forth the Company's plan for addressing those needs by implementing the AMI network and back-office systems, as well as deploying electric AMI meters; and (4) describe the Company's approach to engaging customers, driving value, and protecting data throughout the AMI deployment.

Q. How is your testimony structured?

A. Sections I and II include an Introduction and the Purpose and Structure of the Testimony, respectively. Section III provides Background on the development of the AMI Implementation Plan. Section IV summarizes the Company's AMI Cost Recovery Proposal, requesting approval of a new AMI reconciling mechanism; Section V describes the reasons for the Company's transition to AMI, reaffirming the findings in D.P.U. 20-69-A that now is the "ideal" time to invest in AMI technologies based on the state of metering in the Company's service territory, as well as changing customer expectations and the shared commitment to achieving clean energy goals. Section VI describes the

Company's AMI Implementation Plan; Section VII provides an overview of the Company's high-level AMI Benefit-Cost Analysis ("BCA"); Section VIII outlines the Company's AMI Customer Engagement Plan; Section IX describes the Company's AMI Data Governance Plan; and Section X is the Conclusion.

Q. Are you sponsoring any exhibits in support of your joint testimony?

A. Yes, we are sponsoring the following exhibits:

- Exhibit NG-AMI-2 is the Company's AMI Implementation Plan.
- Exhibit NG-AMI-3 is the Company's AMI Customer Engagement Plan.
- Exhibit NG-AMI-4 is the Company's AMI Data Governance Plan.
- Exhibit NG-AMI-5 is the Company's CONFIDENTIAL AMI Benefit-Cost Analysis ("BCA") Model.
- Exhibit NG-AMI-6 is a proposed Model AMI Tariff, developed in coordination with NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy ("Eversource").
- Exhibit NG-AMI-7 is the Company's proposed Exemplar Residential AM Meter Reading Opt-Out Tariff Provision.
- Exhibit NG-AMI-8 is a redlined version of the Company's proposed Exemplar Residential AM Meter Reading Opt-Out Tariff Provision

III. Background

Q. Why is the Company including an AMI Implementation Plan as part of its grid modernization filing?

A. On May 21, 2021, the Department issued an order directing the Massachusetts electric distribution companies ("EDCs") to "include proposals to achieve advanced metering functionality through the full-scale deployment of AMI" as part of their grid modernization plans. D.P.U. 20-69-a, at 36. In reaching its decision, the Department found that an extensive stakeholder process initiated in July 2020 in D.P.U. 20-69 allowed the Department to conclude "that a targeted deployment of AMI to electric vehicle customers is not likely to be cost-effective." *Id.* at 52. Rather, the Department determined that, "in consideration of the Commonwealth's long-term energy policy and climate goals, as well as the current status of the companies' metering infrastructure, the Department finds it appropriate to consider a path to achieve advanced metering functionality through a full-scale deployment of AMI." *Id.* at 25.

Q. Does the Company agree with the Department's finding?

A. Yes. The Company agrees that a transition to AMI will position the Commonwealth to take meaningful action toward achieving the clean energy goals codified on March 26, 2021 when Governor Baker signed into law Chapter 8 of the Acts of 2021, *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* ("Climate Act"), as well as the Department's grid modernization objectives, to: "(1) optimize system performance (by attaining optimal levels of grid visibility, command and control, and self-healing); (2) optimize system demand (by facilitating consumer price-responsiveness); and (3) interconnect and integrate distributed energy resources." D.P.U.

15-120/15-121/15-122 at 106. In addition, approximately 900,000 AMR meters that are currently in use throughout the Company's service territory are nearing the end of their estimated useful lives. As such, the Company also agrees with the Department's finding that "[b]ecause a significant proportion of AMR meters deployed in the Commonwealth will reach the end of their useful life in the next few years, this offers an ideal opportunity to craft comprehensive meter replacement plans." D.P.U. 20-69-A at 26.

Q. Please explain the importance of AMI to grid modernization.

A. The AMI Implementation Plan is an integral part of the Company's overall approach to grid modernization and achieving the Department's grid modernization objectives. Through AMI, customers can obtain enhanced information, choice, and control over their electricity consumption, enabling them to reduce their energy bills through greater insights into energy cost drivers and personal usage. AMI will also enable customers to access new product and service offerings. Moreover, the granular and timely energy information and remote capabilities support grid-side applications through more efficient operation of the distribution system, enhancing resource diversity, and by further facilitating the integration of distributed energy resources ("DERs").

AMI also provides enhancements to several grid modernization functionalities, such as observability (monitoring and sensing), power quality management, distribution grid control, grid optimization, reliability management and DER operational control through

enhanced load and voltage data, automated outage and restoration notification, and operational telecommunications that enable the exchange of information and/or control with residential and small commercial DER technologies. AMI provides granular load data from internal power monitoring at the customer level, which provides a step change in data available for grid planning and operations. The data can be aligned with other system data to create loading and voltage profiles at all points along a feeder, leading to more detailed load and DER forecasts for planning and operational needs.

Q. Are there other factors that support the Company's decision to move forward with AMI?

A. Yes. In addition to the Department's findings supporting full-scale AMI deployment, NMPC received regulatory approval in November 2020 to deploy AMI to approximately 1.7 million electric customers and 640,000 gas customers. As a result, the Company believes it can incorporate lessons learned as well as enterprise-wide efficiencies into its deployment of AMI in the Commonwealth.

IV. <u>Cost Recovery</u>

Q. How does the Company propose to recover the costs associated with AMI implementation?

A. The Company, in coordination with Eversource, developed a proposed Model AMI Tariff, included as Exhibit NG-AMI-6. The tariff includes a reconciling mechanism that, if approved, would allow the EDCs to recover incremental costs associated with full-

scale AMI deployment outside of base distribution rates. The Company is seeking approval of this Model AMI Tariff and associated reconciling mechanism in this proceeding. After Department approval, the Company will file a Company-specific tariff based on the approved mechanism.

Q. Please describe how AMI-related costs would be eligible for recovery using the proposed mechanism.

A. The AMI reconciling mechanism would establish an "AMI Factor" to recover eligible costs identified each calendar year in which the AMI Factor is effective (also referred to as the "Recovery Year"). As set forth in the Model AMI Tariff, the AMI revenue Requirement will be calculated to recover: (1) the monthly revenue requirement for Eligible Investments recorded as in service in the AMI Investment Year immediately prior to the Recovery Year; (2) the average annual revenue requirement for the calendar year ending December 31 of the AMI Investment Year two years prior to the Recovery Year, for cumulative Eligible Investments placed into service in the AMI Investment year two years prior to the Recovery Year; (3) the annual revenue requirement for the Recovery year on Eligible Investments recorded as in-service in the AMI Investment Year immediately prior to the Recovery Year; and (4) Recoverable O&M Expense.

Q. How would the AMI reconciling mechanism work?

A. As set forth in Exhibit NG-AMI-6, eligible AMI costs incurred will be used to determine an annual revenue requirement that the Company would be eligible to recover, subject to

Department review and approval. The Company will make an annual cost recovery filing with the Department, similar to existing reconciling mechanisms, when it will present: (1) Project documentation of all Eligible Investment recorded as in-service by the Company during the Prior AMI Investment Year; (2) documentation supporting non-recurring O&M expense as part of Recoverable O&M Expense; (3) the AMI Reconciliation; and (4) Bill Impacts.

Q. Is the Company also seeking Department approval of the estimated AMI budget for recovery through the Model AMI Tariff?

A. No. As described in Section VIII, the Company developed a high-level AMI BCA, which establishes that the general benefits of AMI outweigh the costs. However, the indicative cost estimates included in the BCA are not pre-construction quality estimates, and, therefore, require further refinement before being submitted to the Department in a subsequent filing as suitable for recovery under the proposed Model AMI Tariff mechanism. The Company anticipates making such a filing so as to allow sufficient time to align AMI meter installations with the heightened risk of AMR meter failure in 2024.

Q. How does the Company propose to address unrecovered AMR asset costs?

A. The Company has installed or replaced (and continues to do so) a subset of AMR meters since the initial AMR deployment began approximately 20 years ago. The installations and replacements are used for situations, such as customer growth, meter testing requirements, and meter failures. While the Company is actively looking for ways to

limit unrecovered AMR asset costs, there is a resulting unrecovered investment in the legacy metering assets. The Company proposes to address the amortization of the unrecovered investment over a specific period of time to be determined in its next depreciation study and base distribution rate case.

V. The Company's Transition to AMI

Q. Please describe the Company's current metering capabilities.

A. The Company delivers electricity to approximately 1.3 million customers. Currently, the Company's electric metering infrastructure has limited ability to meet the evolving and diverse needs of its customers. Most meters in Massachusetts use AMR technology. Deployed in the early 2000s to replace manual meter reading processes, this technology sends a radio signal to a fleet of service vans as they drive by to collect monthly meter reads. The AMR technology contains core features that the Company relies on for identifying customer load, billing customers appropriately based on their electricity consumption, and managing customer connections to the Company's infrastructure.

Approximately 900,000 of the electric AMR meters currently in the field are electro-mechanical meters with an AMR retrofit. The electro-mechanical portion of the meter is reaching the end of its estimated 30-year life within the next three years, which will cause the meters to slow down and offer inaccurate bills. Likewise, the AMR retrofit portion of those meters is reaching its estimated 20-year life, with a pivot point in the risk of meter

failures in the Spring of 2023 and a near doubling of the forecast risk of AMR meter failures in the Spring of 2024. Every year beyond those dates represents an increased risk of meter failures for the Company and its ability to accurately perform a core business function: delivering energy and billing customers.

Q. Are there any other factors the Company is considering when trying to manage the risk of AMR meter failures?

A. Yes. In April 2021, the Edison Foundation Institute for Electric Innovation issued a report, *Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2021 Update)*, estimating "that 107 million smart meters were deployed by year-end 2020, covering 75 percent of U.S. households, and that 115 million smart meter deployments are expected by year-end 2021." With approximately 75 to 80 percent of the U.S. using AMI, there are indications that manufacturers are producing far fewer AMR meters. As such, the risk of an uptick in AMR meter failures may be challenging to address given the relative scarcity of the technology in the market to replace failed meters.

Q. What is AMI?

A. AMI refers to four key advanced metering elements: (1) an integrated network of smart electric meters capable of capturing customer energy usage data at defined intervals and supporting grid-edge applications; (2) a two-way communications network and related information technology ("IT") infrastructure for transmitting the data and control signals using radio frequency and cellular communications technology; (3) a meter data

management system ("MDMS"), IT platform, and cybersecurity protections to securely and efficiently collect, validate, store, and manage the meter data; and (4) customer systems including billing and a customer energy management platform ("CEMP") to provide energy usage data access, insights, and service offerings that enable customer energy management.

1) <u>The need for a new metering solution</u>.

Q. Why is a new metering solution needed?

A. As noted by the Department, a new metering solution is required to address "the Commonwealth's long-term energy policy and climate goals, as well as the current status of the Companies' metering infrastructure…." D.P.U. 20-69-A at 25. The Company also believes a modern metering solution is needed to address evolving customer expectations, including enhancements to customer convenience, choice, and control.

Customers are increasingly seeking automated distribution system capabilities and enhanced access to energy information. AMR technology neither provides enhanced functionality nor does it provide energy usage data with the granularity and frequency required to deliver energy insights, personalized energy efficiency, and demand response to customers. With AMI, however, the Company believes it can meet evolving customer needs, using the two-way communication capabilities to enable remote connections, providing dynamic time-varying rate ("TVR") structures that can be remotely

programmed, conducting remote meter investigations, and enabling enhanced outage management.

From an operational perspective, the Company needs to address its existing electric AMR metering assets, doing nothing is not an option. Indeed, a rough estimate using the Company's BCA suggests that approximately 40% or more of the AMI bill impacts are unavoidable, because of the costs that would be incurred to replace the AMR metering assets. Moreover, in the absence of AMI, additional investments in grid modernization efforts (*e.g.,* more feeder sensors) would also be necessary to provide enhanced information on the grid that would have been handled through AMI devices. Therefore, investing in AMI now addresses this key operational need while paving the way for enhanced functionality. In addition, investing in AMI mitigates the risk of sunk costs that could be incurred from re-investing in AMR technology, which is incapable of meeting the needs of a modern electric grid, and is becoming increasingly obsolete.

Q. Please elaborate on how customer needs are changing.

A. Industry research and customer survey results suggest that customer expectations of their utility are expanding. Customers expect their utility to provide reliable, safe, clean, and affordable energy while also providing access to actionable information, giving customers greater choice and control over their energy usage, and delivering energy services in a simple and convenient way. In addition, the Company's research through

the Household Energy Usage, Behaviors, and Preferences study from 2018, as well as the Smart Energy Consumer Collaborative's "Consumer Platform of the Future" (July 25, 2018), suggest customers:

- Express a willingness to alter energy use to achieve savings;
- Want to easily access their energy usage data from a variety of channels;
- Have an 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.

Q. Please elaborate on how the needs of the electric distribution grid are changing.

A. Significant change is occurring across the energy industry due to evolving customer behavior and expectations, including the increased adoption of DERs, such as renewable distributed generation, beneficial electrification, electric vehicles ("EVs"), electric heat pumps, and advanced "smart" technologies to actively manage energy use in customers' homes and places of business. The Company expects this trend will continue and will likely escalate as customers' expectations and technologies continue to evolve. As customers adopt more DERs and engage in load management programs to manage their energy needs, the distribution system will continue to become more dynamic and complex. Each new DER interconnection has a physical impact on the grid and creates new challenges and opportunities for distribution system planning and operations.

Historically, power has flowed predominantly in one direction and has been forecasted based on long-term trends. One-way power flow has meant that distribution equipment has required only local autonomous control settings that do not need to be remotely monitored or controlled in a timely fashion. As a result, there is currently little real-time visibility of the grid downstream of the substation, which limits the distribution utility's ability to monitor distribution loading and voltage and communicate energy usage information to customers. Going forward, the grid needs to be managed more granularly, both in time and location, to continue to serve customers safely and reliably. AMI will help to address these long-term trends.

2) <u>Evaluating and refining a solution to address the metering need</u>.

Q. Please describe the Company's approach to identifying a solution to the unmet needs identified above.

The Company implemented a two-step evaluation process to determine the relative merits and cost effectiveness of a variety of customer, grid, and meter-level technology solutions. In the first step, the Company identified and compared metering technology solution options and complementary customer and grid technologies to determine which options met the capability requirements of a modernized grid. In the second step, the Company compared the relative economics of the solutions meeting that threshold. The solutions the Company evaluated included: current AMR meters; targeted/enhanced

AMR meters; targeted AMI deployment; full AMI deployment; end-user solutions; transformer-level sensors; and pole-top readers.

Q. What did the Company conclude based on this functionality assessment?

A. The Company's functionality assessment identified full-scale AMI deployment as the only fit-for-purpose solution to meet the grid modernization objectives and capabilities, customer expectations, as well as the Company's AMR meter replacement need.

The Company found that AMR technology does not provide any of the customer-facing functionalities that enhance customer energy management or the grid-facing functionalities that support the improved system operations, planning, and DER integration required in a changing energy landscape. Conversely, customer- and grid-facing technologies other than AMI meters can provide a subset of the functionalities available from full-scale AMI deployment, but they cannot deliver the required revenue-grade billing determinants. Instead, these non-meter technology platforms drive increased customer costs without alleviating the need to replace the existing AMR meters or the need for additional investments to support a well-coordinated and integrated grid modernization plan.

3) Value for Customers, the system, and advancing clean energy goals

Q. Does the Company expect the proposed AMI solution to deliver value for customers, the distribution system, and the Massachusetts clean energy goals?

A. Yes. AMI will deliver new functionalities capable of enabling customers to realize benefits from the new technology, enhancing the distribution system, and bringing the Commonwealth closer to shared clean energy goals. Sections VI and VII of this testimony also discuss the AMI-enabled functionalities in more detail.

Q. How did the Company evaluate the value of the proposed AMI investment?

A. To quantify and evaluate the benefits of the proposed investment, the Company developed the AMI BCA. The high-level BCA demonstrates that full-scale AMI deployment can deliver total benefits of approximately $728 million with a BCA ratio of 1.51.[1] The AMI BCA is further discussed in Section VII of our testimony and Section 4 of the AMI Implementation Plan, which is provided as Exhibit NG-AMI-2.

Q. How does the AMI Implementation Plan ensure accountability by the Company?

A. The implementation of AMI is a large, complex project, spanning multiple years. The Company believes that the success of delivering such an initiative requires effective program reporting and management. For the purposes of tracking and reporting AMI

[1] There is an opportunity to realize cost synergies based on the deployment of AMI by the Company's Upstate New York affiliate. The nature and extent of the cost synergies, however, is dependent on the technology adopted in each respective jurisdiction and the timing of the proposed AMI deployments.

implementation, the Company will work with the Department to identify a suitable reporting structure and metrics that will provide transparency to stakeholders on the efficiency and effectiveness of the implementation.

The Company has also taken a comprehensive approach to ensure that customers realize the envisioned benefits of the AMI program. This effort includes: (i) the development of the detailed AMI Customer Engagement Plan; (ii) consideration of alternative metering solutions and a comparison with the proposed AMI solution based on relative functionalities, benefits, and costs; (iii) a procurement process for the AMI solution, evaluating functionalities and flexibility to address technology obsolescence risk; (iv) refined cost estimates through a Request for Solution ("RFS") solicitation for the major components of the AMI solution, including the electric meters, field area network ("FAN") equipment, back-office systems, and related professional services to enhance cost certainty; and (v) development of a project governance structure.

VI. AMI Program Implementation

Q. Please describe the Company's proposed timeline for deployment of AMI.

A. Following Department approval of the Model AMI Tariff and associated AMI cost recovery mechanism, the Company proposes a four-and-one-half-year phased deployment schedule, as shown in Figure 1-2 in the AMI Implementation Plan, Exhibit NG-AMI-2. In general, AMI implementation will consist of 18 months of detailed

process design, procurement activities, organizational development, and back-office system installation and upgrades. This will involve building and testing end-to-end solutions, developing procedures and training materials, organizing implementation, including training field and office personnel, developing communication materials, and initiating the Customer Engagement Plan, Exhibit NG-AMI-3.

The Company will also begin to deploy the AMI mesh communications network in advance of meter deployment. The Company will then commence three years of electric AMI meter deployment. As noted earlier, approximately 900,000 of the electric AMR meters currently in the field will reach the end of their estimated 20-year life in the coming years. To address this operational issue, the Company proposes to install approximately 30% of the electric AMI meters in the first year, 40% in the second year, and the final 30% of the territory in the last year of meter deployment. The Company will design the meter deployment schedule to mitigate the risk of stranded assets.

Q. What are the AMI functionalities that will be available upon deployment of AMI to customers?

A. The AMI functionalities are divided into near-term and future functionalities based on when those functionalities are expected to be available. The following near-term functionalities will be enabled within the first five years of the initial AMI implementation: (i) CEMP – Near Real Time Customer Data Access; (ii) CEMP – Customer Energy Insights; (iii) CEMP – Bill Alerts; (iv) CEMP – Load Disaggregation;

(v) CEMP – Green Button Connect; (vi) Integration with In-Home Technologies; (vii) TVR; (viii) Grid-Edge Computing; (ix) Voltage Measurements; (x) Outage Detection; (xi) Remote Interval Meter Reading; (xii) Remote Meter Configuration; (xiii) Remote Meter Investigation; (xiv) Remote Electric Connect and Disconnect; and (xv) Theft Protection.

Except for TVR and outage detection, the Company proposes to develop and implement the near-term functionalities when meter installation begins. The benefits and costs associated with the near-term AMI functionalities are reflected in the high-level BCA.

Q. What are the AMI-enabled future functionalities?

A. Potential future AMI functionalities that rely on the grid-edge computing platform capabilities include: (i) grid mapping/locational awareness; (ii) real-time load disaggregation; (iii) bypass theft detection; (iv) intelligent voltage monitoring; (v) distributed (*i.e., g*rid-edge) outage detection; (vi) temperature monitoring; (vii) arc sensing; (viii) high impedance detection; (ix) broken neutral detection; and (x) active demand response. The AMI-enabled future functionalities are in various stages of development and testing by AMI vendors; they are not included in the high-level AMI BCA.

Q. What opportunities does AMI provide for third-party market participation?

A. AMI will animate the market for third-party products and services by enabling customers to share energy usage information with authorized entities. With access to granular energy usage information, such third-parties may be able to develop and offer new products and services such as alternative TVR structures, demand response programs, and more. Furthermore, third-party market participants will be able to work directly with customers to manage energy usage, either by providing actionable insights or by providing customers with new in-home products that can connect to their meter through the HAN to monitor and manage energy usage in real-time.

Q. Please describe how full-scale AMI deployment will enhance the Company's other customer-facing programs?

A. AMI deployment provides a unique opportunity to meet customers' evolving expectations by enhancing the Company's existing portfolio of customer-facing programs and services, ranging from offerings such as residential and commercial energy efficiency and demand response to the Company's comprehensive electric transportation initiative. AMI also presents an opportunity to maximize adoption and effectiveness of third-party technologies and services. Through access to more granular energy usage information and energy insights, AMI will enable the Company to better design, target, and implement its key customer-centric offerings.

The Company has taken a conservative approach to assumptions about integration benefits with other programs in its BCA. As AMI is implemented, the Company expects

the respective future program filings will leverage the new capabilities, reflecting the associated enhancements, savings estimates, and program delivery components.

Q. How does the Company envision delivering AMI benefits to income-eligible and environmental justice communities?

A. National Grid is committed to delivering the energy transition for all. As described in the Customer Engagement Plan, this includes a focus on developing and understanding the journey map for income-eligible customers, which will include additional support from the Company's consumer advocates. Furthermore, the Company believes the data provided by the AMI platform will help the Company and third parties cater energy solutions to income-eligible customers, thereby helping them to reduce their overall energy burden.

Q. Has the Company addressed customer health and safety concerns regarding the AMI meters in the AMI Implementation Plan?

A. Yes. The Company recognizes that AMI meters have generated concerns about exposure to radio frequency. Consistent with D.P.U. 12-76-B and D.P.U. 20-69-A, the Company's approach affords customers who have these or other concerns the ability to opt-out of receiving an AMI meter.

Q. Are there any fees associated with opting out of receiving the AMI meter?

A. Yes. Similar to the Company's approach for residential customers who currently opt-out of receiving an AMR meter, residential customers who opt out of an AMI meter would be responsible for a monthly meter reading fee, as well as a one-time meter exchange fee if they choose to opt out after receiving an AMI meter after an AMI meter has been installed. Exhibit NG-AMI-7 and Exhibit NG-AMI-8 includes the proposed modifications to the Company's existing AMR meter opt-out tariff to include the ability to opt out of an AMI meter.

Q. How does the Company's AMI solution address concerns about technology obsolescence?

A. The Company is focused on ensuring the longevity of the AMI solution given the payback period and changing customer and electric distribution system needs. As such, the Company evaluated the capabilities and technology roadmaps of the AMI vendors as part of the procurement effort to mitigate this risk. The AMI solution the Company will deploy represents the latest generation of AMI technology. The technology maximizes future flexibility and adaptability because the meters support over-the-air firmware upgrades and grid-edge computing platform capabilities. This means that supporting software applications and updates can be deployed remotely to the meters. This capability mitigates the risk of technology obsolescence and bolsters the ability to tailor subsequent solutions to meet evolving needs.

Q. How will the Company manage the AMI program?

A. The Company will build on learnings from NMPC's AMI deployment and implement industry-standard project management practices. This will include complete and thorough business unit engagement activities to maintain continuity throughout the project. The AMI program governance structure will include representation from senior leadership and subject matter experts from across NGUSA. A dedicated Steering Committee comprised of business and IT program sponsors as well as senior leadership will provide strategic oversight. The Steering Committee will provide guidance to the program and alignment across Company priorities such as grid modernization. In addition, the Steering Committee will help facilitate program staffing and ensure proper risk mitigation and management.

The Company will also establish a project management office ("PMO") directly linked to workstreams, serving as the conduit between the project front line and the Steering Committee. The PMO will be composed of Company and NGSC employees supported by consultants, who can provide industry leading perspective and experience. The PMO will have broad project responsibilities including providing oversight and direction to overall program activities, fiscal oversight, local resolution, critical updates to stakeholders, and management of an integrated project schedule with defined milestones. The PMO will also use a decision matrix to determine which risks and key decisions should be escalated for senior-level resolution.

Q. What is the status of the Company's vendor selection process for implementing the AMI program?

A. The Company engaged in a competitive request for proposals process throughout all jurisdictions within the NGUSA footprint to leverage volume pricing. The process included a request for information to identify qualified potential bidders. The request for solutions covered AMI meters,[2] FAN communications equipment, head-end and meter data management systems, and associated professional services. The Company completed a comprehensive total cost of ownership analysis of the qualified vendors in order to shortlist a preferred vendor. The Company is negotiating the master service level agreement terms and conditions with the down-selected vendor.

VIII. Benefit-Cost Analysis

Q. Please describe the BCA for the proposed AMI investments as presented in the AMI Implementation Plan.

A. The AMI Implementation Plan, Exhibit NG-AMI-2, contains the results of the high-level BCA, Exhibit NG-AMI-5, the Company developed to determine the relative cost-effectiveness of full-scale AMI deployment. The model is based on significant work performed by the Company's affiliates NECO and NMPC, with refinements to capture Massachusetts-specific inputs where feasible given the time available to develop the BCA in response to D.P.U. 20-69-A.

[2] The RFS included a request for information about both electric meters and gas modules.

Section 4 of the AMI Implementation Plan presents additional detail regarding the high-level BCA. Most AMI costs appear in the first four-and-one-half years. Years one and two contain costs associated with setting up back-office and IT systems to support the new meter functionality. Years three and four show a spike in costs associated with the actual meter capital and installations. As the meters are deployed, there is a corresponding benefit from avoided AMR costs. Following meter installation, O&M savings are realized in every year thereafter. Later year benefits increase as an illustrative TVR is fully phased in and customer response reaches a steady state.[3]

Q. What are the costs associated with the Company's proposed AMI investments?

A. The BCA includes an indicative cost estimate of $480.67 million net present value ("NPV") over 20 years (assuming an opt-in TVR scenario). The BCA was developed using an indicative estimate scaled up from the cost estimate included in the Company's affiliate's, NECO's, recent AMF filing, and further refined to capture inputs from the AMI RFS and contract process. While the indicative estimates support the Department's findings that the benefits of AMI outweigh the costs, and therefore it is prudent to move forward with full-scale AMI deployment, the Company will supplement its cost estimate with more refined pre-construction budget amounts to further provide evidence to the Department that supports preauthorization of the Company's AMI proposal, either in this

[3] Note that the Company does not propose implementation of TVR in connection with this filing. The Company will work with the Department and other EDCs to identify a suitable future filing for consideration of TVR.

proceeding or in a subsequent proceeding subsequent to the Department's approval of the proposed Model AMI Tariff, and prior to moving forward with AMI implementation and cost recovery.

During the deployment period, the costs will consist of the following nine program elements: (1) AMI Electric Meter Equipment and Installation; (2) Communication Network Equipment and Installation; (3) AMI Head-End and Meter Data Management Systems; (4) Customer Information System Enhancements; (5) Customer Enablement Products and Services; (6) Analytical Tools and System Integrations; (7) Cybersecurity; (8) Customer Engagement and Education; and (9) Project Management. As shown in Figure 1-3 of the AMI Implementation Plan, Exhibit NG-AMI-2, the approximate total costs for the nine program elements during the deployment period are broken into five primary cost categories:

- AMI Meters and Communications (Capital): $284 million
- Service Company IT: $53 million
- Other Capital: $59 million
- Program Operating Cost: $72 million
- 2023-2027 Run-the-Business ("RTB"): $20 million.

Q. What are the summary results of the high-level BCA for full-scale deployment of AMI?

A. The high-level BCA ratio is 1.51 assuming the Department adopts an opt-in TVR structure. Overall, the ratio shows that implementing AMI is cost effective and beneficial for customers. Moreover, the Company anticipates the ratio will improve with further refinement and the realization of efficiencies from NMPC's deployment of AMI.

Q. Which sensitivities did the Company consider in the BCA?

A. There are elements that feed into the BCA that are outside of the Company's control. One example is customer behavior, which can be influenced by marketing, education, and outreach campaigns.

To capture the uncertainty of these unknown and largely uncontrollable factors, the BCA includes different assumptions meant to bookend possible outcomes of benefit realization. For example, it includes different scenarios around TVR enrollment, as well as customer response to TVR and usage insights/bill alerts. The Company includes these sensitivities because the assumptions are considered the most uncertain with potentially large impacts; while other uncertainties exist, none are expected to have as wide ranging of an effect on the BCA. The BCA model includes high- and low-customer response cases for each TVR enrollment case to account for customer price response uncertainty. Most of the BCA results correspond to the midpoint between high- and low-customer response levels.

Q. What are the expected quantified benefits from the AMI investments?[4]

A. The total estimated benefits are $728 million 20-year NPV (assuming the mid-point of an opt-in TVR scenario). The Company categorized the quantifiable benefits from the AMI investments as follows:

- Avoided O&M Costs: $80.18 million
- Avoided AMR Costs: $185.93 million
- Customer Benefits: $327.54 million (opt-in)
- Societal Benefits: $55.07 million (opt-in)
- Revenue Benefits:79.20 million

The AMI Implementation Plan shows the estimated 20-year NPV benefits for each of these categories. The customer benefits category accounts for a significant portion of overall benefits. A large portion of the societal benefits are tied to customer benefits as well, as changes in customer usage lead to decreases in emissions. Thus, these two categories vary with differing assumptions of TVR enrollment and customer response. On the other hand, the Avoided AMR and Avoided O&M benefit categories do not vary by TVR scenario, as these benefits are realized as the AMI solution is deployed thereby avoiding the need to replace the end-of-life AMR meters and leading to operational efficiencies through reduced meter reading.

[4] As with the quantified AMI costs, the quantified AMI benefits are subject to further refinement as part of a subsequent filing.

Q. Are there any other benefits expected from the deployment of AMI that have not been quantified?

A. Yes. There are a number of potential future benefits from the deployment of AMI that have not been quantified in the BCA. One such benefit is the opportunity to integrate other end-point devices (*e.g.,* smart street lights and smart remote methane detectors) using the AMI communications network and back-office systems. Another such qualitative benefit is tied to electric transportation. The Company has developed a comprehensive Electric Transportation initiative. As that program is geared generally toward helping improve customer adoption and utilization of EVs, the Company has not forecasted any benefits from AMI in terms of helping to accelerate EV adoption. The BCA does, however, include an estimated benefit due to customers shifting EV charging patterns in response to TVR.

Q. Is the Company proposing a specific TVR structure as part of this proposal?

A. No. The BCA includes an illustrative opt-in TVR structure with a time-of-use ("TOU") rate and critical peak pricing ("CPP") assumptions upon which a future TVR proposal could be based. The Company expects the Department will consider specific TVR proposals enabled by AMI as part of a separate proceeding.

Q. How does TVR impact the BCA?

A. As mentioned, for purposes of estimating the TVR benefits within the BCA, the Company presents benefits from an illustrative TOU/CPP supply rate. The illustrative rate is technology-neutral and designed for the residential class only (*i.e.,* all TVR benefits modeled in the BCA are brought about by this single design and come only from residential usage). The TVR savings modeled do not assume adoption of any additional technology such as in-home displays or smart appliances; therefore, the estimated savings should be accessible to all customers.

Plausible benefits estimated from the Company's Worcester Smart Energy Solutions Pilot and a survey of programs across the United States suggest that a TOU/CPP supply rate design, or another design that performs at least as well, achieves benefits large enough to create a cost-effective AMI proposal. The Company therefore believes that the approach to estimating TVR benefits in the BCA establishes a threshold level of customer net benefits that alternative TVR designs should be required to meet in any forthcoming TVR docket.

VII. Customer Engagement Plan

Q. Please describe the Company's Customer Engagement Plan.

A. The objective of the Company's AMI Customer Engagement Plan is to inform and educate customers on AMI implementation and the benefits of smart meters, to increase acceptance of the new meters, to increase participation in future innovative rate structures

that align customer benefits with clean-energy objectives, and to empower customers to use new insights and services provided by AMI. Customer empowerment and enablement are critical to achieving the benefits of AMI; therefore, the Company's Customer Engagement Plan provides a robust roadmap intended to guide customers through the AMI deployment and beyond.

Q. How will the Company execute on its Customer Engagement Plan?

A. The Customer Engagement Plan consists of three phases: Phase I is customer awareness and education prior to meter installation; Phase II is the customer experience through deployment, including the ability to opt out of receiving a new AMI meter; and Phase III is empowering and enabling customers with AMI meters to maximize the functionality and benefits made possible by the new devices and future innovative pricing plans.

In Phase I, the Company will build an extensive 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. Phase I will occur prior to deployment.

In Phase II, the Company will build on the broad education base established in Phase I and narrow the focus of communication toward individual customers leading up to and during smart meter installation. This process will include specific tactical information to guide customers through the day of meter installation, including the timeline of events, what to expect, and alternate choices available, including opting out of meter installation.

In Phase III, the Company will shift its focus to empowering and enabling customers to take full advantage of their new, more granular, timely energy usage data. The Company's CEMP, discussed above, as well as the HAN, will serve as customers' access point to their energy data. During this phase, the Company will facilitate customer interaction with third-party vendors who can help supplement customer needs with new and innovative products and services.

Q. How did the Company integrate learnings from Worcester Smart Energy Solutions pilot programs into the Customer Engagement Plan?

A. The Customer Engagement Plan leverages lessons learned and best practices from the Company's experience with the Worcester Smart Energy Solutions Pilot, as well as that of NMPC's experience with its Clifton Park Demonstration pilot. The Company has incorporated key customer engagement recommendations from the pilots, including: using a phased approach; ensuring early development of customer engagement tools; providing customer data access and end-use automation technology; implementing personalized insights and outreach; following an opt-out design for meter deployment;

leveraging recurring customer feedback surveys; and promoting the program through local events.

Q. Can customers opt out of the AMI program?

A. Yes. As noted above, the Company's approach is consistent with the Department's direction in D.P.U. 12-76-B. During all phases of deployment, customers will have the opportunity to decline receipt of a new advanced meter. Customers will be given advanced notice, via mail and email, of plans to install AMI meters and of the opportunity—and procedure to be followed—to opt out of the AMI metering program. Processes and resources will be in place to support customers who are considering or have decided to opt out.

Q. What type of training or resources will Company employees receive to prepare for and ensure a successful AMI deployment?

A. The Company's employees are key ambassadors and vital to a successful deployment as many live in the Company's service territory. The Company will educate employees, including customer service representatives, field workers, customer and community managers, commercial and industrial ("C&I") account managers, corporate communications, regulatory team members, and senior management early and often on the entire AMI program 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. More detail regarding employee training is set forth in the Customer Engagement Plan.

Q. Will there be any local Company resources available on-the-ground to address customer questions or concerns?

A. Yes, as part of the Customer Engagement Plan the Company plans to do the following:

- Leverage local resources such as customer and community managers or account managers to provide support in conjunction with community leaders;
- Utilize the existing Worcester Sustainability Hub; and
- Attend local community events.

These local resources will be knowledgeable about AMI and able to answer questions and address customer concerns. They will also have access to additional information such as fliers, FAQs, Fact Sheets, a "Getting Started Guide," and more that can be provided to customers.

Q. How does the CEMP enhance customer engagement?

A. The CEMP is a critical component of the Customer Engagement Plan. It builds on the work happening today by enhancing customer-facing initiatives with AMI 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 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 AMI meters. The platform is designed to put customer needs first and allow for quick iterations and adjustments based on user behavior or Company interactions, coordinated with other customer experience improvements. Some CEMP components, such as monthly energy summaries with average usage in smaller increments, could also be layered into non-digital communications like the customer bill or bill insert. The platform will be customers' new touchpoint to access their energy data and it will support overall customer engagement with AMI.

For example, residential customers can use the CEMP to access their bill and how much energy they have used, to live-chat with a customer service representative, look into their energy history over time, set high-usage alerts, and receive information on energy savings programs, tips, budget plans, and third-party services to help them save on their bills.

Likewise, C&I customers will be able to use the CEMP to have better insights and tools in one place. It will also support a portfolio view of facilities along with other tools geared specifically for C&I customers. Through the CEMP, C&I customers will have access to detailed data visualization and analytical tools on consumption data, energy use intensity benchmarking by building, personalized recommendations, the ability to contact an account representative, and more.

Q. How will the Company reach income-eligible customers regarding AMI?

A. The Company is committed to ensuring that all customers receive clear communications about the benefits of smart meters and new pricing plans. The Company plans to leverage its existing communication channels to ensure multi-faceted smart meter communications efforts that will meet the customer wherever located. These channels include direct marketing, such as postcards, emails, bill inserts, on-bill messages, outbound phone calls, and social media posts; media advertising on bus sides, shelters, and posters in communities; community partnerships; Company Consumer Advocates; and personalized call center software.

IX. Data Governance

Q. How does the Company propose to address data privacy, security, and protection?

A. The Company has created a Data Governance Plan, Exhibit NG-AMI-4, regarding data privacy, access, security, and protection. The Data Governance Plan covers two broad categories of energy data: customer energy usage data and system data. Customer energy usage data is defined to include a customer's electric usage as recorded at the meter in kilowatt-hours. System data is defined to include grid-facing information, such as planning documents that address grid impacts, load-flow models, DER forecasting, and voltage information. Customer data will be accessible by customers, Company employees, and customer-authorized third-parties. System data through the Company's existing System Data Portal.

As the Company builds out the detailed requirements for the deployment of AMI and the CEMP, the Company expects to collect the following customer data: read date and days; read type; total kilowatt hours; delivery charges; supply charges; late payment charges; total charges; metered peak kilowatts; metered on-peak kilowatts; bill peak kilowatts; bill on-peak kilowatts; TOU off-peak kilowatt hours; reactive power; and load factor.

Q. How will customers access their energy usage data?

A. As mentioned, customers can access their energy usage data through the CEMP, which will be designed so that customers can access this information directly. In addition, customers will be able to access their real-time energy usage data by utilizing the HAN.

Q. How can customers share their energy usage data with third-parties?

A. Customers can choose to share their energy usage and billing data with authorized third-parties through Green Button Connect. Once a customer has authorized a third-party to have access to their data, Green Button Connect facilitates computer-to-computer communication and provides a standardized protocol to provide the third-parties with access. With Green Button Connect, customers can automate the process and securely authorize the Company and designated third-parties to send and receive data on their behalf. This functionality will be developed as a key feature of the CEMP.

Q. How is customer and system data protected?

A. The Company takes customer and system data seriously and is committed to protecting all types of data generated by customer and system operations. Providing access to this data requires the Company to secure, protect, and manage the information.

The Company has developed a comprehensive, integrated data privacy framework comprised of policies, standards, guidelines and statements designed to ensure compliance with privacy and information security obligations while keeping customer and system interests in mind. The data privacy framework is comprised of three key components: (i) a commitment to core data-privacy principles; (ii) regular assessments of the Company's performance in accordance with the principles; and (iii) constant vigilance. The Company's three-tiered approach tracks across people, process, and technology:

- Setting forth policies and standards intended to ensure the Company works to maintain 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.

In addition, the data privacy framework addresses legal and regulatory requirements, privacy and identity theft vulnerabilities, incorporated accountabilities, business practices and technical and operational controls to effectively manage data privacy risks.

XI. Conclusion

Q. Does this conclude your testimony?

A. Yes, it does.

Massachusetts Electric Company and
Nantucket Electric Company
d/b/a National Grid
D.P.U. 21-81
July 1, 2021
H.O. _____

Exhibit NG-AMI-2

AMI Implementation Plan

Advanced Metering Infrastructure (AMI) Implementation Plan

For

Massachusetts Electric Corporation
and
Nantucket Electric Corporation
each d/b/a National Grid

July 1, 2021

Table of Contents

1. Overview

Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid ("National Grid" or the "Company") is planning to transform the way it delivers energy, empowering customers and taking further meaningful steps to achieve shared clean energy goals through the implementation of advanced metering infrastructure ("AMI"). The three figures below illustrate the overall AMI solution, including the two-way mesh communications network, the planned timeline to deploy back-office systems and AMI meters over a four-and-one-half-year period beginning in 2023, and an investment-grade view of anticipated AMI implementation costs during the deployment period.

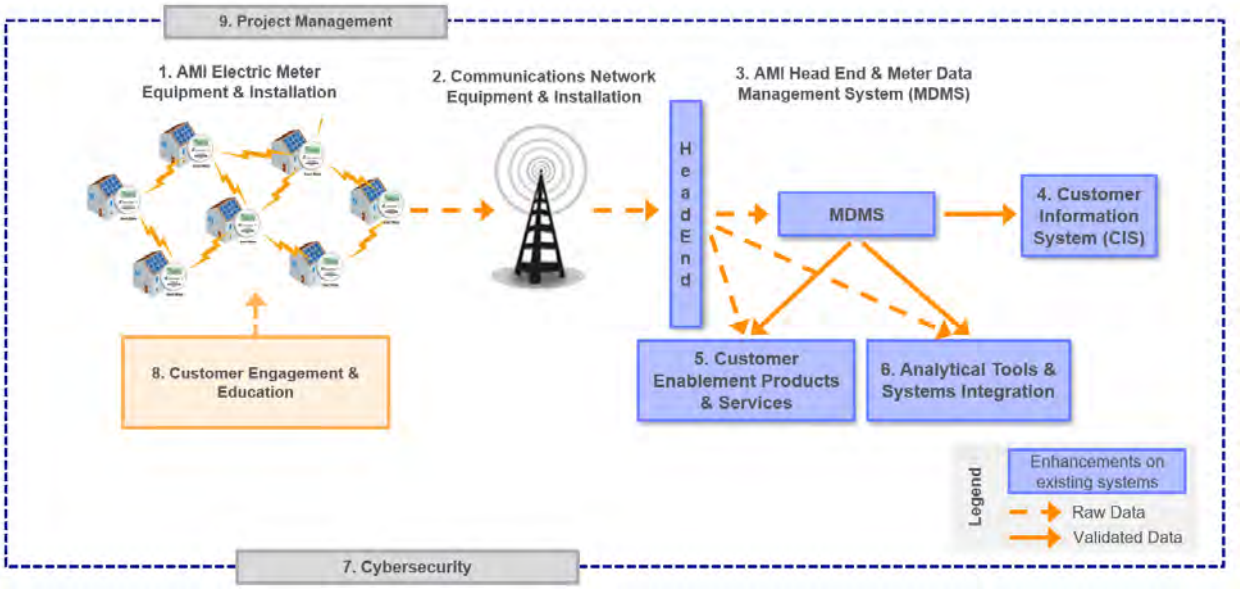

Figure 1-1 AMI System Components

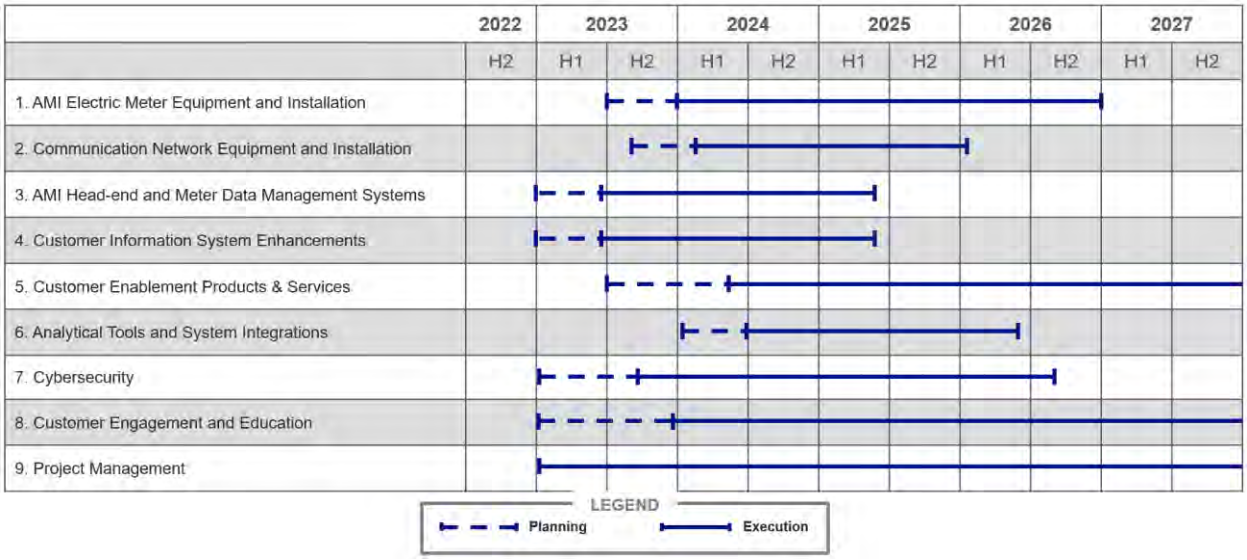

Figure 1-2 AMI Program Deployment Timeline

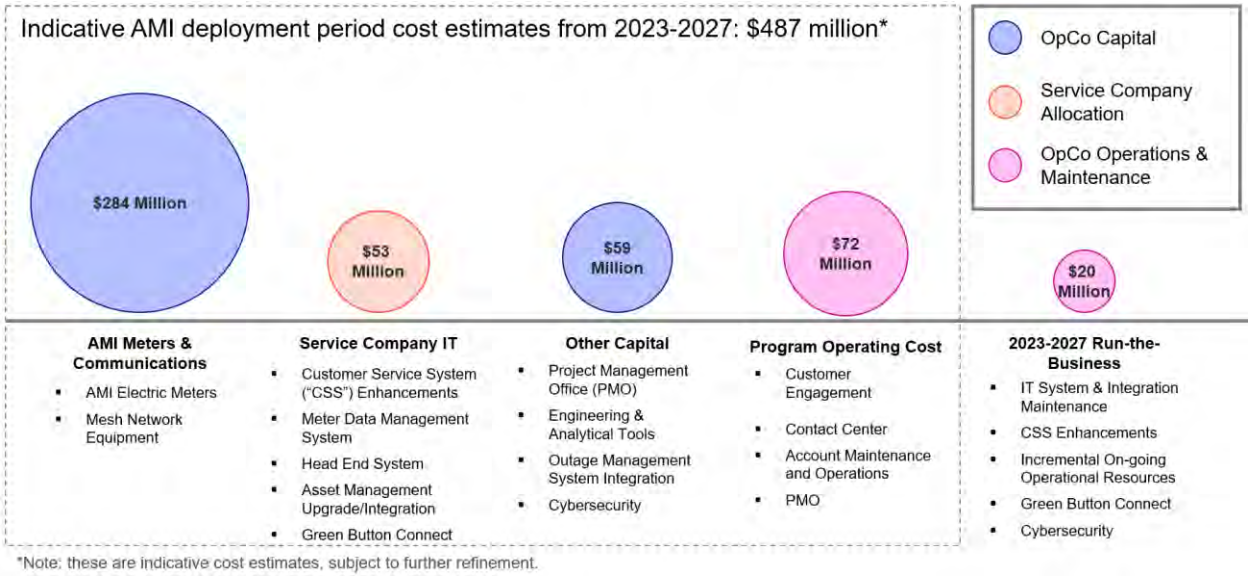

Figure 1-3 High-Level AMI Program Deployment Cost Estimate[1] (2023-2027)

[1] The indicative cost estimates are subject to further refinement as part of a subsequent filing.

2. Introduction

On May 21, 2021, the Massachusetts Department of Public Utilities ("Department"), "in consideration of the Commonwealth's long-term energy policy and climate goals, as well as the current status of the [electric distribution companies' ('EDCs')] metering infrastructure,"[2] directed National Grid[3] and the other EDCs to file plans for the full-scale deployment of advanced metering infrastructure ("AMI").[4] Pursuant to the Department's order, National Grid provides this AMI Implementation Plan ("Plan") outlining its proposal to deploy a two-way communications network and approximately 1.4 million electric AMI meters for the benefit of residential and small business customers in Massachusetts beginning in 2023.

National Grid's vision is to be at the heart of a clean, fair, and affordable energy future. Achieving that vision, as well as the ambitious clean energy goals set forth in the Commonwealth's recently enacted climate legislation,[5] requires an integrated approach to decarbonization across multiple sectors. The Company has likewise adopted a Responsible Business Charter, affirming its commitment to achieving net zero carbon emissions by 2050.[6] The Company believes AMI meters are a key component to enabling this shared vision for transforming how energy is produced, delivered, and used.

Customers are also increasingly interested in greater convenience, choice, and control with regard to their energy usage. Throughout the country, AMI has become an essential tool for utilities to address evolving customer expectations. Indeed, AMI is now the predominant metering technology in the United States, with an estimated 115 million smart meter deployments expected by year-end 2021, representing approximately 80% of households.[7] The recent expansion of AMI technology in the Northeast is of particular note, with the New York Public Service Commission's ("NYPSC") November 2020 order approving the Company's Upstate New York affiliate's proposal to deploy approximately 1.7 million electric AMI meters.[8]

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[2] D.P.U. 20-69-A at 25.
[3] Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid (referred to herein as "National Grid" or the "Company").
[4] *See also* D.P.U. 20-69-A at 27.
[5] Senate Bill 9, *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* (signed March 26, 2021).
[6] National Grid, *Responsible Business Charter* (October 1, 2020) at 5.
[7] The Edison Foundation, Institute for Electric Innovation, *Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2021 Update*) (April 2021) at 1.
[8] Case Nos. 17-E-0238 and 17-G-0239, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Electric and Gas Service*, Order Authorizing Implementation of Advanced Metering Infrastructure with Modifications (November 20, 2020) (hereinafter "NY AMI Order") at 52.

The transition to AMI also comes at a critical time for the Company's existing automated meter reading ("AMR") fleet in the Commonwealth, which is nearing the end of its useful life. As set forth in its 2015 Grid Modernization Plan filing in D.P.U. 15-120 and reaffirmed in comments filed in D.P.U. 20-69, the Company forecasts an increased risk of meter failure for approximately 900,000 electro-mechanical meters that were retrofitted with AMR technology in the early 2000s.[9] The Company anticipates the electro-mechanical AMR fleet will hit an inflection point in the Spring of 2023, when there will be a heightened risk of meter failures. By the Spring of 2024, this risk is forecast to increase significantly, nearly doubling the number of annual meter installations the Company typically performs. National Grid agrees with the Department that the approaching end-of-life conditions for the AMR fleet "offers an ideal opportunity to craft comprehensive meter replacement plans."[10]

The three "needs" identified above – clean energy, customer, and operational – are common across National Grid USA's operating jurisdictions (Massachusetts, New York, and Rhode Island). As such, the Company and its affiliates have done extensive analysis and stakeholder outreach to determine the relative merits and cost effectiveness of a variety of customer, grid, and meter-level technology solutions. Based on the foregoing, the Company, like the Department, has determined that full-scale AMI deployment is the only fit-for-purpose solution capable of addressing the operational AMR metering need, while providing a comprehensive platform to deliver value for customers, and enabling further meaningful progress toward clean energy goals. The relative value of the AMI solution is further detailed in the attached high-level benefit cost analysis ("BCA"), which shows approximately $728 million in benefits on a 20-year net present value ("NPV") basis and a 20-year BCA ratio of 1.51.

3. Defining the Metering Need

There are three compelling unmet needs that are driving the transition to AMI: 1) an operational need created by the current fleet of AMR metering assets reaching the end of their estimated useful lives; 2) evolving customer expectations; and 3) a shared commitment to achieving ambitious clean energy goals.[11] With input from internal subject matter experts, customer surveys, and external stakeholders, the Company has worked to identify, define, and understand these unmet needs, as well as the potential solutions to address them. This AMI Implementation Plan is the culmination of that extensive effort.

[9] *See* D.P.U. 20-69, Reply Comments of Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid at page (Sept. 4, 2020) 3-14 (citing D.P.U. 15-120, Response to Information Request D.P.U. 3-2 (April 3, 2017)).
[10] D.P.U. 20-69-A at 26.
[11] *See e.g.,* D.P.U. 20-69-A at 25 ("[I]n consideration of the Commonwealth's long-term energy policy and climate goals, as well as the current status of the Companies' metering infrastructure, the Department finds it appropriate to consider a path to achieve advanced metering functionality through a full-scale deployment of AMI.").

3.1. Operational Need

From an operational perspective, the Company's existing meter fleet largely consists of electro-mechanical meters retrofitted with an encoder receiver transmitter ("ERT") that provides AMR functionality,[12] as well as solid-state electric AMR meters with integrated communication capability. The design life of the electromechanical meters is 30 years *(see* Figure 3-1), while the ERT (*see* Figure 3-2) and solid-state meters have design lives of approximately 20 years. The Company retrofitted the electro-mechanical meters with ERTs beginning in 2000, meaning they started reaching the end of their 20-year design life this year. Likewise, the Company began purchasing and installing solid-state meters in 2003. In fact, in its initial grid modernization proposal (D.P.U. 15-120), the Company forecasted that it would need to replace approximately 900,000 electro-mechanical meters that were retrofitted with ERTs by the end of 2025.[13] That replacement forecast remains true. The Company, therefore, agrees with the Department that this is "an ideal opportunity to craft comprehensive meter replacement plans" using AMI technology.[14]

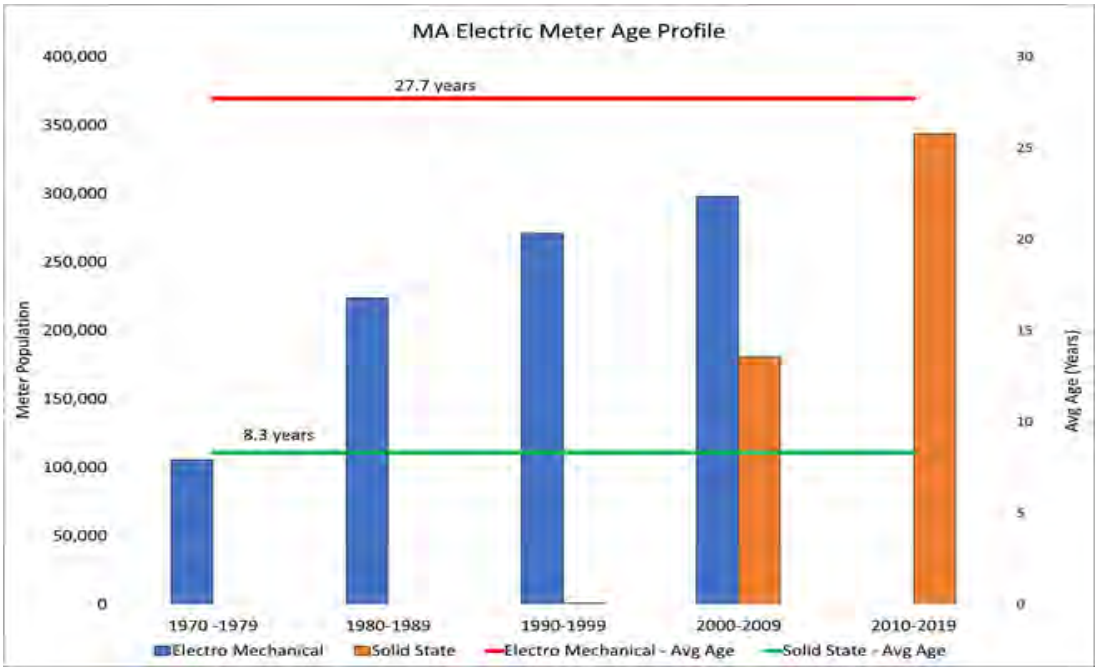

Figure 3-1 Massachusetts Electric Meter Age Profile (30-Year Useful Life)

[12] AMR metering functionality allows the Company to gather monthly meter readings with vehicles that drive past the meters and pull the energy usage data using a short-range radio frequency ("RF").
[13] *See* Docket D.P.U. 15-120, National Grid Response to Information Request D.P.U. 3-2 (April 3, 2017).
[14] D.P.U. 20-69-A at 26 ("Because a significant proportion of AMR meters deployed in the Commonwealth will reach the end of their useful life in the next few years, this offers an ideal opportunity to craft comprehensive meter replacement plans.").

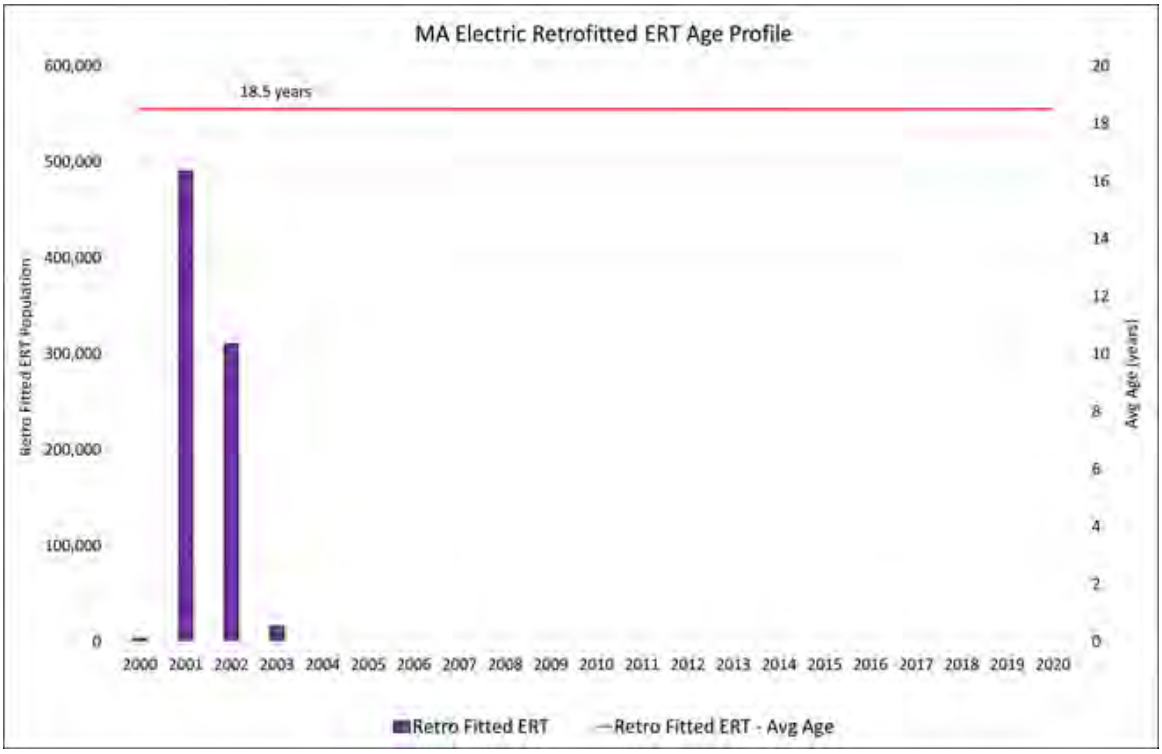

Figure 3-2 Retrofitted ERT Age Profile
(20-Year Useful Life)

To ensure it can continue meeting its regulatory obligations, the Company must proactively address this metering need by replacing the existing meters. In this way, a significant portion of the metering costs are unavoidable (*i.e.*, the current meters must be replaced regardless of the metering solution); meaning there is no "do-nothing" scenario. The key challenge is timing. The Company's meter engineering team projects a pivotal increase in AMR meter failure risk beginning in Spring 2023, with a significant increase in AMR meter failure risk (a near doubling of forecast AMR meter replacements) beginning in Spring 2024. As shown in Figure 1-2, the Company's AMI deployment plan generally contemplates a managed ramp-up period to allow for project sanctioning, contract execution, and onboarding resources, followed by 18 months of work to design, procure, and install back-office systems. The Company has aligned its AMI meter deployment schedule to allow sufficient time to complete the necessary back-office work and begin meter deployment in alignment with the anticipated increased risk of AMR meter failures.

This timing is important, as there are risks with waiting too long to implement a proactive meter replacement program. For example, if there is a significant uptick in AMR meter failures in Massachusetts, the Company may not be able to procure a sufficient quantity of AMR replacement meters on the market. This is a growing concern. With more than 80% of the

residential market in the United States using AMI meters,[15] vendors are producing fewer AMR meters. As such, procuring a large volume of AMR meters on short notice to address increased meter failures could prove challenging.

3.2. Evolving Customer Expectations

Customers expect more from their utility – not only seeking affordable, reliable, and safe energy service, but also increasingly looking for access to actionable information, greater choice and control over their energy use, and delivery of energy services in a simple and convenient way. Limiting the "needs" analysis to the operational concerns and metering costs outlined above does not capture the whole picture, as it ignores the significant opportunity to deliver AMI-related functionality and benefits for customers.

For example, moving forward with like-kind replacement of AMR, as opposed to transitioning to AMI, would deprive customers of access to energy usage data with the granularity and frequency that makes it useful for delivering energy insights or personalized energy efficiency and demand response. Moreover, AMR meters with triple ERT technology only support the most basic of time-varying rate ("TVR") structures – an important tool for integrating additional renewable generation, facilitating beneficial electrification (*e.g.*, electric vehicles (EVs) and electric heat pumps), and/or reducing peak load. AMR meters also lack the two-way communication capabilities that enable remote connections, remote TVR configurations, remote meter investigations, and outage management enhancements. This inability to remotely communicate with AMR meters impacts customers, who are looking for solutions that increase the ease and convenience of interacting with their utility.

AMI also opens important opportunities for the Company to assist customers facing economic insecurity and environmental justice concerns. As set forth in the Customer Engagement Plan, AMI creates a platform to deliver new data and technology that can help the Company identify opportunities (*e.g.*, enhancing building envelopes, improving ventilation, and targeting energy efficiency programs/incentives) to assist customers in improving their health, comfort, and productivity, while lowering energy burdens. The Company believes AMI will help maximize progress in these areas by animating the market, generating new engagement opportunities with existing programs such as MassSave's Enhanced Residential Program, and enabling the Company to work collaboratively with innovation leaders and customers to build positive change.

[15] The Edison Foundation, Institute for Electric Innovation, *Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2021 Update*) (April 2021) at 1 ("As of year-end 2019, electric companies had installed 99 million smart meters. Based on survey results and approved plans, we estimate that 107 million smart meters were deployed by year-end 2020 covering 75 percent of U.S. households, and that 115 million smart meter deployments are expected by year-end 2021.").

3.3. Shared Clean Energy Goals

On March 26, 2021, Governor Baker signed into law Chapter 8 of the Acts of 2021 (S.9), "An Act Creating a next Generation Roadmap for Massachusetts Climate Policy" (the "Climate Act"), which established, *inter alia*, a commitment to achieve net zero greenhouse gas emissions by 2050. National Grid has likewise adopted a Responsible Business Charter establishing a shared commitment to achieving net zero carbon emissions over the same period, as well as a focus on a fair and affordable transition to a clean energy economy for all customers.[16]

National Grid, like the Department, recognizes that AMI is a foundational investment for achieving the shared greenhouse gas emission reduction goals. In this way, AMI will enable operational efficiencies through remote meter reading, connect/disconnects, and outage investigations that are expected to result in fewer truck rolls and therefore fewer greenhouse gas emissions. Likewise, AMI will provide customer benefits through increased control and management of energy consumption, using energy insights, personalized energy efficiency offerings, demand response programs, high-usage alerts, access to near real-time energy usage data, and opportunities for dynamic TVR structures (*e.g.,* on-peak periods and critical peak pricing). This added functionality is expected to reduce greenhouse gas emissions through additional energy usage reductions.

AMI is also a key part of the Company's broader effort to achieve the Department's grid modernization objectives, including the interconnection and integration of distributed energy resources ("DERs"). Specifically, AMI provides distributed sensing capabilities, supporting a more flexible grid that can accommodate the increased levels of distributed generation required to meet the Department's objective. A smarter, more flexible grid will also enable customers to invest in DER technologies where it is the most cost effective to do so; provide transparency regarding system needs and opportunities when siting DER technologies; support DER optimization through more granular data and control at the customer level; and provide real-time data that will allow for improved load and DER forecasts as part of the planning process.

In light of the foregoing, the Company agrees that replacing end-of-life AMR meters with like-kind AMR technology threatens to derail progress toward developing a modern grid capable of enabling the functionality required to meet clean energy goals.

4. Identifying a Solution

The Company implemented a two-step evaluation process to determine the relative merits and cost effectiveness of a variety of customer, grid, and meter-level technology solutions capable of addressing the unmet needs defined above. In the first step, the Company identified and

[16] National Grid, *Responsible Business Charter* (October 1, 2020) at 5.

compared metering technology solution options, including proposals from peer utilities in other jurisdictions, as well as complementary customer and grid technologies, to determine which options meet the objectives of a modernized grid. In the second step, the Company compared the relative economics of the solutions meeting that threshold. The solutions evaluated included:

- Like-kind replacement of current AMR meters;
- Targeted/enhanced AMR meters;
- Targeted AMI deployment;
- Full-scale AMI deployment;
- End-user solutions;
- Transformer-level sensors; and
- Pole-top readers.

4.1. AMI Programs in Other Jurisdictions

The Company's AMI analysis included a jurisdictional survey of utility filings that requested approval for different types of investments (*e.g.*, AMI-only or AMI plus a GMP) across the country. This analysis focused on learnings from the following utilities:

- Hawaiian Electric Company ("HECO")
- Southern California Edison ("SCE")
- Public Service Electric and Gas Company ("PSE&G") in New Jersey[17]
- Orange and Rockland ("ORU") in New York
- Xcel Power in Minnesota
- Duke Energy in North Carolina
- Dominion Power in Virginia
- Dayton Power & Light ("DP&L") in Ohio

The filings for each of the utilities were assessed for the scope of the proceeding, investment/program approval request, and the elements of the request that led to its eventual approval or elements that led to additional review or ultimate denial. While each proceeding had elements of local policies and issues that are not transferrable, there were several overarching themes the Company drew from the survey to inform its analysis. The learnings include:

[17] *See Petition of Public Service Electric and Gas Company for Approval of its Clean Energy Future-Energy Cloud (CEF-ED) Program on a Regulated Basis*, New Jersey Board of Public Utilities Docket No. EO18101115, Decision and Order Approving Stipulation (January 7, 2021) (approving PSE&G's proposal to install approximately 2.2 million AMI meters).

1. Concrete near-term programs and actions that fit into a long-term strategic vision/roadmap are key for regulatory approval. Leveraging information from pilots at affiliate companies or other utilities is also important.

   Close coordination of the AMI and GMP filings ensures the AMI investment is being made as part of the Company's broader longer-term roadmap for both grid modernization and the customer experience. AMI is one of the key near-term programs the Company believes is necessary to enable a host of customer- and grid-facing functionalities.

2. Pilots and phased implementation are an important way for commissions to become comfortable with new technologies and rate designs.

   To ensure that the AMI investment is robust and considers the learnings of similar programs elsewhere, the Company distilled key learnings from its Worcester Smart Energy Solutions Pilot and its affiliate's Clifton Park, New York Reforming the Energy Vision ("REV") Demand Reduction Demonstration ("Clifton Park Demonstration"), which provided a good foundation for this filing, particularly around customer engagement strategies.

3. Stakeholder participation is important for success.

   The AMI filings had robust stakeholder processes that informed the ultimate AMI investment decisions and program designs. In this case, the Company built this Plan based on years of stakeholder input and analysis, as well as the detailed questions and input received from the comments filed in D.P.U. 20-69 and the related technical sessions. Moreover, the Company has continued to reach out to stakeholders throughout the Commonwealth regarding AMI strategies, and it developed a robust Customer Engagement Plan to ensure stakeholder participation and input throughout the deployment and post-deployment period.

4. AMI filings need to address obsolescence issues directly as technologies are rapidly evolving in the marketplace.

   Stakeholders are concerned about the longevity of the AMI solution given long payback periods and evolving customer and grid needs. The Company has evaluated the capabilities and technology roadmaps of AMI vendors as part of the procurement effort. The solution the Company is proposing represents the latest generation of AMI technology. It includes over-the-air firmware upgrades and grid-edge computing platform capabilities, such as software applications that are deployable to the meters for both grid- and customer-facing use cases. The capabilities of the new generation AMI solutions help to mitigate stakeholder concerns regarding technology obsolescence.

5. Accountability, such as reporting can facilitate efficient project management and delivering benefits for customers.

   The Company will work with the Department to establish a reporting framework and objective metrics that will track program progress and effectiveness, while also helping customers realize the benefits of AMI.

4.2. Screening Metering Solutions

This section describes the technical metering solution that is best suited to achieve the required grid modernization capabilities. The Company evaluated the relative merits and cost effectiveness of a variety of customer-, grid-, and meter-level technology solutions. The recommended solution is outlined in additional technical detail, including the planned timeline for the delivery of AMI (*see* Figures 1-1 and 1-2) and how that functionality is critical to achieving the Department's grid modernization objectives: "(1) optimize system performance (by attaining optimal levels of grid visibility, command and control, and self-healing); (2) optimize system demand (by facilitating consumer price-responsiveness); and (3) interconnect and integrate distributed energy resources."[18]

The Company initiated a two-step process to evaluate the various options and functionalities that will support next-generation metering in Massachusetts in line with the grid modernization objectives. With the first step, the Company identified and compared metering technology solutions and complementary customer and grid technologies on a functionality basis. The options and functionality assessment reflect input from metering experts and subject-matter experts. With the second step, the Company considered the relative economics of the viable options identified in step one. Below is a brief description of the metering technology solutions (customer- and grid-facing) the Company evaluated:

- **Current AMR**: The electric AMR meters contain either a single or triple communication module configuration where each such module supports the transmission of a single billing determinant. The Company uses a drive-by meter reading vehicle to retrieve meter data through short-range radio frequency ("RF") signals emitted from the AMR devices. AMR meter technology supports the monthly collection and processing of customer metering data. The triple communication solution provides a technical limitation in that no more than three energy measurements (*i.e.*, TOU periods) can be collected; this technology was also part of the "Targeted Enhanced AMR" solution discussed below. Although AMR technology is mature, having been broadly deployed for decades across the United States, it has increasingly been replaced by AMI, which is better suited to support innovative energy policies and grid modernization objectives.

[18] D.P.U. 15-120 at 106.

- **Targeted Enhanced AMR**: This option would expand the current AMR solution by implementing targeted deployment of additional triple communication module electric AMR meters. The additional enhanced AMR devices would be deployed to support expanded (basic) time-varying and demand rates. The solution would require each meter to be manually re-programmed, adding additional operational cost, any time the Department implements or modifies TVR, or a customer decides to change his or her TVR enrollment. This limits the ability for the Department and customers to be agile in the adoption of innovative rate structures (*e.g.*, adjusting peak periods over time to align with a shifting peak period), while also creating a significant cost burden due to the requisite reprogramming field visit. Additionally, a triple communication AMR meter is 2 to 3 times more expensive than an AMI meter. This targeted option would only be used to implement specific utility programs on a limited or opt-in basis to support time-varying and demand rates. As such, the Company determined that targeted enhanced AMR (*i.e.*, triple communication module) is cost prohibitive to utilize as a technology platform, based on meter and operational costs.

- **Targeted AMI Deployment**: A targeted deployment of cellular-based AMI meters can be deployed to support enhanced customer benefits. It is likely that as DER saturation increases and related interval measured tariffs evolve, customers enrolled in the associated programs will be required to have an interval read AMI meter. In the absence of full-scale AMI deployment, which would provide sufficient geographic meter deployment to support a RF mesh network, the Company would continue to deploy the cellular technology necessary for new applications that require interval meters. This is the key technical difference between the targeted AMI deployment solution and the full-scale AMI deployment alternative outlined in this Plan and described in further detail below. A combination of a smaller geographic meter density and inability of peer-to-peer meter communication reduces the current and future functionalities enabled by cellular AMI as compared to full-scale AMI deployment. This solution would be integrated to customer systems, including billing and the CEMP, to provide energy usage data access, insights, and service offering to enable enhanced customer energy management. Therefore, the Company agrees with the Department's determination "that a targeted deployment of AMI to electric vehicle customers is not likely to be cost-effective."[19]

- **Full AMI Deployment**: A comprehensive, full-scale AMI solution, involves the deployment of smart meters to all customers in Massachusetts. An integrated advanced metering network (RF mesh network) will be implemented to support electric AMI devices throughout the service territory. The broad deployment supports maximum functionality and adaptability of the intelligent computer platform residing in metering devices, along with peer-to-peer communication, data analytics and integration with third-party devices. Similar to the targeted AMI deployment solution, full-scale AMI

[19] D.P.U. 20-69-A at 25.

will integrate with customer and billing platforms, as well as the CEMP, to provide energy usage data access, insights, and service offerings to enable enhanced customer energy management. The Company's analysis of this solution is consistent with the Department's finding, "[I]n consideration of the Commonwealth's long-term energy policy and climate goals, as well as the current status of the Companies' metering infrastructure … it [is] appropriate to consider a path to achieve advanced metering functionality through a full-scale deployment of AMI."[20]

- **End-User Solutions**: Customers can procure and install devices in their home that offer insight and enhanced granularity regarding their energy consumption and usage patterns. A wide variety of technical solutions exist in the market such as high-resolution home sensors and in-home technology energy management packages. A key limitation of these solutions involves the absence of interconnectivity and integration with the Company's customer and billing systems, as well as the CEMP, resulting in isolated, standalone third-party solutions. Although this technology can enable enhanced customer functionality such as load disaggregation, these solutions cannot provide revenue-grade billing determinants and they do not meet ANSI energy measurement standards. Additionally, these solutions can be costly to deliver, while providing a small subset of full AMI functionality and integration. Future technology advances in end-use solutions may ultimately provide revenue-grade metering;[21] however, it is highly uncertain whether they will be cost-effective alternatives to AMI.

- **Transformer-Level Sensor**: Across the distribution system, sensors are strategically placed to support a variety of grid modernization functionality such as locational awareness/GPS, while also collecting granular, time-aligned voltage and current data. This allows the Company to better regulate voltage on the transmission system, receive outage notifications and support current and potential transformer analysis.

- **Pole-Top Reader**: This technology leverages a combination of standard and enhanced AMR technology, replacing drive-by meter reading vehicles with remote AMR meter reading radios. A pole-top reader can support the enhanced meter reading frequency of the AMR devices, but remains limited to meter register readings and does not provide the same level of functionality and data delivery as AMI.

As illustrated in Table 4-1, the Company compared functionality of the various solutions. The comparison demonstrates that only targeted AMI and full-scale AMI, provide the wide range of functionality for customers. Although the targeted AMI option offers similar customer-facing functionality to full AMI, it possesses significant limitations regarding grid-facing functionality

[20] D.P.U. 20-69-A at 25.
[21] *See e.g.*, Green Mountain Power, *GMP Pioneers Patent-Pending System Using Energy Storage to Make Meters Obsolete* (April 30, 2019), https://greenmountainpower.com/news/gmp-pioneers-patent-pending-system/.

due to geographic meter saturation limitations and the loss of peer-to-peer communication and related distributed intelligence capabilities as compared to full AMI. In addition, as noted by the Department, "given that the costs to upgrade back-office supporting systems to enable advanced metering functionality through AMI meters do not vary significantly between a targeted and a full-scale deployment, full utilization of these upgraded back-office systems will likely result in efficiency gains."[22]

By comparison, the current AMR technology does not deliver the benefits of an AMI solution. It was implemented in the early 2000s to replace manual meter reading processes and generated timelier and more accurate meter reads for traditional rate design billing. The solution has been utilized in a limited manner to support simple TVR and could be extended to additional customers as described above in the Targeted Enhanced AMR solution section. However, the AMR technology options do not provide the customer-facing functionalities that enhance customer energy management or the grid-facing functionalities that support the improved system operations, planning, and DER integration required in a modernized grid. Additionally, the AMR metering assets are reaching the end of the manufacturer's estimated useful life, requiring significant investment to replace existing AMR metering devices with in-kind technology in the near term.

Likewise, customer- and grid-facing technologies can only provide a subset of the full-scale AMI functionalities, but are not a viable alternative to an AMI metering solution; notably, such solutions cannot deliver revenue-grade interval meter reading data. Not only do these technology platforms drive increased customer costs, investment in these solutions does not address the need to replace the existing AMR meters.

Given the foregoing, the Company's functionality analysis determined AMI is the only fit-for-purpose solution to meet the objectives and capabilities for a modernized grid. A screening analysis regarding targeted and full-scale AMI solutions was performed to estimate the benefit and cost implications of each program. Based on the screening analysis, the Company determined that targeted deployment avoids only a fraction of total AMF costs, while presenting a significant reduction to the anticipated program benefits. As a result of the screening analysis and the poor cost/value proposition for the targeted AMI solution, the Company does not believe it is the most suitable metering option.

[22] D.P.U. 20-69-A at 27.

Table 4-1: Functionality Assessment of Metering Solutions

	AMF Functionality/Use Case	Complete Metering Solutions				Complementary Customer and Grid Technologies		
		Current AMR	Targeted Enhanced AMR (for opt-in TVR)	Targeted AMF*	Full AMF	End User Solutions**	Transformer-Level Sensor	Pole-Top Reader***
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	○	○	◔	●	○	◐	◔

*Harvey Balls for Targeted AMI indicate functionality enabled for customers who adopt AMI meters, not the entire population
**Includes combinations of high-resolution home sensors with in-home technology packages and no integration with CEMP or Company systems
***Assumes integration with utility platform services

In addition to the functionality comparison in Table 4-1, the BCA includes an estimate of the cost to replace AMR meters with new AMR meters when they reach the end of their 20-year useful lives. The AMI BCA fundamentally outlines the incremental benefits AMI can achieve compared to the AMR solution, while defining the cost differential required to implement full-scale AMI. The cost of AMR replacement is treated as an avoided cost in the BCA, because, in lieu of an AMI program, the Company would be required to replace the AMR assets. Overall, the BCA results confirm the Department's finding that the benefits of full-scale AMI deployment outweigh the costs as compared to an AMR replacement program.

4.3. The Full-Scale AMI Technical Solution

As set forth in Figure 1-1 (and further illustrated in additional detail in Figure 4-1, below), the AMI technical solution includes four key advanced metering elements: 1) an integrated RF peer-

to-peer (mesh) network of smart electric meters capable of capturing customer energy usage data at defined intervals and supporting grid-edge applications; 2) a two-way communications network and related IT infrastructure for transmitting the data and control signals utilizing mesh and cellular communications technology; 3) an integrated head-end system, MDMS, IT platform, and cybersecurity protocols 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 enable customer energy management.

At the end-point level, the Company will deploy AMI technology that will capture and transmit energy usage data (15-minute intervals every 30 to 45 minutes for electric customers) through a RF mesh or cellular communications network. This same information can also be communicated to in-home/business and mobile devices directly from the electric meter. A series of gateway devices are strategically placed throughout the service territory to collect meter data and transmit the data through a backhaul network to the Company. The head-end system then processes the data before it is transmitted to the MDMS, which performs data validation and generates the appropriate billing determinants for each customer. This data will be processed by the Customer Service System ("CSS") for billing and delivered to the CEMP, which provides customers and authorized third parties with access to energy consumption data, energy insights, and service offerings.

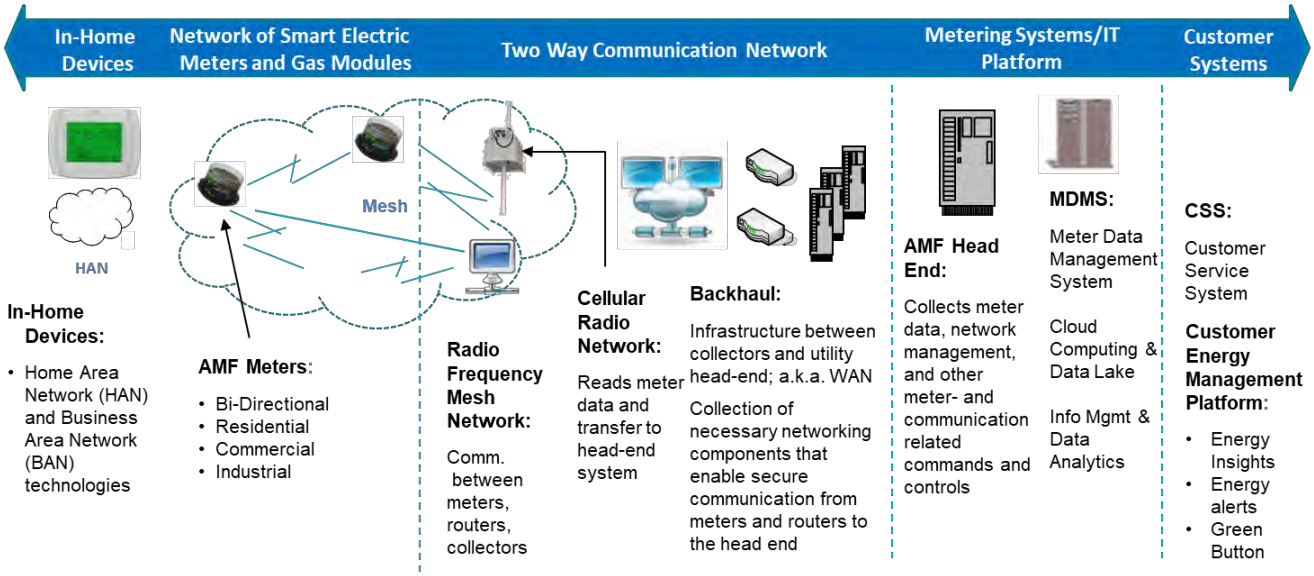

Figure 4-1: AMI Technology Elements

One of the key design considerations is "data latency," which, in an AMI solution, refers to the time delay from when a meter or end-point captures data to when the information is available to a customer or authorized third-party service provider. With the evolution of energy services, customers and third parties are no longer satisfied with simply accessing granular data; now, the

timeliness and availability of the energy usage data is of growing importance to support demand response, TVR, and enhanced customer education and energy management.

The Company's AMI plan provides access to energy usage information for all customer classes through three primary channels: 1) the CEMP; 2) facilitating data sharing with authorized third parties using Green Button Connect My Data ("Green Button Connect"), which will be accessible from the CEMP; and 3) directly from the meter through a HAN. The first two channels, the CEMP and Green Button Connect, require meter usage data transmission from the meter, through the end-to-end AMI solution, to the data sharing platforms in the CEMP. Through this data process, the Company will provide access to 15-minute raw electric energy usage data at 30 to 45-minute latency. Customers will have access to the CEMP through the web and mobile devices. The HAN, the third channel, provides optionality for customers to obtain real-time usage data directly from the meter. Electric AMI meters contain a physical radio and associated firmware to provide a wireless signal to HAN devices for data transmission. Similar to how devices are connected in homes today through a wireless router, meters can be paired[23] with in-home devices that customers or third parties deploy to share and display customer data in real time. Customer data can also be made available to customer mobile devices, leveraging HAN and third-party internet-based service offerings. A description of data access channels and latency parameters is provided in Table 4-2.

[23] 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 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 the HAN device, such as an in-home display or home energy manager.

Table 4-2: Customer Data Access Latency

Data Access Channel	Description	Data Latency
Customer Energy Management Platform ("CEMP")	Customers can access their own usage data directly and download it to share with third parties.	• For electric customers, 15-minute raw interval data will be available every 30 to 45 minutes. • Bill quality data will be available every 24 hours.[24]
Green Button Connect	Facilitates computer-to-computer communication to allow for a standard protocol by which customers can provide authorized third parties direct access to energy usage data.	
Meter to Home-Area-Network (HAN)	Transmits data directly from meter to HAN.	• Real-time raw energy usage data.

The above channels with their respective data latencies support the customer-facing functionalities and related benefits outlined in this Plan. The channels also support a variety of grid-facing functionalities and related benefits where lower data latency may be required. Table 4-3 categorizes the AMI functionalities that are dependent on customer data and the required latency.

[24] To generate "bill quality" data, a series of validation, estimation, and editing ("VEE") functions are performed on the raw data.

Table 4-3: AMI Customer Data Access Latency Requirements

	AMI Functionality	Data Latency Requirements	
		Standard	Real-Time
Customer - Facing	CEMP - Near Real-Time Customer Data Access	X	
	CEMP - Customer Energy Insights	X	
	CEMP - Bill Alerts	X	
	CEMP - Load Disaggregation	X	X
	CEMP – Green Button Connect	X	
	Integration w/ In-Home Technologies		X
	TVR - Customer & DER	X	X
	Remote Interval Meter Reading	X	
	Remote Meter Configuration	N/A	
	Remote Meter Investigation	N/A	
	Remote Electric Connect and Disconnect	N/A	
	Theft Detection	X	
Grid-Facing	Voltage Measurement - Voltage Conservation	X	X
	Outage Detection - Automated Notification	N/A	
	TVR - Load Shift	X	X
	Load & Voltage Data - Situational Awareness/Forecasting	X	

In addition to displaying usage data through a HAN or business-area network, home energy management systems will be able to receive and send secure communications from the Company or authorized third-parties. This can enable real-time customer access to meter data, including load/price signals and real-time integration with smart devices such as thermostats, water heaters, and other appliances. These enhanced service opportunities will also be available through the CEMP.

Another key design attribute of the AMI solution is the flexibility and adaptability of the solution to meet evolving customer and grid needs. The solution the Company proposes to implement represents the latest generation of AMI technology; its capabilities include over-the-air firmware upgrades and grid-edge computing platform functionality. Supporting software applications will be deployable to the meters for both grid- and customer-facing use cases, providing more choice, convenience and control. The Company believes the grid-edge computing platform will enable

significant future customer- and grid-facing distributed intelligence use cases. Early examples of such opportunities include: high impedance detection, theft detection, locational awareness/grid mapping, intelligent voltage monitoring, reliability analysis, and electrical fault identification. Collectively, the grid-edge capabilities have the potential to improve reliability, better manage voltage fluctuations with the proliferation of DERs, and, importantly, improve safety by identifying unsafe conditions that customers can proactively address. The Company will also work with stakeholders and third parties to identify and consider new capabilities to ensure that evolving customer and grid needs continue to be met in the future.

4.4. Benefit-Cost Analysis

This section presents the results of the high-level BCA conducted by the Company to determine the cost effectiveness of full-scale AMI deployment. In response to D.P.U. 20-69-A, the Company worked closely with internal stakeholders to identify and refine the cost and benefit inputs to accurately capture the details of a full-scale Massachusetts AMI deployment. However, given the time available, some of the inputs have been scaled from the Company's affiliates' AMI filings. As such, the BCA represents an indicative estimate of relative costs and benefits. The Company will continue to further refine and develop the inputs to reflect a more detailed pre-construction AMI budget that will be used for purposes of the proposed cost recovery mechanism – the Company will provide the refined AMI budget in a subsequent filing.

To capture the value of AMI over the meter lifecycle (including back-office system development), the BCA considers a 20-year timeframe. The Company believes this is appropriate given the time for meter installation and the manufacturers estimated meter life of 20 years. Total benefits and costs are shown on an NPV basis using the 20-year term, end-of-period cash flows, and a discount rate equal to the Company's after-tax Weighted Average Cost of Capital ("WACC") of 7.56%.

Unless otherwise stated, results in this section assume an illustrative TVR is offered on an opt-in basis and that 15% of customers will eventually opt in to TVR. The opt-in value is consistent with the NYPSC's Order approving AMI for the Company's Upstate New York affiliate,[25] as well as findings from the Sacramento Municipal Utility District ("SMUD")[26] and the DOE.[27] To calculate the illustrative TVR benefit, the Company uses an example TOU/CPP design; however,

[25] NY AMI Order at 35-36 ("Based on studies of similar opt-in TVP rates in the country, the opt-in participation rate should be reduced to 15%, from the Company's more aggressive assumption of 20%).
[26] Smart Grid Investment Grant, Consumer Behavior Study Analysis, *Time-of-Use as a Default Rate for Residential Customers: Issues and Insights* (June 2016).
[27] U.S. Department of Energy, Lawrence Berkeley National Laboratory, *American Recovery and Reinvestment Act of 2009: Final Report on Customer Acceptance, Retention, and Response to Time-Based Rates from Consumer Behavior Studies* (November 2016); *see also* 2017 NY Rate Case, *supra* note 36, Prepared Testimony of the Staff Advanced Meter Infrastructure Panel at 27 (August 25, 2017) ("Exhibit ___ (SAMIP-5) contains a report of DOE sponsored customer behavior studies from 2016 in which 10 utilities ran rate pilots. According to this report, opt-in programs had an average participation rate of 15%, versus 93% for opt-out programs.").

National Grid is not proposing adoption of a TVR rate design as part of this filing. The design used is purely illustrative.

Summary results of the high-level BCA appear in 4-2 showing a benefit-cost ratio for the Base Case scenario of 1.51. The red bar represents the cost of the program, while the turquoise bar represents the benefits of the program, taken to be the midpoint between high and low customer response cases. The customer response cases bookend the extent to which customers respond to usage and price signals with conservation and load shifting. Error bars on the benefits show the range of benefits that result from the high and low customer response cases. Detailed cost and benefit numbers are provided in Sections 4.4.1 and 4.4.2, respectively.

Figure 4-2: NPV costs and benefits. Upper and lower bounds of benefits defined by high and low customer response cases (bar corresponds to midpoint)

The proposal achieves cost-effectiveness by leaning on the many benefits that do not require widespread participation in TVR. Accordingly, the Company does not believe the cost effectiveness of the AMI program will be meaningfully affected by customer migration to third-party energy suppliers. Research into jurisdictions with well-established third-party suppliers indicates that TVR participation is unlikely to drop below the 15% tested in the opt-in case.[28]

Figure 4-3 unwinds the NPV calculation by showing the stream of annual costs and benefits over the 20-year analysis period. Again, the error bars are determined by customer response cases. The figure draws attention to the importance of considering a 20-year analysis timeframe to

[28] Data obtained via email correspondence with ERCOT indicates that 18% of residential customers in Texas were on TVR in 2018, six years after smart meter deployment.

understanding the full value of AMI: costs appear in early years with the installation of back-office systems and meters, while benefits tend to accrue later.

The first 18 months of the program consist of costs associated with setting up back-office and IT systems to support the new meter functionality. Years three through five show a spike in costs associated with the actual meter capital and installation cost with the meter deployment. Similarly, large benefits from avoided AMR meter costs drive early year benefits. Following meter installation, operations and maintenance ("O&M") savings are anticipated in every year thereafter. Later year benefits increase with an increase in electrified loads, the anticipated phasing in of TVR, and customer participation/response to price signals reaching a steady state. Later year costs consist of items that are required to sustain the program.

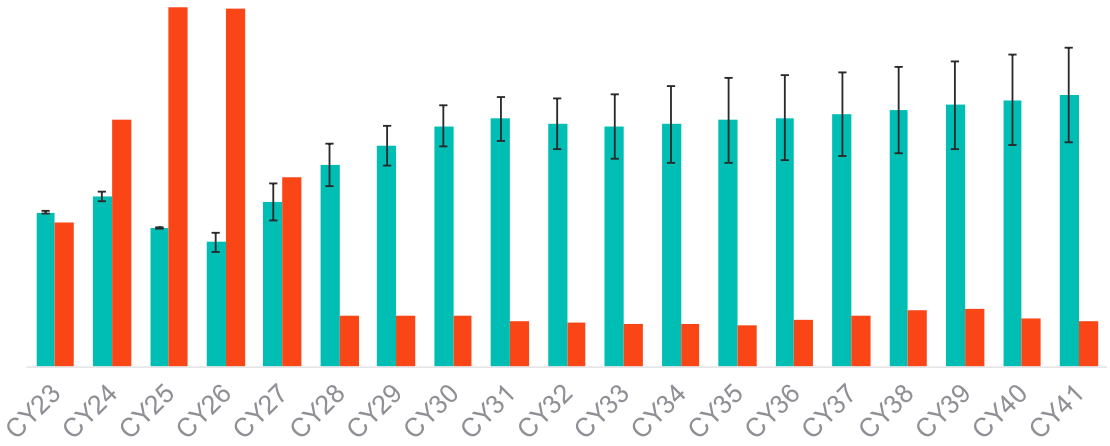

Figure 4-3: Costs and benefits over the analysis period. Upper and lower bounds of benefits defined by high and low customer response cases (bar corresponds to midpoint)

4.4.1. Quantified Cost Categories[29]

During the four-and-one-half year deployment period, the costs consist of the following nine program elements: 1) AMI Electric Meter Equipment and Installation; 2) Communication Network Equipment and Installation; 3) AMI Head-End and Meter Data Management Systems; 4) Customer Information System Enhancements; 5) Customer Enablement Products and Services; 6) Analytical Tools and System Integrations; 7) Cybersecurity; 8) Customer Engagement and Education; and 9) Project Management. As shown in Figure 1-3, the approximate total costs for the nine program elements during the deployment period are broken into five primary cost categories:

[29] All costs are subject to further refinement in a subsequent filing.

- AMI Meters and Communications (Capital): $283.72 million
- Service Company IT: $52.56 million
- Other Capital: $58.63 million
- Program Operating Cost: $72.39 million
- Run-the-Business ("RTB"): $20.06 million

The Company has taken multiple approaches regarding program estimates to establish enhanced cost certainty. Primary to these efforts is a request for solution ("RFS") for the core components of the AMI program encompassing the electric meters, head-end system, MDMS, field-area network ("FAN") equipment, and professional support services. The Company also leveraged its experience with past large-scale meter deployments to help refine the estimates.

Table 4-4 shows the 20-year NPV and nominal deployment phase costs of each of the nine program cost elements. These following subsections provide brief descriptions and some disaggregation of these costs.

Table 4-4: High-level AMI program costs by category (M$)

Cost Category	20-year NPV	Deployment Phase Nominal
AMI Electric Meter Equipment and Installation	$218.08	$275.92
Communication Network Equipment and Installation	$16.94	$14.51
AMI Head-End and Meter Data Management Systems	$38.53	$18.84
Customer Information System Enhancements	$8.40	$8.66
Customer Enablement Products and Services	$8.75	$5.34
Analytical Tools and System Integrations	$45.98	$28.27
Cybersecurity	$7.03	$5.56
Customer Engagement and Education	$64.49	$41.52
Project Management	$72.46	$88.74
Total Costs	**$480.67**	**$487.36**

AMI Electrical Meter Equipment and Installation

This category includes the cost of smart electric meters, their installation, an inventory of meters,

necessary support infrastructure, and anticipated refresh costs throughout the analysis horizon. As shown in Figure 4-4, the equipment and installation cost of the electric meters accounts for the majority of the costs. This element is the single largest cost component of the AMI Implementation Plan.

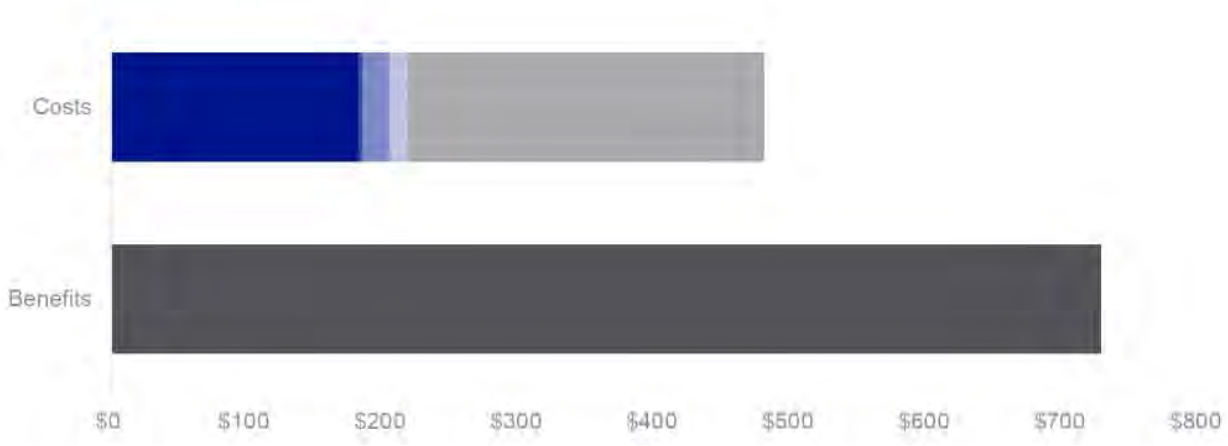

Figure 4-4: NPV costs with AMI Electrical Meter Equipment and Installation highlighted

Communication Network Equipment and Installation

This category includes the communications network equipment, its installation, and the associated backhaul network costs for transmitting meter data. Though important, these costs are small compared to the other cost categories. Figure 4-5 highlights these costs among the total costs to show their relative contribution to the total.

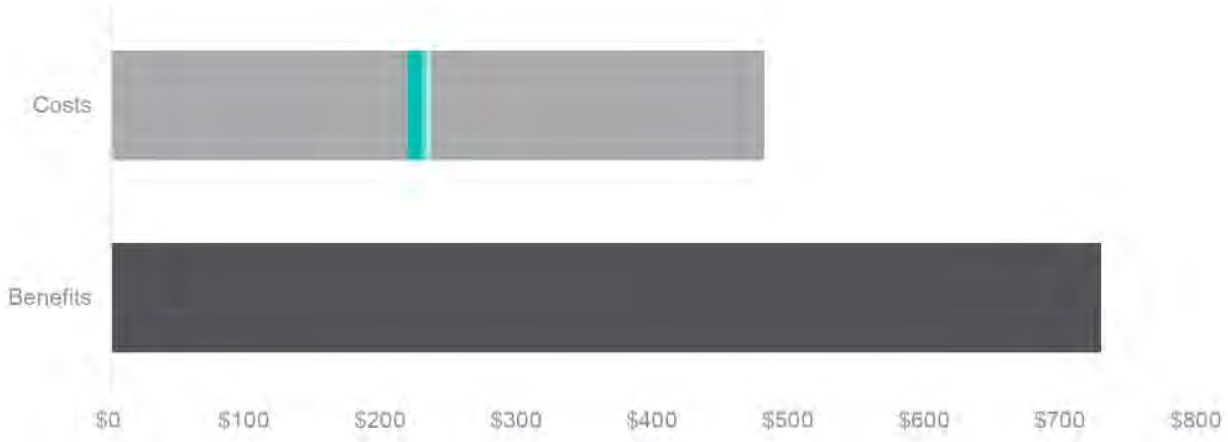

Figure 4-5: NPV costs with Communication Network Equipment & Installation highlighted

Customer Engagement and Education

This category includes the cost of outreach to customers: comprehensive customer engagement, ongoing business operations, and anticipated TVR implementation and administration. These components are shown in Figure 4-6. Administration of the TVR is the only cost element to fluctuate depending on the customer response; the Company expects that customer engagement with TVR and cost to administer the rates would rise and fall in tandem.

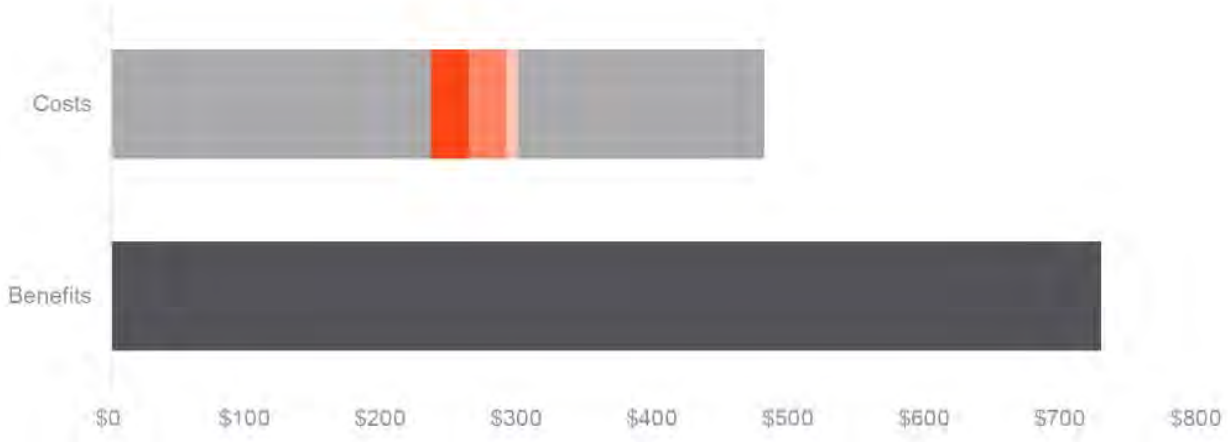

Figure 4-6: NPV costs with Customer Engagement and Education highlighted

Remaining Cost Categories

The remaining six cost categories are:

- Project Management;
- Analytical Tools and System Integrations;
- AMI Head-End and Meter Data Management Systems;
- Customer Enablement Products and Services;
- Customer Information System Enhancements; and
- Cybersecurity.

Figure 4-7 highlights these remaining categories, which predominantly include project management and IT, MDMS, and head-end system infrastructure. The cost of an IT platform for data collection, monitoring and control of the communication system includes opportunities for cost synergies arising from sharing infrastructure with the Company's Upstate New York affiliate.

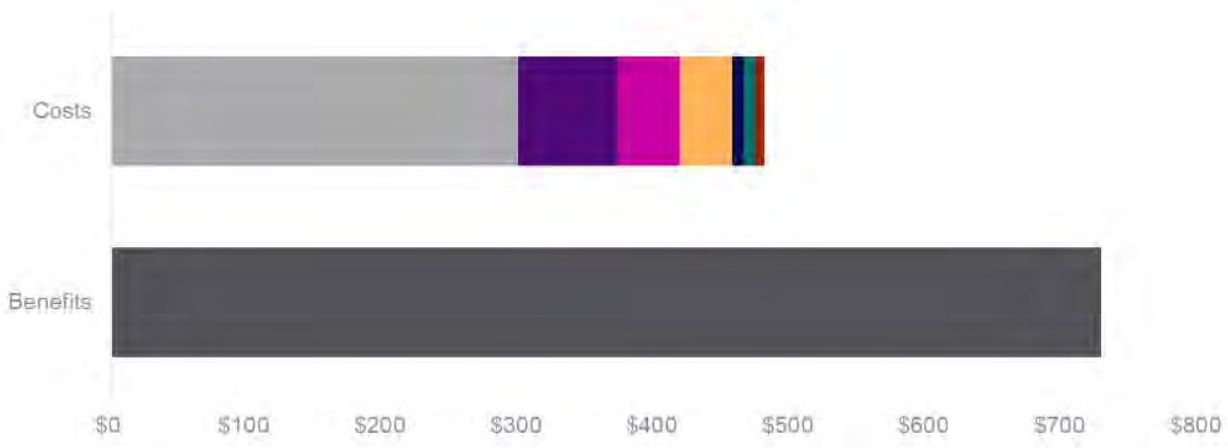

Figure 4-7: NPV costs with the remaining cost categories highlighted

4.4.2. Quantified Benefit Categories[30]

For the BCA, the Company categorized benefits into the following segments:

[30] As with the quantified cost categories, the quantified AMI benefits are subject to further refinement.

- Avoided O&M costs;
- Avoided AMR Replacement Costs;
- Customer Benefits;
- Societal Benefits;
- Revenue Benefits; and
- Non-quantified benefits not reflected in the BCA.

Table 4-5 shows the calculated NPV benefits for each of these categories for different customer response cases. The customer benefits category is the largest as it accounts for 45% of benefits. A large portion of the societal benefits are also tied to customer benefits, as changes in customer usage drive decreases in emissions. Therefore, these two categories vary with differing assumptions of customer response. On the other hand, the Avoided O&M, Avoided AMR, and Revenue Benefits categories do not vary based on the level of customer engagement.

Table 4-5: AMI program benefits by category listed for different response scenarios (M$ 20-year NPV)

Benefit Category	Midpoint	Low	High
Avoided O&M Costs	$80.18	$80.18	$80.18
Avoided AMR Costs	$185.93	$185.93	$185.93
Customer Benefits	$327.54	$293.13	$361.96
Societal Benefits	$55.07	$34.02	$76.11
Revenue Benefits	$79.20	$79.20	$79.20
Total Benefits	**$727.92**	**$672.45**	**$783.38**

Avoided O&M Costs

AMI implementation allows the Company to avoid specific O&M costs, including: 1) AMR meter reading vehicles, personnel, and annual software and maintenance; 2) meter investigations; 3) a portion of the meter visits required to connect and disconnect[31] service; 4) damage claims; 5) outages; 6) the Field Collection System ("FCS") for AMR meter reading; and 7) the MV-90 interval meter system. Figure 4-8 shows these benefits in the context of total program benefits. The largest benefits come from avoided truck rolls for AMR meter reading and labor cost savings based on the ability to use AMI to remotely read, connect, and disconnect service. The

[31] Any collections-related disconnections will be done in compliance with applicable rules and regulations governing terminations of residential electric utility services, including Department orders and requirements.

Company notes that this assumption is conservative as benefits from "soft offs" (*i.e.*, for an apartment unrented between tenants) are not quantified.

Achievement of many of the avoided O&M costs, such as avoided meter reading, are under the Company's control. Others, such as outages and damage claims are impacted by external factors like weather and service orders, which the Company cannot control.

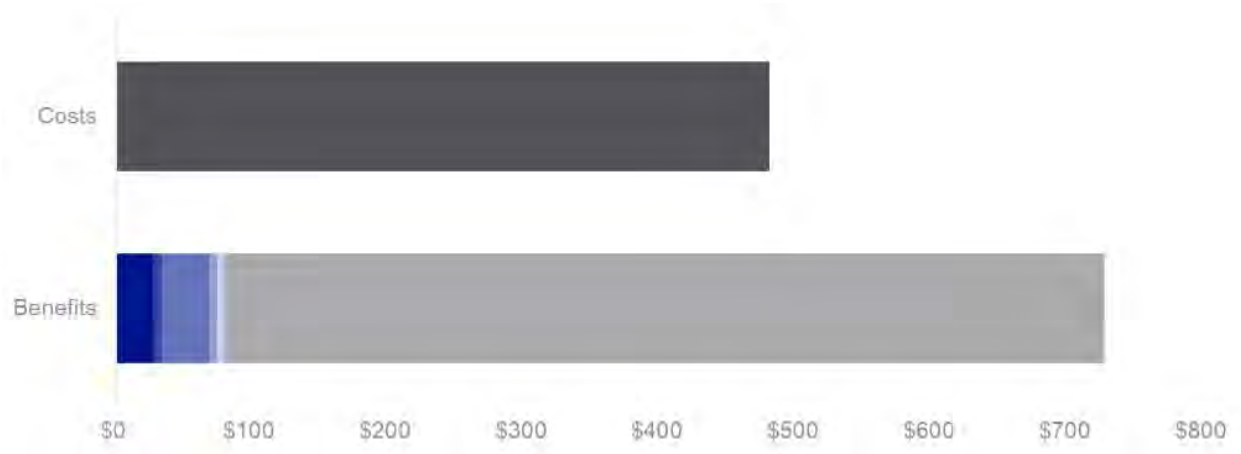

Figure 4-8: NPV benefits with Avoided O&M costs highlighted

Avoided AMR

The avoided AMR cost line item represents the avoided cost of replacing the aging AMR meters that are approaching the end of their estimated useful life. The benefit is primarily driven by the capital costs of the AMR meters including installation, as shown in Figure 4-9. This cost savings nearly offsets the capital and installation cost of the new AMI meters, but not the back-office systems and communications network required to operate the AMI system. The benefit highlights the advantages of aligning the proposed AMI deployment with the anticipated life-cycle replacement of AMR meters.

Should grid modernization efforts proceed in the absence of AMI, the need for granular usage data would exist but not be met by non-AMI meters. In such a case, the Company would have to deploy additional sensors throughout the distribution system to gather the data that would otherwise come from AMI meters. The Avoided Sensors benefit is the cost of the additional sensors that would be required in a non-AMI counterfactual scenario. While the Avoided AMR benefit is generally within the Company's control and therefore has a higher certainty, unlike the Avoided O&M benefit, Avoided AMR represents projected future costs (*i.e.*, costs that are not incurred today) that will be avoided by AMI deployment.

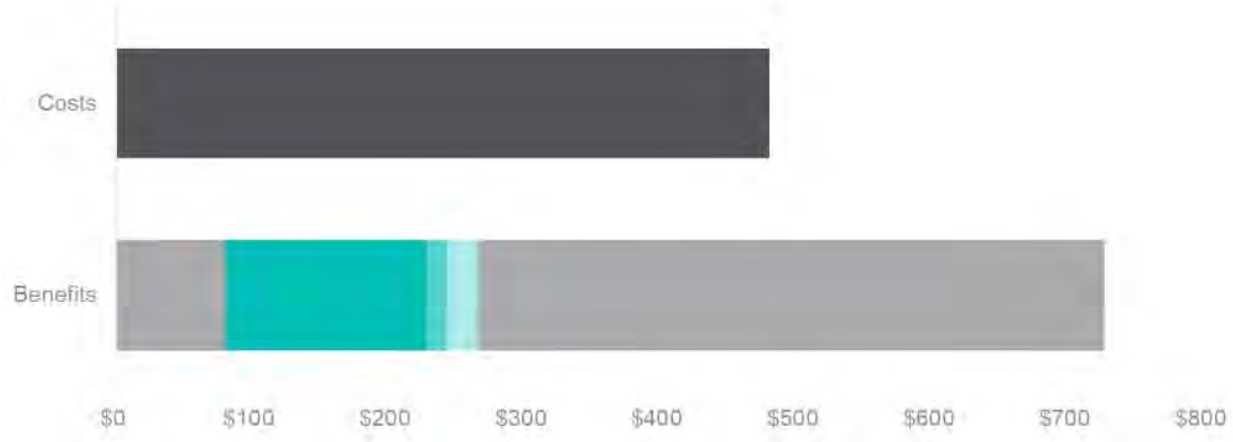

Figure 4-9: NPV benefits with Avoided AMR costs highlighted

Customer Benefits

AMI will provide customers with the enhanced understanding, choice, and control over their energy usage, enabling possible reductions in total bills. The quantified customer benefits from AMI-enabled savings include: 1) reduced energy loads from VVO; 2) customer response to energy insights/bill alerts; 3) avoided energy and demand cost associated with customers shifting EV charging from on-peak to off-peak periods; 4) shifting customer energy usage in response to TVR rates; and 5) reduced loss of customer load due to shorter duration outages.

Energy insights/bill alerts account for 8% of the total benefits. As described in the Customer Engagement Plan, the savings are enabled by the CEMP. The increased visibility into energy usage afforded by the CEMP will enhance customers' ability to manage their energy consumption. Likewise, the Company will be able to assist customers through insights like personalized energy tips and mid-cycle bill predictions.

Reductions in load drive additional benefits beyond the avoided energy and capacity costs. For example, reducing consumption and shifting usage to off-peak periods results in emissions reductions. Most of the emissions savings are counted under societal benefits, as they do not imply customer savings, but some benefit of CO_2 reduction is monetized through the Regional Greenhouse Gas Initiative ("RGGI") and embedded in the avoided cost of electricity. The embedded CO_2 costs are included under customer benefits.

Also, any reduction in electric energy and demand lowers the clearing price for all energy purchased via mechanisms referred to as Demand Reduction Induced Price Effect ("DRIPE")

and cross-DRIPE. This effect is also captured among the customer benefits. The analysis only considers intrastate DRIPE and does not include the possible impact on other states in Independent System Operator – New England ("ISO-NE") territory.

To the extent demand reductions occur during transmission and distribution peak hours, there are savings associated with deferral of related capacity cost. Given the increasing peaky-ness of load shapes in the absence of TVR, this effect is critical to avoiding overbuild of the distribution system.

Though not quantified, AMI and grid modernization capabilities have option value compared to other grid investments. Traditional distribution infrastructure and energy storage are fixed in location and scale, whereas TVR can be designed and marketed to flexibly respond to where and how it is needed. More traditional infrastructure investments will still be required alongside AMI and grid modernization efforts, but the high-resolution data provided by AMI has the potential to make the investments more targeted and less risky.

The Company also includes a Customer Outage benefit, which quantifies the value to customers of reductions in lost load during outages. The benefit takes advantage of automated outage notification enabled by widespread AMI deployment.

Figure 4-10 highlights customer benefits among the total project benefits. The VVO and Energy Insights/Bill Alerts benefits do not require customers to be enrolled in TVR. However, other benefits, such as Non-EV Load Shifting, do depend on TVR enrollment. EV benefits from TVR are capped by TVR enrollment such that the number of EV owners receiving an incentive to shift charging away from peak hours does not exceed the number of residential customers enrolled in TVR. Because EV owners are likely to seek out low-cost charging, opt-in EV pricing benefits are conservative estimates. The BCA assumes that current EV programs could reach 30% of EV owners, so EV benefits from TVR are limited to the 70% of potential enrollees that would be incremental to the penetration level of current programs.

Outside of the VVO benefit, which is largely under the Company's control, customer benefits depend on customer behavior and regulatory decisions as much as the Company's actions. For this reason, the benefits are less within the Company's control and are therefore less certain.

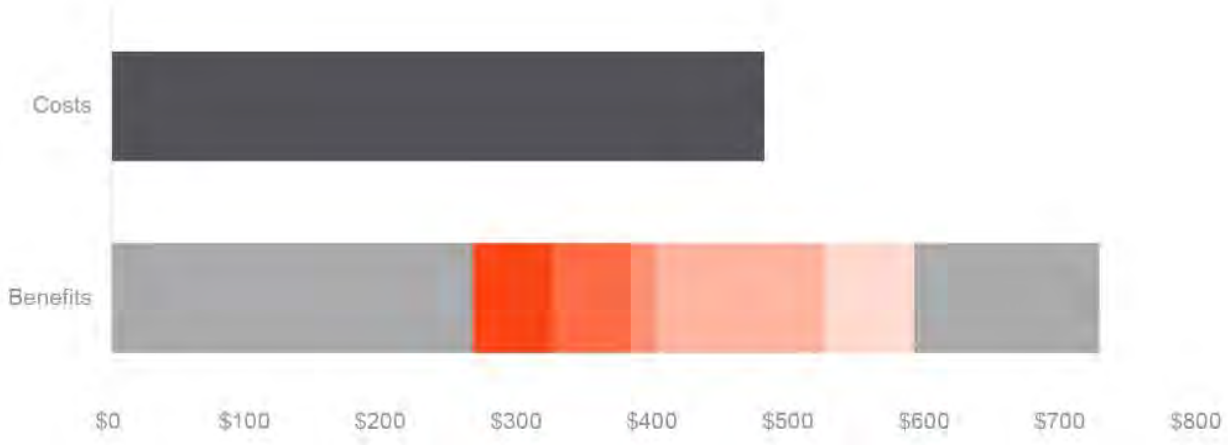

Figure 4-10: NPV benefits with Customer Benefits highlighted

Though the Company is not proposing adoption of the illustrative TVR design (*i.e.*, TOU/CPP) as part of this filing, the Company believes that to realize the benefits described in the BCA, any proposed rate design must perform at least as well as the TOU/CPP rate used to perform the BCA. In short, the Company believes the illustrative TVR design should serve as a benchmark for the design of any future TVR proposal.

The illustrative TOU/CPP design reflects TOU pricing in the supply part of the rate. This results in total rates (supply plus delivery) with an on-peak/off-peak ratio of 1.33 and a CPP/on-peak ratio of 5.57. The peak period definition is given in Table 4-6 and CPP calls are limited to 70 hours per year. The Company notes that peak period definitions should change over time to reflect system cost and perhaps emissions.

Table 4-6: Illustrative TVR peak periods

Months	Peak Period
December-March	7:00-12:00 16:00-21:00
April-May	17:00-22:00
June-September	11:00-21:00
October-November	7:00-12:00 16:00-21:00

The extent customers alter their energy usage in response to price signals and improved access to energy usage information comes with uncertainty. A survey of substitution elasticities[32] in response to TOU and CPP rates found values ranging from -0.5%[33] to -18%.[34] Generally, an opt-in population is more responsive to price signals because they are a self-selected group who are choosing to engage with their energy usage.[35] In the Clifton Park Demonstration, the Company's Upstate New York affiliate likewise observed that more engaged customers tend to respond more to price signals.

The BCA model includes high- and low-customer response cases for each TVR enrollment case to account for customer price response uncertainty. Taking the example of a TOU/CPP rate, a high customer response compared to a low customer response means:

- A larger decrease in on-peak energy usage due to the on-peak rate;
- A larger corresponding increase in off-peak energy usage due to the off-peak rate;
- An equivalent decrease in peak demand due to CPP pricing (explained below);
- A larger decrease in total usage due to energy insights and bill alerts; and
- A longer phase-in time to achieve these steady-state response levels.

This last point is meant to emphasize that customers will take some number of years to settle into consistent usage patterns as they adjust to new rate structures and availability of detailed usage information. This time is assumed to be shorter for opt-in cases due to the advanced understanding/engagement of TOU rates for these customers.

Societal Benefits

As mentioned in the customer benefits section, the Company anticipates non-embedded emissions reductions benefits that do not directly impact customer costs, but that should be included as benefits. The Company quantifies reductions in CO_2 due to decreased truck rolls[36] and decreases in emissions from load shifting and energy conservation. Figure 4-11 shows these benefits. Societal benefits carry uncertainty with them for the same reasons as the customer benefits on which they depend. Also, TOU periods that do not accurately mirror times when grid emissions are increased may result in load changes that increase emissions. However, other

[32] Substitution elasticities indicate by what percentage the on/off-peak consumption ratio changes for every 1% change in the on/off-peak price ratio.
[33] *See* Faruqui, A., Lessem, N., Sergici, S., Mountain, D., Denton, F., Spencer, B., King, C., *Analysis of Ontario's Full Scale Roll-out of TOU Rates – Final Study* (2016).
[34] *See* Potter, J., George, S., Jimenez, L., Smart Pricing Options Final Evaluation: The final report on pilot design, implementation, and evaluation of the Sacramento Municipal Utility District's Consumer Behavior Study (2014).
[35] *See id*.
[36] Decreased truck rolls include fewer vehicle trips to read meters, connect and disconnect service, and investigate service anomalies.

benefits, such as avoided CO_2 from truck rolls and VVO-related benefits, are more within the Company's control and not sensitive to TOU period definition.

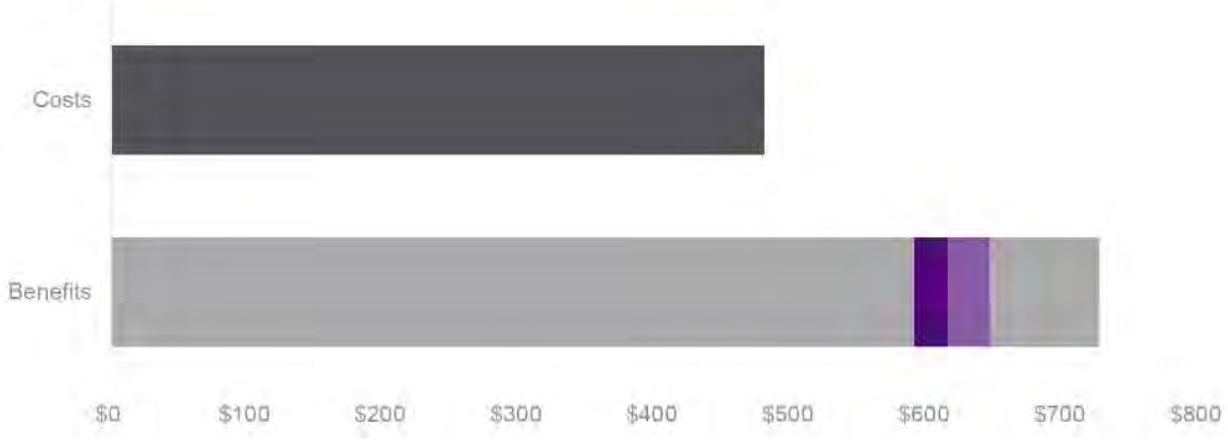

Figure 4-11: NPV benefits with Societal Benefits highlighted

Revenue Benefits

Revenue benefits include three sub-categories: improvement over electro-mechanical meter accuracy, reduction in theft of service, and reduction in bad debt write-offs. The categories are broken out in Figure 4-12. Changes to these values lead to the Company either over- or under-collecting, which is then corrected in rates. For this reason, the Company generally views these benefits as transfers between ratepayers; therefore, the Company typically would not include them in a societal cost test.[37] Nevertheless, reducing unintentional transfers between ratepayers is a positive outcome, and the Company has included the benefits in the BCA.

[37] Viewing such benefits as a sensitivity to the BCA by removing them entirely (*i.e.*, reducing total NPV benefits by $79 million and dropping the benefit-cost ratio to 1.35) still results in a BCA ratio comfortably above 1.0.

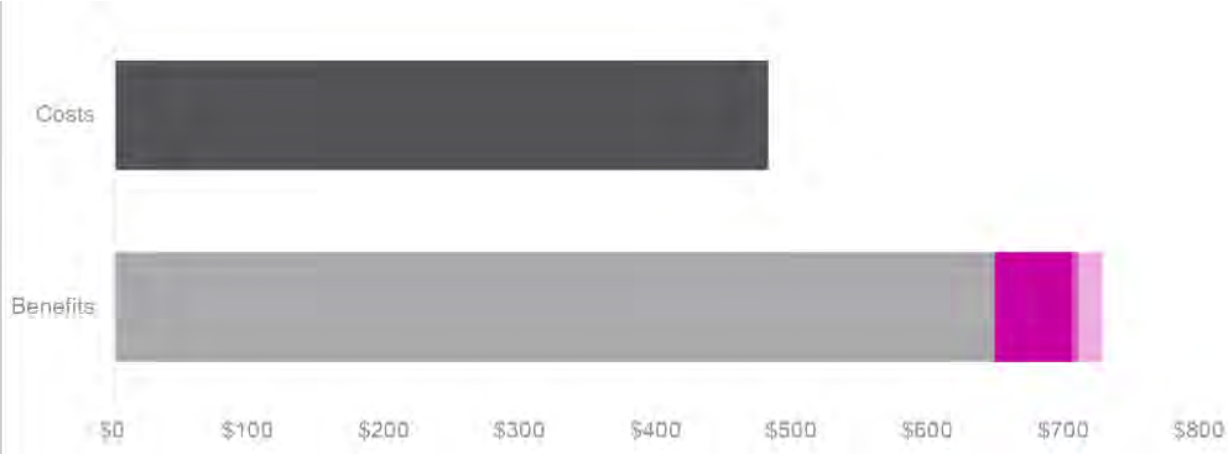

Figure 4-12: NPV benefits with Revenue Benefits highlighted

4.4.3. Qualitative Benefits

In addition to the benefits quantified above, there are many other benefits enabled by AMI that are more difficult to quantify, in many cases due to high uncertainty around developing markets and technology. Several such benefits are discussed qualitatively below, though this list is not exhaustive. These benefits highlight the value of AMI meters and the associated network being a flexible platform for a variety of future use cases.

4.4.3.1. FERC Order 2222

The Federal Energy Regulatory Commission's ("FERC") adoption of Order 2222, allowing for aggregated DERs ("DERA") to fully participate in the wholesale market, will require a revenue quality metering solution capable of meeting the ISO-NE settlement requirements. While ISO-NE must still specify the data requirements, the Company anticipates the deployment of AMI to customers at the retail delivery point will meet such requirements and provide sufficient revenue quality metering for DERA energy settlement.

In this way, the AMI meters are expected to be a sufficient wholesale metering solution for DERA based on facility-level net load. However, such meters will not be capable of revenue quality load disaggregation to report data for individual DER devices separately from facility-level loads, and it is unclear whether the potential future development of real-time load disaggregation would be suitable for DERA settlement purposes. AMI would also not be a solution for the telemetry and more real-time data exchange requirements for certain market products based on currently available technology. Achieving such functionality would likely require installation of additional equipment.

4.4.3.2. End-Point Devices

The AMI communications network and back-office systems can be leveraged over time to integrate other end-point devices to provide additional customer value that is not quantified in the BCA. The Company is open to exploring the use cases in ongoing and/or future forums with the Department and interested stakeholders. Execution of these and/or other new functionalities that demonstrate ongoing utilization of the AMI network and are BCA positive could be the subject of future performance incentives. A non-exhaustive list of future opportunities is included below.

Water Utility/Municipality Revenue Opportunities with Joint Use

Water utilities could leverage the technical umbrella of the Company's proposed AMI network to support overlapping metering efforts, offering a "Metering-as-a-Service" to interested jurisdictions. The Company's platform could serve as the wireless FAN, backhaul, and back-office validation systems for a smart water metering capability.

AMI for Street Lights and Ancillary Devices

The integration of AMI metering, wireless communications, and lighting control technology have fostered an expanding array of ancillary device deployments in support of customer-centric services. Many vendors have developed proprietary platforms that combine a photoelectric control having dedicated solid-state AMI chip-meter technology and varied forms of wireless communication modes incorporated within a small form-factor for use in conjunction with street lighting infrastructure. The advent of these collective technologies was initially promoted by the energy efficiency and environmental benefits achievable through remote controlled light emitting diode technology applications in street lighting. The opportunity for customer specified operating schedules was further enabled by using the AMI metering for the energy consumption measurement of the individual street light. This advancement would allow the lighting control device to integrate with the AMI electric metering mesh network to transition street lighting from an unmetered to a metered billing application. Additionally, the lighting control devices provide electric power quality monitoring, operational performance, maintenance diagnostics of the luminaire, GPS, structure inclination and other lighting system data unavailable without a site investigation assessment.

The further advancement of these technologies has been expanded within the street lighting industry and other business use cases under the "Smart City" moniker. The small form factor and wireless communication capability in conjunction with the availability of electric service voltage on potential vertical real estate has fostered a ground swell of innovative and complementary applications. These combined technologies have included video streaming, asset detection (*e.g.*, license plate reader, parking management), environmental sensors (e.g.,

climatology, pollution and hazardous chemicals), gunshot detection, traffic management, emergency services, waste management and other internet of thing devices. Additionally, the control and metering capabilities are considered the prospective solution to managing the expansive deployments of community Wi-Fi applications, EV charging facilities, and mobile communication infrastructure *(e.g.,* 4G LTE and 5G). The Company's proposed communications infrastructure and potential back-office systems could be leveraged to support network services to interested third parties.

However, the metering and lighting industries continue to address the need for established industry standardization of meter accuracy testing and application performance criteria. Additionally, the adoption of uniform industry communication standards for this technology segment will minimize the limitations imposed by proprietary protocols, further expanding interoperability and end-use opportunities.

"Smart" Gas Meters

Advancements in meter technology have developed gas meters with multiple safety functionalities, including temperature sensing, overpressure protection, excess flow monitoring, and air-detection tamper alerts. Each of these attributes will trigger the meter to potentially shut off gas to prevent emergency situations from occurring. The smart gas meters also can shut off gas to the customer proactively through the AMI network if an external safety event is occurring nearby, such as a fire, gas leak or other unplanned emergency. Having the AMI mesh network in place enables Massachusetts and the Company to advance this emerging technology quickly to enhance customer safety as smart gas meters become available. Smart gas meters require back-office integration to enable full end-to-end operability.

"Smart" Residential Methane Detectors

Residential methane detectors ("RMD") equipped with communication devices, also known as smart residential methane devices, are currently in research and development for AMI deployment. In the event the smart RMD senses methane at a customer location, it would be able to send a notification to the Company through a fixed communication network, expediting the Company's response even if a customer has not called to report the issue.

Gas TVR and Demand Response

Historically, discussions of TVR have focused on electricity. Gas markets lack the temporal resolution to pass signals through to rates. However, in the future, sub-daily gas rates may be used to create financial signals for customers to efficiently use the gas system. Sub-daily usage is already measured for system operations, which can impact the terms of supply contracts. In addition to making sub-daily rates feasible, an increase in temporal resolution of gas system data would support the expansion of gas demand response.

The Company's affiliates are currently engaged in several gas demand response programs or pilots. Data is a critical component of those efforts. To capture the data, supplemental metering is used to gather the necessary information regarding customer participation. If AMI was available, the programs could be deployed more efficiently, as there would not be a need for supplemental metering. Also, AMI could potentially allow for additional tiers of participation in the programs/pilots providing flexibility for customers. One learning from the demand response pilots is that customers assign a significant value to having access to granular usage data. Many of the participants in the programs have stated that this has more value to them than the incentives they receive.

One of the Company's Downstate New York affiliates was the first utility in the country to explore incentivized gas demand response for firm C&I customers as part of a pilot that began in 2017. The three-year pilot includes 16 facility-participants with a goal of shifting gas load outside the peak hour (*i.e.*, changing the shape of the load profile). Events within the pilot are called for three hours between 6 a.m. and 9 a.m. from December through March. The pilot was approved as part of the affiliate's 2016 rate case and the company was awarded the inaugural Utility Industry Innovation in Gas Award by the National Association of Regulatory Utility Commissioners. Additionally, the Company's Downstate New York affiliate launched both incentivized Bring Your Own Technology and non-incentivized behavioral residential and small-and-medium business gas demand response programs for winter 2019-2020.

Though same-day incentivized gas demand response programs are a relatively new offering, tariffed rates that create peak-day reductions via customer behavior have been a critical component of system planning and design for many decades. Specifically, National Grid and its affiliates have operated both interruptible (customer-controlled curtailment for events called at the utility's discretion) and temperature-controlled (utility-controlled curtailment for events initiated based on air temperature) rates for large C&I customers. Nearly 3,000 customers are on these rates in Downstate New York. However, based on the market response for the demand response pilot, the Company's affiliates proposed expanding their demand response portfolios in Downstate New York as part of their pending rate case with a modified version of the current demand response program and two new programs to reach the small-medium-business and residential classes. Customer participation in the rates requires additional metering to track usage and, if necessary, calculate bills for non-compliance. Full-scale AMI deployment could enable rollout of similar programs to gas customers in Massachusetts. Also, the presence of more granular usage data from AMI for gas customers would facilitate program deployment and evaluation, helping the Company better understand usage and reward customers.

Improved Gas Reliability

Integration of gas end-point devices into the AMI network would improve forecasting, response to events, and the scale at which demand response could be deployed in the gas distribution

system. Accuracy and efficiency of long-term and emergency planning processes are improved when informed by high-resolution data. Event tracking and interruption isolation would benefit from high-resolution data combined with smart meter sensing and an ability to remotely disconnect service. And as already mentioned, AMI could enable gas demand response, which could reduce peak demands and mitigate high- or low-pressure conditions to prevent interruption events.

4.4.4. Benefit-Cost Sensitivities

In addition to the Base Case presented throughout this section, the Company analyzed three sensitivities to highlight specific alternative viewpoints. The sensitivities look at the economics of an opt-out TVR rate, use of a lower societal discount rate, and the impact of removing all benefits that depend on customer response to rates and usage information. Figure 4-13 shows the 20-year NPV benefits and costs for the Base Case and each of these sensitivities, and the following subsections describe each sensitivity in more detail.

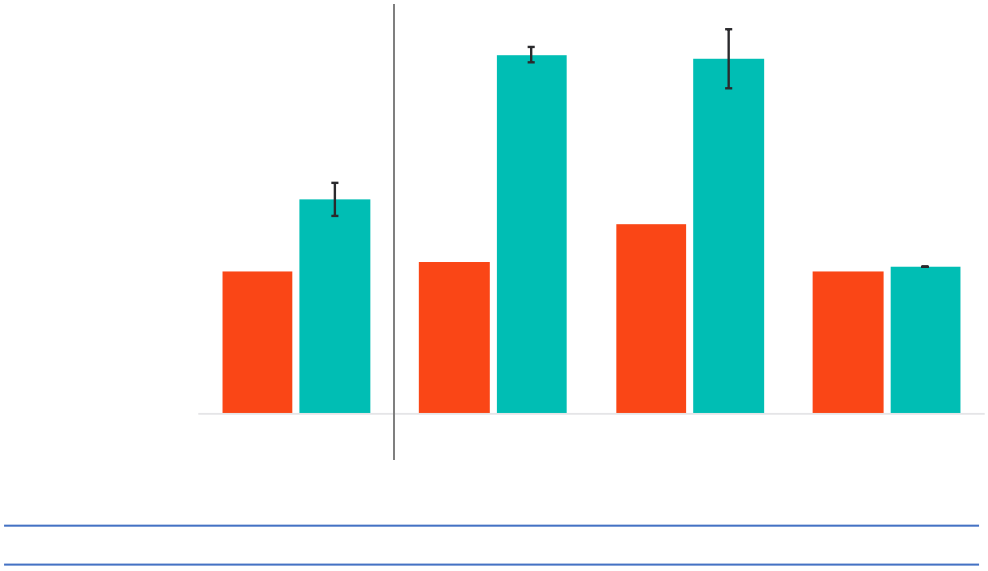

Figure 4-13: NPV costs and benefits for sensitivities. Upper and lower bounds of benefits defined by high and low customer response cases (bar corresponds to midpoint)

Opt-Out TVR

Many factors affect the number of customers that enroll in TVR. Regulatory policy will dictate whether TVR will be offered on a default service basis (opt-out) or not (opt-in). Even within either TVR structure the number of customers who participate will vary. This sensitivity presents results on an opt-out basis, assuming 85% participation, resulting in a benefit-cost ratio of 2.37.

The choice of 85% participation is more conservative than the 86% to 90% participation rates observed by other opt-out TVR programs in Ontario, Canada[38] and as observed by the California investor-owned utilities.[39] Moreover, the opt-out assumption is considerably lower than the 98% participation rate the Company observed in its Worcester Smart Energy Solutions Pilot.

Consistent with findings in other jurisdictions, the BCA model results show that an opt-in approach results in higher TVR benefits per enrolled customer, but an opt-out approach results in higher TVR benefits overall. The large number of customers seeing the CPP price signal provides the largest benefit in the opt-out sensitivity.

Societal Discount Rate

The Company maintains that the most reasonable rate to discount future year costs and benefits for grid modernization investments is the Company's after-tax WACC (currently 7.56% nominal) due to the fact that the grid modernization investments are utility investments, and after-tax WACC is the Company's effective discount rate. However, it is useful to also see results given a lower societal discount rate. Using a lower nominal discount rate of 2.33% values cash flows in later years more than a higher discount rate. Since most costs occur in early years, but benefits occur in later years, the net effect is an increase in the benefit-cost ratio to 1.88.

Benefit Attrition Due to Third-Party Service

The Department previously expressed concern that the benefits associated with AMI could be reduced by the Company serving fewer kWh of supply. This concern was largely driven by the expansion of community choice aggregation ("CCA") programs in the Commonwealth. The Company believes that such migration will not meaningfully impact AMI benefits. Indeed, evidence from jurisdictions with mature third-party supplier markets suggests the percentage of customers on TVR will not drop below that assumed in the Company's opt-in TVR scenario (*i.e.*, 15% participation). Furthermore, third-party suppliers have indicated a strong interest in offering TVR to customers if advanced metering is installed.[40] As such, the Company does not believe that the continued presence of CCAs will meaningfully reduce AMI benefits by eroding TVR participation.

In spite of evidence that TVR participation is unlikely to drop below the level assumed in the Base Case, the rightmost section of Figure 4-13 presents a "No Customer Response Benefits Sensitivity." With this sensitivity, all benefits from TVR participation (including EV load shifting), Energy Insights/Bill Alerts, and the associated CO2 reductions are removed. This

[38] Navigant, *Time-of-Use Rates in Ontario, Part 1: Impact Analysis* (2013).
[39] Nexant, *California Statewide Opt-in Time-of-Use Pricing Pilot: Final Report* (2018).
[40] *See e.g.,* D.P.U. 20-69, Reply Comments of Good Energy, L.P. (Sept. 4, 2019) ("Good Energy's primary concern in any rollout of TVR for utility Basic Service is that the same opportunities to offer TVR are afforded to municipal aggregations.").

hypothetical sensitivity illustrates that the AMI program is likely to be cost-effective (benefit-cost ratio of 1.03) even with zero customer participation.

5. Implementation Plan

This section outlines the various components of AMI implementation, including the implementation timeline, meter deployment, customer engagement, program management, the impact on existing customer programs, and opportunities for multi-jurisdictional synergies.

5.1. Timeline

As shown in Figure 1-2, the Company proposes a four-and-one-half year AMI deployment program. The first phase, which covers the 18 months following regulatory approval of the cost recovery mechanism and a managed project ramp up, will address detailed design, remaining procurement activities and the installation and upgrade of the back-office systems. The second phase, beginning during the back-office work and running for approximately one year, focuses on deploying the communication network. The third phase, which would commence after the completion of the back-office work, involves deployment of electric meters over three years. In addition, the Company will engage customers, as set forth in the Customer Engagement Plan, with activities occurring before, during, and after meter deployment.

5.1.1. Back-Office Implementation and Process Design

The first stage of deployment – the installation and upgrade of the back-office systems and process design work – will begin after approval and a ramp-up period.[41] During this time, the Company will conduct detailed design work, holding cross-functional workshops to identify key priorities, as well as developing and refining an integrated meter and FAN deployment strategy. The design strategy will seek to maximize benefit realization for customers while mitigating any concerns (*e.g.*, potential stranded assets) that are identified. Furthermore, the Company anticipates incorporating lessons learned from its affiliate's AMI deployment in Upstate New York – the back-office work for which began in June 2021. For further detail, Figure 5-1 illustrates activities the Company will perform at each stage of deployment.

[41] The managed ramp-up period will allow for project sanctioning, contract execution, and onboarding resources.

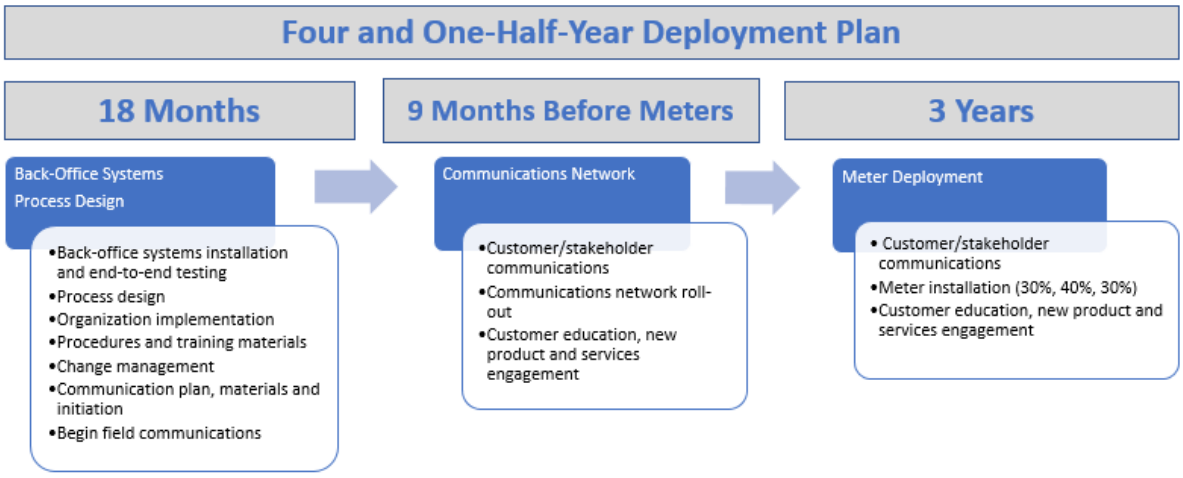

Figure 5-1 Illustrative Deployment Activities

5.1.2. Communication Network Deployment

The Company will initiate the communication network deployment work at the tail end of the back-office implementation and process design work – approximately nine months before meter deployment. The communication network deployment will overlap with the back-office work and continue through meter deployment. The communication network deployment will execute on the FAN strategy developed during the back-office implementation and process design phase. As outlined in the Customer Engagement Plan, the Company will also seek to begin communicating with customers and stakeholders during this time to provide information on expected deployment timelines, what customers can expect during meter deployment, and the benefits enabled by smart meter deployment.

In addition, National Grid will collaborate with peer utilities in the Commonwealth to explore opportunities to share the AMI network. The Company and other utilities in the region already have an existing shared telecommunications network ("STN") agreement that enables the sharing of fiber and microwave radio wide-area network infrastructure. With the deployment of the AMI network, National Grid and the peer utilities could potentially expand the existing STN to include the backhauling of AMI data, decreasing costs as well as dependence on public carrier cellular networks. National Grid also intends to explore the possibility of sharing mesh network nodes where service areas overlap with other peer utilities (*e.g.*, gas-only service areas). In this way, the Company and peer electric utilities could enable gas utilities to access the mesh

network, which would help to avoid redundancy. Such a solution would involve complex requirements, including network compatibility with the various metering solutions, as well as considerations such as cybersecurity, firmware and version control, and maintenance. Building out this option would require additional collaboration among utilities, along with the release and adoption of applicable WiSUN interoperability standards.

5.1.3. Meter Deployment

During meter deployment, the Company proposes to install approximately 1.4 million electric AMI meters across its service territory. The Company will design the AMI meter deployment in concert with the planned replacement cycle of the AMR electric meters, to best manage deployment costs and mitigate remaining net book costs.[42] The Company will install approximately 30% of the electric AMI meters in the first year of meter deployment, followed by 40% in year two, and 30% in year three. Moreover, National Grid anticipates the electric meter deployment to vary locally across the state based on considerations such as geographic area, and population density. During this time, the Company will also ensure coordination among the different deployment components: meter delivery, equipment staging, resource planning, remaining FAN deployment, and ongoing customer engagement.

5.1.4. AMI Meter Opt-Out

Consistent with D.P.U. 20-69-A,[43] the Company will provide customers an opportunity to decline receipt of an AMI meter during all phases of deployment. Customers will receive advanced notice of plans to install AMI meters via mail and other outreach methods, such as radio and educational events. The outreach will notify customers of their ability to opt out, as well as the procedure required to do so. Customers who choose not to participate in the AMI metering program will be able to opt out before or after receiving a new meter, and will receive a non-AMI meter instead.[44] The Company will manually read the meters, and, similar to those who opt out of receiving an AMR meter today, they will be subject to a one-time meter exchange fee in addition to a manual meter reading fee.[45]

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[42] While the Company is seeking to mitigate unrecovered AMR costs, it will continue to install and replace a subset of AMR meters in response to customer growth, meter testing requirements, and meter failures. The Company will seek to amortize the unrecovered investment over a specified period to be determined in its next depreciation study and rate case.

[43] D.P.U. 20-69-A at 35 ("In D.P.U. 12-76-B at 47-49, the Department addressed this issue and determined that each company would be required to have an opt-out tariff in effect before the deployment of new advanced meters as part of the company's grid modernization plan.").

[44] During demonstration project meter installation for the Company's Upstate New York affiliate in Clifton Park, most customers who opted out of receiving a meter did so through the call center or in person at the time of installation.

[45] *See* M.D.P.U. No 1215 (National Grid's AMR meter opt-out tariff).

If a customer chooses to opt out of a meter, the Company will seek to understand the reason for the customer's decision not to participate in the AMI program. This will allow the Company to focus additional resources toward other sectors, or specific customer groups that may consider opting out for similar reasons. In addition, customers who opt out of a smart meter will receive additional materials on the smart meter benefits they are likely to forego by not participating, including access to features and services that require smart meter data (*e.g.*, more personalized usage insights and bill-saving opportunities with new TVR plans).

For the purposes of the BCA, the Company assumes that 1% of customers will opt out of AMI meters. The assumption matches the highest value of the AMI meter opt-out range identified by Consolidated Edison Company of New York, Inc. (Consolidated Edison) in a survey of peer utilities.[46] By comparison, the Company's Upstate New York affiliate experienced a 0.2% opt-out rate for the installation of electric AMR meters (approx. 3,200 out of 1.7 million) on a territory-wide basis. The two AMI pilot programs, Worcester Smart Energy Solutions and Clifton Park, experienced slightly higher opt-out rates of 5% and 8%, respectively. Notably, the pilots differed from the proposal here in that they did not include meter reading and replacement charges for opting out, and, in the case of the Clifton Park Demonstration, it did not include a TVR component. The Company, therefore expects opt-out rates in line with its prior experience and that of Consolidated Edison's benchmarking report. Moreover, the Company's proposal includes a robust Customer Engagement Plan with significant effort dedicated to education and outreach, which the Company believes further supports its assumed 1% opt-out rate.

5.2. Customer Engagement

Customer engagement is one of the most important pieces of the proposed AMI program. 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. The Customer Engagement Plan presents the Company's approach to educating, engaging, and empowering customers to maximize the AMI benefits.

Many of the benefits lie within the increased granularity and timeliness of the energy usage data AMI technology will deliver. Access to this information helps tie energy usage directly to the cost of energy, incentivizing changes through bill savings and by driving step changes in peak

[46] Proceeding on Motion of the Comm'n as to the Rates, Charges, Rules and Regul. of Consol. Edison Co. of New York, Inc. for Elec. Serv., Advanced Metering Infrastructure Business Plan, NYPSC Case No. 15-E-0050 at 38 (November 16, 2015) ("Customer acceptance of AMI is high as evidenced by very low meter 'opt out' and resistance rates coupled with increasing customer recognition of benefits in controlling their use and costs. Average opt-out rates for peer utilities were less than 1% with reported data ranging from .0003% to 1%."); see also Consolidated Edison Co., Advanced Metering Infrastructure Benchmarking Report, 5, 39 (October 15, 2015).

energy reduction, especially when combined with future TVR designs. Customers will benefit from:

- Improved access to timely energy usage data;
- Enhanced control over energy management and costs; and
- Better connections to third-party vendors for innovative energy solutions.

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 desires are not uniform.

5.2.1. Customer Strategy and Segmentation Insights

To better serve customers, the Company has drawn on the lessons learned through its needs-based customer segmentation work. With that process, the Company identified six residential and five commercial segments, each of which contain in-depth profiles of energy-related attitudes, products and services customers are interested in, engagement preferences and favored means of interaction. With each of the residential and most of its commercial accounts now coded with their respective segment, the Company is well positioned to engage customers on the benefits of AMI in a more personalized way through preferred messages and communication channels.

National Grid has begun to leverage these insights to better identify and target customers for different product and service offerings. For example, the Company's residential analysis revealed two segments ("Educated Eco-Friends" and "Affluent Conservers") that are most interested in engaging with National Grid by purchasing energy-related products and services; about 38% to 42% of Massachusetts customers fall into these groupings.

Notably, many of the products and services classified as low awareness but high interest across customer segments are relevant to AMI-enabled functionality, such as TVR, bill alerts, access to more granular energy usage data, and load disaggregation.

For the Customer Engagement Plan, which seeks to engage *all* National Grid customers in the Commonwealth, the Company expects to utilize digital footprint habits (*i.e.*, how customers use technology) and desired brand interaction channels (*e.g.*, website, phone calls, paper bills, and apps) from each segment to differentiate its outreach to customers with preferred messages and communication channels (*e.g.*, direct mail, website, email, social media, and community meetings). This approach will help the Company most effectively educate and empower different customers to maximize AMI benefits. Personalized messaging through preferred channels improves the customer experience and will prompt customers to engage more actively with AMI 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 the segmentation analysis to optimize between universal and targeted messaging. The Company will also refresh the segmentation analysis periodically to ensure its insights remain relevant and useful to ongoing customer engagement efforts. Additional details on the Company's customer strategy and segmentation insights and how they impact the Company's plan to engage customers as part of AMI deployment are included in the Customer Engagement Plan.

5.2.2. Phases of Customer Engagement

The objective of the Customer Engagement Plan is to inform and educate National Grid customers on the benefits of smart meters, to increase participation in adopting the new technology, and to empower them to utilize new insights and services. Using the learnings from its Worcester Smart Energy Solutions Pilot, customer strategy and needs-based segmentation analysis, as well as internal and external research and collaborative sessions, the Company developed a three-phased approach to customer education and engagement. A summary of the three-phased approach is outlined below, depicted in Figure 5-2, and described in detail in the Customer Engagement Plan:

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

- **Phase II (Deployment):** The Company plans to build on Phase I 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 AMI pilots to maximize engagement with different customer types.

- **Phase III (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 continues to build out its Customer Energy Management Platform ("CEMP"), which will be customers' new touchpoint to access their energy data. 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 help to further facilitate the introduction of interested customers to third-party vendors capable of supplementing customer needs with new and innovative products and services.

The Company will also leverage the more granular usage data to develop new targeted and innovative energy efficiency programs that will allow for continuous customer engagement and more personalized energy usage alerts and recommendations.

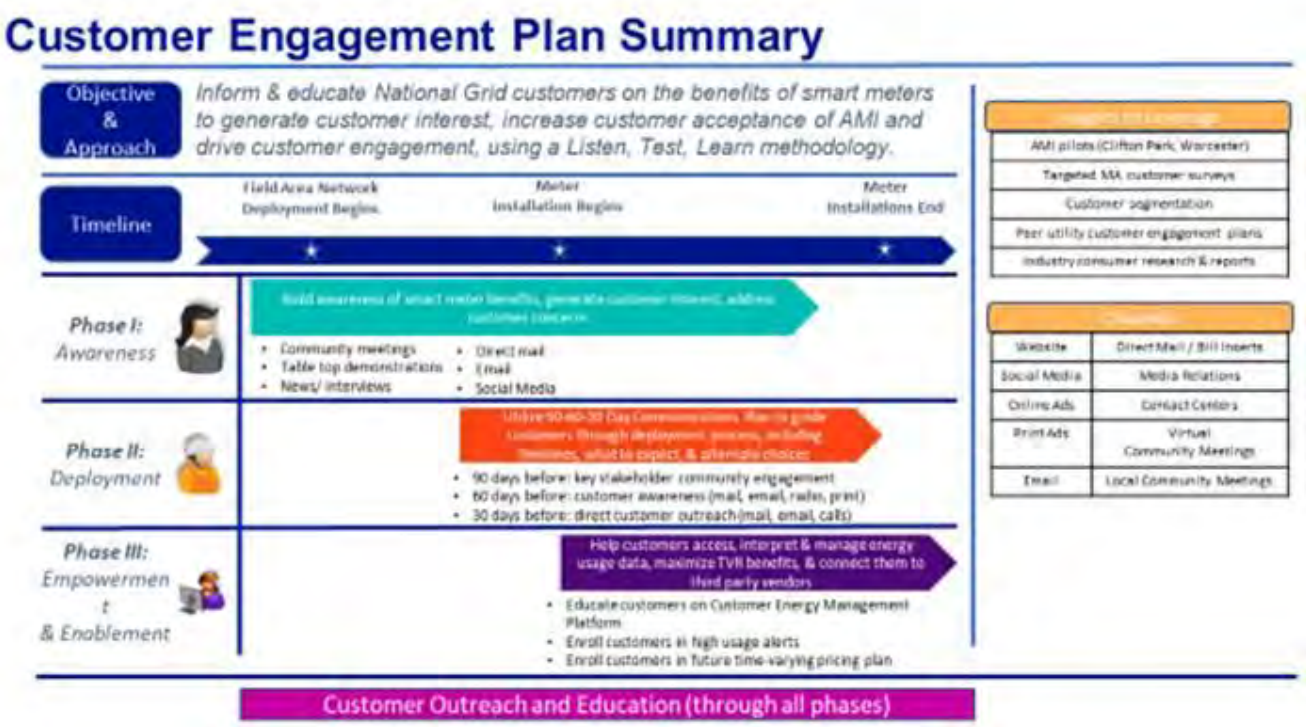

Figure 5-2: Customer Engagement Plan Summary

Throughout the three phases, the Company will continue to collect customer feedback using surveys (*e.g.,* online, mail, telephone), in-person focus groups, online focus groups, and customer forums as part of its overarching "Listen, Test, Learn" approach to smart meter deployment.[47]

[47] 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. For example, the Company conducted a public summit during the design phase that allowed it to hear from a diverse cross-section of the community and incorporate ideas from customers to improve design of the project. *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 Company will use these channels to track customer awareness of AMI features and benefits, as well as customer empowerment and enablement through use of CEMP functionalities.

5.2.3. AMI & National Grid's Long-Term Customer Vision

The deployment of the smart meters and associated communication network will provide significantly more granular data at a greater frequency than is available with current AMR technology (15-minute vs. monthly intervals, respectively). National Grid is committed to enhanced third-party data access, which will create new opportunities for innovative third-party services. AMI will establish 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. Once AMI is deployed, National Grid will seek to leverage this foundational infrastructure and capabilities to provide new customer solutions where feasible.

5.2.4. Data Governance and Management

The Company's AMI Data Governance Plan lays out a comprehensive set of principles and standards for the customer and system data produced by the Company's proposed AMI deployment. These guiding principles are designed to ensure that the data generated 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 operational requirements, as well as grid modernization and clean energy objectives. The Data Governance Plan provides a structure for how AMI data will be governed. The plan also discusses system data as it pertains to AMI in the context of ongoing grid modernization efforts. In addition, the plan includes an explanation of how the Company will provide customers with access to data, and how it will enable the sharing of that data with authorized third parties.

The Company has developed a comprehensive and integrated data governance framework designed to ensure compliance with privacy and information security regulations across all jurisdictions in which it does business. The framework is meant to ensure that customers' data is properly protected, but also readily available to them or any third party with whom they wish to share their data. In striking this balance and committing to the secure delivery of AMI, the Company focuses on three key data security 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. The approach is also reflected in its risk-based cybersecurity framework that 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 Data Governance Plan includes further detail of the Company's approach to data, privacy, and its commitment to cybersecurity, including discussions of: customer data; system data; data access; data sharing; Green Button Connect; HANs; as well as data privacy, security, and protection.

5.3. Program Management

Building from the model used by its New York affiliate, the Company will establish an AMI project management office ("PMO") directly linked to workstreams. The PMO will serve as the conduit between the project front line and other business units. In this respect, the PMO will help deliver new and exceptional customer value by aligning the Company's strategic planning, portfolio management, process excellence, and change management capabilities throughout AMI implementation. This approach will leave the Company well positioned to efficiently deliver the AMI project in a cohesive, agile manner that provides benefits for customers and addresses the Company's operational needs.

The AMI project will also leverage a robust set of National Grid standards developed as part of its Business Management System ("BMS"). Specifically, a set of BMS standards has been developed around program and change management. The standards include ten core principles that the AMI project will adhere to for promoting common practices and successful outcomes. Each principle has been well defined and includes a related set of performance requirements. Furthermore, the BMS standards are accompanied by a comprehensive Company portal that includes training, tools, and templates. An illustration of the core principles for program and change management appears below in Figure 5-3.

Figure 5-3: Core principles of program and change management standards

The Company will also leverage its Centers of Excellence ("COEs"), which will lend internal support to the AMI project team. The COEs will provide experienced services in several important project areas, such as program management, change management, business architecture, and process mapping. Additionally, the COEs provide for an independent assessment of the AMI project through their program assurance and project controls teams.

While the proposed AMI deployment timeline includes 18 months for back-office systems implementation and detailed design, the Company recognizes the importance of proactive planning to ensure internal resources are appropriated and organized to successfully deliver AMI. In this respect, the Company will take steps to build from the work of its Upstate New York affiliate by preparing Requests for Proposals ("RFPs") for external support in the areas of project management, business integration, and IT integration (discussed further below). Such "implementation readiness" activities also include assembling project plans and schedules, organizational resourcing, establishing business unit collaboration and communication processes, and preparing for internal sanctioning processes. This work is ongoing in support of the Company's Upstate New York affiliate's AMI program and will contribute to the Company's readiness to move forward with AMI implementation in the Commonwealth.

5.3.1. Governance

The Company will establish an AMI program governance structure, which will include representation from senior leadership and subject matter experts across the Company. An illustrative example of the governance structure is included as Figure 5-4. In doing this, the Company will build from the work being done to support the deployment of AMI by its Upstate New York affiliate and incorporate lessons learned from discussions with other large internal programs, as well as meetings with consultants and peer utilities who have implemented AMI.

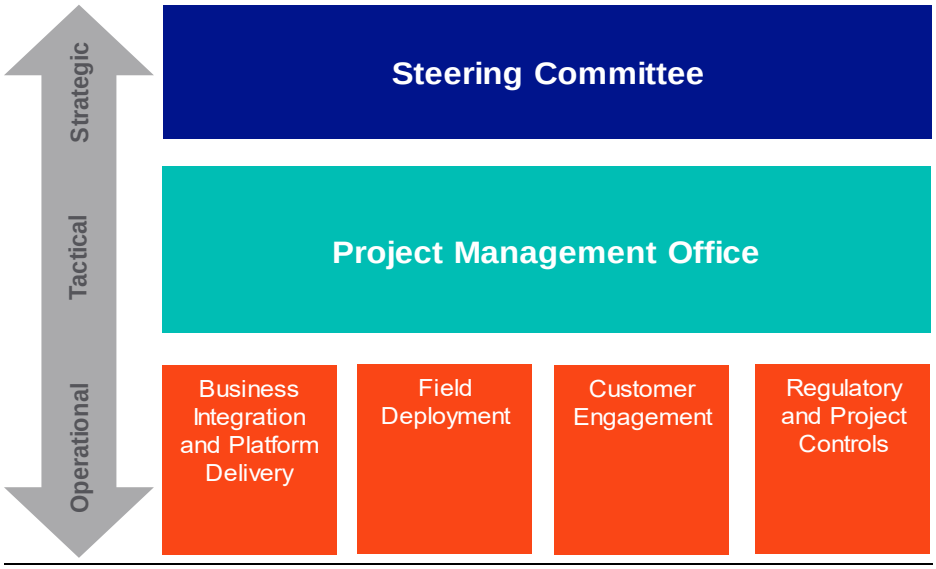

Figure 5-4: Example program governance structure

5.3.2. Company Staffing and Training

The Company expects to utilize a mix of new and existing employees to manage AMI program implementation. In some cases, as AMI changes the way the Company operates, existing employees will be repurposed to fill new positions. Additional staff is expected to support areas such as project management, implementation, change management, and business integration.

As discussed in more detail in the Customer Engagement Plan, the Company will provide AMI training to all Company employees with an emphasis on customer service representatives, who will serve as a primary conduit for customers interacting with the new technology and services. Training will be provided through a variety of channels and materials to ensure that information is delivered and accessible to all employees. The channels and materials include:

- Company Town Halls;
- Employee Communications;
- Emails;
- In-person Training Sessions;
- Frequently Asked Questions ("FAQ") Resources;
- User Manuals; and
- Instructional Videos.

As implementation of AMI progresses, the Company intends to utilize existing employees' capabilities to analyze and leverage AMI data to maximize energy saving benefits and assess the overall impact of AMI implementation. Teams within the Company, such as Advanced Analytics and Energy Forecasting, have skills in both electric domain knowledge and quantitative analysis to ensure the Company is capturing and delivering benefits. Additional capabilities include:

- Quantitative analysis associated with short-, mid-, and long-term electric and gas system distribution planning;
- Predictive and prescriptive analytics;
- Modeling DERs such as solar, EV, and energy storage and their impact on the Company's network; and
- Forecasting customer demand, accounting for weather variability, price elasticity, economic growth rates, technology trends and other variable factors.

Examples of advanced analysis that will be possible with AMI data include improved load modeling, customer energy saving strategy design, preventative maintenance, and theft detection.

5.3.3. Customer Integration

The Company will also use the strategies and tactics outlined in the Customer Engagement Plan to inform and educate customers about the benefits of smart meters. The outreach efforts are aimed at increasing participation and acceptance of the new technology, as well as the eventual adoption of new insights and services. In this way, the Company will coordinate with internal teams focused on customer engagement, such as Customer Insights, Marketing, Customer Energy Management, and Customer Experience Products. Working collaboratively, the internal coordination will ensure the materials, processes, and outreach efforts defined in the Customer Engagement Plan are successfully executed. As customer needs evolve, the team will develop the means through which insights or benefits continue to be delivered to customers.

5.3.4. Business Integration

Business integration is an important step toward ensuring AMI implementation is successful and efficient. It strengthens the Company's AMI-related communication and collaboration processes

across the business units, ensuring the project's resources are holistically aligned. Additionally, by proactively managing change, business integration provides for a smooth transition into the ongoing management of the AMI resources and associated programs once the initial deployment is complete.

Many employees will be impacted by the AMI deployment, including meter field technicians, meter shop technicians, customer service representatives, control center operators and billing analysts. Each role will need to accommodate the incorporation of this new technology. To aid in a smooth transition, the business integrator will promote internal communication, engagement, and adoption of the AMI technology and functionality across the Company. This will include alignment with programs such as grid modernization investments and IT business objectives.

The business integrator will also be supported by industry-leading consultants and will establish robust partnerships with other teams across the Company. The objective of establishing these partnerships is to raise awareness of the AMI program, coordinate tasks to ensure efficient implementation, and build change management processes to enable the transition to new ways of working once AMI deployment is complete.

5.3.5. Systems and Grid Integration

Likewise, systems and grid integration activities are key to harnessing the full capability of smart meter benefits across the Company's infrastructure, software, and systems. By successfully deploying physical equipment and enabling data exchanges between the meters, modules, and collectors to back-office systems, the Company can maximize the effectiveness of the overall AMI platform. As such, the Company's plan includes costs associated with IT and systems integration, based on an approach to systems and grid integration that includes:

- Capability analysis and end-to-end definition of functionality at each step;
- Systems architecture to define data interfaces between systems and components;
- Defining detailed requirements for all systems and interfaces;
- Custom configuration and development of application program interfaces ("APIs");
- A well-coordinated deployment strategy that minimizes the impact to communities and customers;
- Detailed test case planning and definition; and
- Careful test execution and defect documentation.

In general, AMI platforms have highly complex data exchanges. To address these complexities and facilitate the exchange of standardized data elements between all affected systems, the industry has turned to systems integration solutions supported by an enabling middleware technology, such as an enterprise service bus ("ESB"). The Company plans to follow this same industry-accepted approach. Other benefits of strong systems integration include:

- Improved system response time and performance;
- Lower labor costs and increased operational efficiency; and
- Compatibility across system devices and software.

The Company's systems- and grid-integration teams will manage these activities in coordination with a dedicated IT PMO team and qualified vendor partners, who will be chosen through the vendor selection and management process.

5.3.6. Vendor Selection and Management

The Company and its affiliates have conducted comprehensive AMI procurement and vendor negotiation activities taking into consideration requirements for all jurisdictions/regions through a competitive RFP/RFS process. This approach has enabled National Grid to obtain optimal pricing and value for customers. The Company managed the AMI vendor selection process within a defined governance framework, considering a range of factors, including current and future technical capabilities, fixed delivery costs, industry experience, risk mitigation and reporting protocols. Additionally, the Company considered vendor experience with AMI system deployments, as well as large-scale manufacturing capability.

The vendor selection process also included a Request for Information ("RFI") to qualify potential bidders based on their ability to support the defined business requirements. Vendors deemed qualified through the RFI process were permitted to submit responses to the RFS. Once the responses were received, each vendor was engaged to clarify outstanding questions or uncertainties regarding the proposed solution, capabilities and pricing. In addition, the Company conducted vendor site visits to assess vendor research and development and manufacturing facilities, where applicable. To gain additional insight into vendor capabilities, National Grid also collaborated with peer utilities who have installed similar software and equipment. After final contract execution, and onboarding, the Company's program team will coordinate with the vendor to deliver the AMI program in line with defined schedules and service-level agreements ("SLAs").

With this program, Massachusetts will be the second National Grid jurisdiction to implement AMI technology with the selected vendor. As such, customers in the Commonwealth will benefit from the Upstate New York affiliate's AMI implementation activity, including opportunities for lower costs due to volumetric pricing discounts and multi-jurisdictional efficiencies, as well as incorporating lessons learned. Toward that end, the New York affiliate has established a PMO, onboarded business integrator support, and is planning additional procurement events for the communications network, meter/module installation, the CEMP, as well as IT infrastructure. Each of these components is described in additional detail in Table 5-1.

Table 5-1: AMI procurement area descriptions

Procurement Area	Description
Initial RFS Components	AMI meters, FAN communications equipment, head-end system, MDMS, and associated professional services
PMO	Professional services to support the Company in the management of the project
CEMP	Personalized integrated web-based platform that utilizes AMI data to educate and engage customers in managing energy use and costs as part of a unified web portal
Business Integrator	Professional services supporting integration of AMI with the Company's existing systems, including delivery development, testing, and implementation of the overall AMI solution
IT Infrastructure & Cybersecurity	IT infrastructure components and a suite of cybersecurity services that are needed in addition to the initial RFS solution components to support the overall AMI solution
Communications Network	Procurement of wide-area network ("WAN") services, equipment and installation
Meter/Module Installation	Field support services to install meters and modules

5.4. Multi-jurisdictional Considerations

National Grid's multi-jurisdictional footprint offers a local utility focus coupled with large utility learnings and efficiencies. As mentioned, the Company's Upstate New York affiliate received regulatory approval for its AMI proposal in November 2020. With that effort under way, the Company and its customers have an opportunity to leverage lessons learned from the affiliate's deployment while also capturing multi-jurisdictional efficiencies. With the current schedule depicted for Massachusetts AMI deployment, the two jurisdictions would overlap for portions of the back-office system/design work and meter installation. The phasing of implementation work in the two jurisdictions would allow for synergistic learning and potential cost savings, while enabling the Company to address operational needs from the increased risk of AMR meter failures.[48] Table 5-2 provides a high-level comparison of AMI implementation proposals/activity across New York and Massachusetts.

[48] The extent of cost savings among jurisdictions due to synergies depends on the timing of regulatory approvals and deployment, as well as state-specific requirements (*e.g.*, regulatory mandates and the specific AMI solution deployed).

Table 5-2: Comparison of AMI Implementation in New York and Massachusetts

	New York	Massachusetts
Company	Niagara Mohawk Power Corporation	Massachusetts Electric Company and Nantucket Electric Company
Latest Business Case Filing	The NYPSC approved NMPC's AMI proposal on November 20, 2020 in Case Nos. 17-E-0238 and 17-G-0239.	D.P.U. 21-81
Approx. Electric Meters	1,700,000	1,400,000
Approx. Gas Modules	640,000	*
Projected Meter/Module Deployment Date	2023	2024
Proposed Timeframe for Meter Deployment	4 years (20%, 35%, 35%, 10%)	3 years (30%, 40%, 30%)
FAN	Mesh	Mesh
Deployment	Full Electric and Gas	Full Electric
Proposed Rates	Illustrative TOU/CPP rate used for BCA[49]	Illustrative TOU/CPP rate used for BCA
Meter Opt-in / Opt-out	Opt-out	Opt-out

* This MA AMI Implementation Plan is specific to electric. Opportunities for AMI gas module/AMI gas meter deployments will be considered as part of future filings of the National Grid gas companies.

Multi-jurisdictional scenarios allow the Company to draw upon the experiences, internal expertise, and shared savings across its affiliates, while crafting an AMI solution that best addresses the needs of customers in the Commonwealth. Moreover, deployment across multiple

[49] Note the NYPSC did not approve a TVR as part of the NY AMI Order; rather, it deferred consideration of innovative pricing proposals to other pending dockets, while noting it is an important part of the suite of AMI benefits.

jurisdictions creates potential cost synergies, including fixed cost sharing opportunities and increased purchasing scale benefits such as:

- **Meter Equipment:** Discounts for common meter and telecommunications specifications, vendors, and meter deployments scheduled within the same time frame.

- **Communications System:** Opportunities to scale and share communication links between National Grid operating companies and SaaS providers. In addition, if common equipment specifications and vendors are utilized for communication equipment installed at substations, the potential exists for procurement synergies through volume discounts.

- **Information Management and Advanced Analytics:** Developing a common front end for data analysis and visualization to accommodate different data structures in the jurisdictions. Additionally, standard data models may be developed to manage master data.

- **Head-End System:** Procuring hardware and software for both jurisdictions from the same vendors.

- **Cybersecurity:** Unit cost synergies for hardware, software and licenses, synergies in delivery/deployment of new security services, and reduced overall resources to maintain the comprehensive portfolio of core and supplementary security services.

- **Meter Data Management System:** Procuring hardware and software for both jurisdictions from the same vendors.

- **Project Management:** Vendor Program Management, Business Process Design/Requirements Definition, Solution Architecture, Requirements Management, Organizational Change Management, Testing Management, Deployment Operations, and Performance Monitoring.

- **Data Lake:** Integration of corporate and operational data from legacy information systems in a common fashion to support AMI initiatives with the use of cloud services

and labor for the development of foundational elements of a data lake to be leveraged across jurisdictions.

- **IT Infrastructure:** An ESB developed with a common architecture and deployed in both jurisdictions. Synergies can be derived in common foundational work prior to deployment.

- **IT Platform/System Testing/Enterprise Architecture:** System testing may produce synergies in early strategy development for shared systems as well as in the coordination of testing during deployment in each jurisdiction.

5.5. Impact on Existing Customer Programs

The Company recognizes the deployment of smart metering as a unique opportunity to accelerate the evolution of its existing portfolio of customer-facing programs and services, ranging from offerings such as residential and commercial energy efficiency and demand response programs to its comprehensive electric transportation initiative. The deployment of AMI will also animate the market for third-party technologies and services, providing opportunities for third-party innovation and delivering additional benefits for customers under policies and programs set forth by state laws and regulations.

To that end, the Company has undertaken efforts to ensure that AMI serves a supporting and enabling role by which the Company, with enhanced customer insights, can better design, target, and implement its key customer-centric offerings. The Company believes that AMI is a critical component to achieving its long-term strategic vision for Massachusetts customers, helping to maximize benefits and reduce costs. Grounded in the Company's customer strategy, and along with ongoing investments in key customer engagement capabilities (particularly on the digital front), deployment of AMI serves as a critical step in meeting the Department's grid modernization objectives.

The Company will also take meaningful steps to ensure that benefits are not double counted and that costs are allocated and recovered appropriately. The Company envisions that post-AMI deployment filings (*e.g.*, EE plans) will leverage AMI, incorporating AMI-enabled functionality and savings opportunities to account for more efficient program delivery. The anticipated overlap and integration points with other customer programs are noted below in further detail. In total, the Company believes it has taken a conservative approach to assumptions around integration benefits with other programs, and it will seek to identify additional pools of customer-centric benefits as it deploys AMI.

5.6. Energy Efficiency

The availability of AMI-enabled interval usage data offers immediate incremental benefits for the Company's long-standing energy efficiency programs in service of its residential, income-eligible, small business, and large commercial and industrial ("C&I") customers, primarily in the form of more personalized targeting, action-based and programmatic recommendations (*e.g.*, Pay-for-Performance), as well as potential enhancements to both: 1) how behavioral savings are achieved; and 2) to future evaluation, measurement, and verification ("EM&V").[50] A further description of the integration in outreach strategies between AMI and the energy efficiency programs is included in the Customer Engagement Plan.

The benefits estimated in the AMI BCA are based on initial customer savings that would occur when customers have visibility into enhanced energy insights and access to future TVR pricing. The savings assume customers have a smart meter paired with the CEMP; they do not assume access to other programs. The identified savings will help to establish a new approach to managing and reducing customer energy usage. For example, the Company's existing Home Energy Reports program captures electric savings that stem from customer behavioral change upon receipt of personalized energy reports with social norm comparisons. The methodology is similar to that which the Company uses to estimate customer response to the immediate availability and presentment of granular usage information that stems from deployment of AMI. In energy efficiency plans occurring after the deployment of AMI, the Company will incorporate this new approach to determine what incremental savings can be achieved above those identified in the AMI BCA. This will ensure that future energy efficiency programs are only counting incremental savings directly tied to clear programmatic efforts.

In addition to calculating benefits, the Company also examined potentially overlapping costs. Once AMI is deployed, the Company expects energy efficiency programs will continue to include customer incentives for in-home/in-business technologies, such as Wi-Fi programmable thermostats and smart appliances to drive the achievement of additional incremental energy savings to meet annual energy savings targets. The Company recognizes that the future energy efficiency plans will include the total participant incentives (*i.e.*, ratepayer-funded rebates and customer contribution costs) associated with such measures in its BCA methodology, and thus it is imprudent to include any additional estimated costs for these enabling technologies within the AMI BCA. The Company envisions that foundational AMI-enabled insights plus ongoing energy efficiency program-addressed adoption of energy-saving tools and products is the most appropriate path forward that greatly reduces any conflicts of interest or methodological complexity.

[50] The Company does not estimate any EM&V-related benefits as part of its AMI BCA, although it recognizes that such a benefit may exist in the long-term.

This Updated AMI Business Case will only use the benefits and costs specific to AMI deployment and will not count the costs and benefits that will be filed with future energy efficiency plans. The Company anticipates that the direct need to bifurcate savings and costs will not arise until after AMI meter deployment begins and data is collected and visualized for customers. Therefore, the important overlap and distinction between AMI and the energy efficiency plans will most likely not arise until the after the period covered by the Company's planned 2022-2024 energy efficiency filing, when the Company anticipates a more robust discussion of evaluation methodologies and other key considerations. This effort will also look to leverage the ongoing collaboration of the Company and other stakeholders.

5.7. Demand Response

Building on the energy efficiency programs, both residential and commercial demand response programs play a critical role in achieving system-wide peak reduction. The deployment of AMI will establish a basis for the implementation of TVR, providing improved price signals to traditional demand response programs. The AMI BCA does forecast and capture customer benefits due to energy conservation during critical-peak periods. As part of future demand response program design, implementation, and evaluation, the Company will work to clearly separate achieved benefits that stem from AMI deployment from those attributed to the Company's ongoing demand response initiatives.

Additionally, TVR provides an economic incentive to encourage adoption of traditional demand response technologies as well as new DERs, such as behind-the-meter energy storage, that can provide valuable contributions to demand response programs. TVR will also allow for more creative demand response program design in the future, leveraging advanced rate structures or more geographically granular peak reduction programs, including potential for DER-specific rates. Demand response program design can further be expanded to include additional grid services, such as voltage regulation support, and targeted deployments to support feeder-specific non-wires alternative ("NWA") projects.

5.8. Electric Transportation

The Company is currently implementing a comprehensive electric transportation initiative. The initiative, which is geared generally toward improving customer adoption and utilization of EVs, is not included in the Company's AMI benefits forecast in terms of helping to accelerate EV adoption. However, due to the enabling functionality of AMI to implement TVR, the Company does envision a quantitative benefit for AMI in helping to shift EV charging patterns to periods when energy is less expensive. As such, the AMI BCA does include estimated benefits due to customers shifting EV charging patterns, thereby reducing their total ownership costs while helping to prevent additional electrical load during on-peak or critical-peak periods.

AMI will also provide the data necessary to develop analytics to better inform, develop, and implement electric transportation programs. For example, applications can detect which

customers are charging an EV at their home, determine the size of a customer's EV charger, and understand charging patterns. Program management tools such as these will provide the ability to develop targeted marketing and enrollment of customers into future EV-specific offerings and deliver scalable analytics to design effective EV rate plans. Additional detail regarding the Company's EV plans will be included in a subsequent filing.[51]

6. Reporting and Program Management

National Grid is committed to ensuring its multi-year implementation of AMI maximizes the benefits and outcomes enabled by the new technology. Delivering such a complex and extensive initiative requires detailed planning, design, and project management. Toward that end, the Company is focused on efficiently deploying the communications network and AMI meters; implementing the customer engagement strategy; and working with customers and other stakeholders to enable the full suite of capabilities AMI offers. The Company believes the success of those efforts also requires effective risk management and transparency through program reporting.

For the purposes of tracking the progress of the AMI program, the Company will work with the Department to identify an appropriate reporting structure and objective metrics that address the status of AMI implementation, including deployment efforts, customer engagement, operations, and third-party engagement. To every extent possible, the Company will work with the other EDC's to ensure consistency in tracking and reporting cadence and content.

The scale, scope, and term of the AMI proposal also requires careful management to ensure customers realize the benefits envisioned by the program. The Company believes this Plan includes the steps necessary to provide such management for the items National Grid can directly control. The steps are described in detail in various sections and are summarized below to convey the Company's comprehensive management approach.

Solution Management:

- The Company developed this Plan to ensure the timing and associated costs of the new functionalities are aligned with system and customer needs, as well as the Company's overall approach to grid modernization.

- The Company considered alternative metering solutions and compared them to the AMI solution based on relative functionalities and benefits and costs. As set forth above, the

[51] *See* D.P.U. 20-69-A at 55.

results demonstrate that full-scale AMI deployment is the most cost-effective fit-for-purpose solution that also delivers the greatest customer- and grid-facing functionality.

- The procurement process for the AMI solution evaluated functionalities, vendor roadmaps, and solution offerings such as Software-as-a-Service ("SaaS"), to provide solution flexibility and adaptability to address the risk of technology obsolescence.

Managing Cost Risk and Delivering Benefits:

- While further refinement is necessary to achieve budget-level figures, the Company has taken multiple actions regarding AMI program cost estimates to enhance cost certainty as compared to the Company's prior AMI filings. Primary to these efforts is cost estimate refinement through the RFS solicitation for major components of the AMI solution including the electric meters, FAN equipment, back-office systems, and related professional services. The costs of periodic technology refreshes (hardware and software) over the 20-year term of the BCA and non-RFS component cost contingencies have also been factored into the costs.

- The Company developed the comprehensive Customer Engagement Plan to support the achievement of the envisioned customer benefits.

- Building from the AMI deployment experience of its Upstate New York affiliate, the Company will employ a project governance structure to oversee the AMI program and make critical decisions, assure cross functional alignment, and effectively manage implementation.

7. Appendix

7.1. Acronym List

aaS = As a Service
ADMS = Advanced Distribution Management System
AMF = Advanced Meter Functionality
AMI = Advanced Meter Infrastructure
AMIaaS = AMI as a Service
AMP = Arrears Management Plan
AMR = Automated Meter Reading
ANSI = American National Standards Institute
API = Application Programming Interface
ASA = Amended Settlement Agreement
BAN = Business Area Network
BAU = Business as Usual

BCA = Benefit Cost Analysis
BE = Beneficial Electrification
BMS = Business Management System
BYOT = Bring Your Own Technology
C&I = Commercial and Industrial
CCA = Community Choice Aggregator
CCST = California Council on Science and Technology
CEMP = Customer Energy Management Platform
CEP = Customer Engagement Plan
CGR = Connected Grid Router
CIS = Customer Information System
CO_2 = Carbon Dioxide
COEs = Centers of Excellence
CPP = Critical Peak Pricing
CPR = Critical Peak Rebate
CSS = Customer Service System
CVR = Conservation Voltage Reduction
D/Dist = Distribution
DCFC = Direct Current Fast Charging
Department or MA DPU = Massachusetts Department of Public Utilities
DER = Distributed Energy Resource
DERMS = Distributed Energy Resource Management System
DG = Distributed Generation
DLM = Dynamic Load Management
DPAM = Distribution Planning & Asset Management
DOE = Department of Energy
DP&L = Dayton Power and Light
DR = Demand Response
DRIPE = Demand Reduction Induced Price Effect
DSCADA = Distributed Supervisory Control and Data Acquisition
DSIP = Distributed System Implementation Plan
DSP = Distributed System Platform
EC4 = Executive Climate Change Coordinating Council
EDI = Electronic Data Interchange
EE = Energy Efficiency
EHP = Electric Heat Pump
EIA = Energy Information Administration
EM&V = Evaluation, Measurement, and Verification
EPO = Energy Profiler Online
EPRI = Electric Power Research Institute
ERT = Encoder Receiver Transmitter
ESB = Enterprise Service Bus

EV = Electric Vehicle
FAN = Field Area Network
FCC = Federal Communications Commission
FCS = Field Collection System
FLISR = Fault Location Isolation and Service Restoration
FTE = Full-Time Employee
GBC = Green Button Connect
GBD = Green Button Download My Data
GDP = Gross Domestic Product
GDPR = General Data Protection Regulation
GHG = Greenhouse Gas
GIS = Geographical Information Systems
GMP = Grid Modernization Plan
HAN = Home-Area Network
HCA = Hosting Capacity Analysis
HECO = Hawaiian Electric Company
HES = Head-End System
HVAC = Heating, Ventilation, and Air Conditioning
ICAP = Installed Capacity
ICE = Interruption Cost Estimate
IEI = Institute of Electric Innovation
IoT = Internet of Things
IOUs = Investor-Owned Utilities
ISA = Interconnection Service Agreement
ISR = Infrastructure, Safety, and Reliability
IT = Information Technology
kW = Kilowatt
kWh = Kilowatt hour
LDV = Light Duty Vehicle
LED = Light Emitting Diode
LIHEAP = Low-Income Home Energy Assistance
LVA = Locational Value Analysis
MA = Massachusetts
MaaS = Meters as a Service
MDMS = Meter Data Management System
MRP = Multi-Year Rate Plan
MV/LV = Medium Voltage/Low Voltage
NaaS = Network as a Service
NG = National Grid
NMPC = Niagara Mohawk Power Corporation
NOx = Nitrogen Oxide
NPP = Non-Regulated Power Producer

NPV = Net Present Value
NY = New York
NYPSC = New York Public Service Commission
NWA = Non-Wires Alternative
OER = Office of Energy Resources
O&M = Operations and Maintenance
OMS = Outage Management System
ORU = Orange and Rockland
PBR = Performance-Based Regulation
PI Historian = Plant Information Historian
PII = Personal Identifiable Information
PIM = Performance Incentive Mechanism
PLC = Power-Line Communication
PMO = Project Management Office
PSE&G = Public Service Electric & Gas
PSR = Platform Service Revenue
PST = Power Sector Transformation
PUC = Public Utilities Commission
PV = Photovoltaic
REC = Renewable Energy Credit
REG = Renewable Energy Growth
REMI = Regional Economic Models, Inc
REV = Reforming the Energy Vision
RF = Radio Frequencies
RFI = Request for Information
RFS = Request for Solution
RFP = Request for Proposal
RGGI = Regional Greenhouse Gas Initiative
RI = Rhode Island
RMD = Residential Methane Detector
RTP = Real Time Pricing
RTU = Remote Terminal Unit
SaaS = Software as a Service
SCADA = Supervisory Control and Data Acquisition
SCE = Southern California Edison
SCT = Societal Cost Test
SECC = Smart Energy Consumer Collaborative
SMB = Small-Medium Business
SME = Subject Matter Expert
SMUD = Sacramento Municipal Utility District
SOx = Sulphur Oxide
STN = Shared Telecommunications Network

SWSN = State-Wide Shared Network
ToC = Table of Contents
TOU = Time of Use
TVR = Time-Varying Rate
TX = Transmission
VAR = Volt Ampere Reactive
VDER = Value of Distributed Energy Resources
VEE = Validation, Estimation, and Editing
VMT = Vehicle Miles Traveled
VPP = Variable Peak Pricing
VVO = Volt-VAR Optimization
WACC = Weighted Average Cost of Capital
WAN = Wide Area Network

Massachusetts Electric Company and
Nantucket Electric Company
d/b/a National Grid
D.P.U. 21-81
July 1, 2021
H.O. _____

Exhibit NG-AMI-3

AMI Customer Engagement Plan

Advanced Metering Infrastructure (AMI)
Customer Engagement Plan

July 1, 2021

Massachusetts Electric Company
Nantucket Electric Company
d/b/a National Grid

nationalgrid

Contents

1. Executive Summary

National Grid USA's vision is to be at the heart of a clean, fair, and affordable energy future. With filing of its Advanced Metering Infrastructure ("AMI") Implementation Plan Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid (together, the "Company" or "National Grid") seeks to take another significant step toward delivering on that vision for customers. The Company's proposed AMI deployment would mark the beginning of a new era for customer energy control and convenience. With this Customer Engagement Plan, the Company defines its strategy for educating customers about smart meter technology, empowering and enabling them to derive the greatest value from the new functionality, and preparing employees to guide customers through the transformational journey.

This plan outlines a general timeline for the AMI project, the installation of back-office systems, the deployment of AMI electric meters, as well as the path for continued customer engagement. While the timelines reflect the Company's initial approach to AMI deployment, the Company will actively seek opportunities to accelerate the delivery of smart meter benefits and functionalities to customers. Throughout AMI implementation, the Company will also continually refine the strategy and tactics set forth in this Customer Engagement Plan to reflect lessons learned and customer feedback.

Embarking on this journey requires a detailed strategy – the Company's approach focuses on three phases. First is customer awareness (Phase I). In this phase, the Company will inform customers about smart meters and begin the conversation about how AMI technology can improve the customer energy experience. Second is deployment (Phase II). As the Company begins to deploy the AMI electric meters, it will step up efforts to prepare customers for installation. This strategy involves a 90-60-30-day pre-deployment plan for communicating with customers and answering questions. Third is empowerment and enablement (Phase III). The next-generation capabilities of the AMI technology can open the door to myriad benefits for customers, such as enhanced access to energy usage data, high-usage alerts, personalized energy efficiency recommendations, remote service connections, and enhanced outage management. It also enables the Department of Public Utilities ("Department") to consider and approve future innovative pricing programs (*e.g.,* time-varying rates, or "TVR"). The third phase represents the Company's ongoing commitment to help customers realize the benefits of AMI.

Making it happen for customers also requires a concerted effort across the organization. The Company identified approximately 30 internal stakeholder groups that will need varying levels of training and education to deliver the AMI program. Groups include Customer Service Representatives, Account Maintenance and Operations, field operations, the control center, Customer Meter Services, and Meter Data Management, among others. The process begins by determining the change impact and training needs for each group. From there, the Company will design, develop, and implement training for the employee groups. After initial deployment, the Company will evaluate, monitor, and adjust training to ensure employees are able to continue delivering value for customers throughout the life of the smart meter program.

2. Introduction

The Company is pleased to provide this Customer Engagement Plan in support of the Company's Massachusetts AMI Implementation Plan.[1] The Company is focused on delivering a simplified and enhanced customer experience, making the benefits enabled by smart meters intuitive and the functionality easy to manage. The 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 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.

AMI is also a key component of the Company's overall grid modernization investments, which are necessary to meet evolving customer expectations and manage the distribution electric grid more granularly considering a range of customer distributed energy resource ("DER")[4] adoption levels. Smart meters enhance the grid modernization investments by providing increased 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 AMI, it is also important that the Company effectively communicate the impact of AMI on the larger grid modernization strategy.[5]

3. Vision for the Customer in the New Energy Landscape

3.1. Overview

Today's customers expect more from their utility – not only seeking affordable, reliable, and safe energy, but also increasingly looking for access to actionable information, greater choice and

[1] D.P.U. 20-69-A.
[2] AMI will capture and transmit energy usage data in 15-minute intervals every 30 to 45-minutes, as compared to one-month intervals with current Automated Meter Reading ("AMR") technology.
[3] The AMI Implementation Plan does not propose a specific TVR design; however, it does include assumptions upon which a proposal to develop TVR will be based. For additional details, please refer to the AMI Implementation Plan.
[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).
[5] For additional details on the GMP, please see the GMP filed contemporaneously with the AMI Implementation Plan.

control over their energy use, and delivery of energy services in a simple and convenient way. National Grid is committed to deliver on these expectations for a modern energy experience.

The Company recognizes the diverse needs and preferences across the many customers it serves. The Company takes great pride in the opportunity to meet customer needs across every segment of society and looks forward to enhancing its service through the "Listen, Test, Learn" methodology described further in Section 5 below.

By deploying smart meters, the Company can enable its customers to take greater control of their energy usage with insights into their energy consumption patterns. Likewise, the Company can offer more innovative energy management and pricing options (*e.g.*, time-of-use ("TOU") rates and critical peak pricing ("CPP")) and facilitate the integration of smarter devices, while enhancing the customer experience throughout all facets of the customer experience lifecycle set forth in Figure 3-1.

Figure 3-1: National Grid's Customer Experience Lifecycle

AMI will also help establish a cleaner, fairer, more resilient and efficient system, consistent with the clean energy and equity goals set forth in Senate Bill 9, *An Act Creating A Next Generation Roadmap for Massachusetts Climate Policy* (the "Climate Act"), as well as National Grid's own clean energy ambitions[6] and Responsible Business Charter.[7] In addition, the Company recognizes the role AMI can play in addressing the broad challenges facing customers and their communities; challenges such as economic insecurity, environmental justice, and the climate crisis.

These goals and challenges show that innovation is an imperative, not an option. AMI is one tool the Company can use to contribute to state and national efforts to tackle these issues. The investment will provide a platform to bring state-of-the-art solutions to all customers, including historically underserved populations, and can be leveraged for customer programs in the future.

The deployment of smart meters represents the biggest step change in a customer's electricity experience in many years and, as a result, the customer touchpoints described in the Customer Engagement Plan represent a series of high-value interactions. In order to maximize progress on the goals and challenges discussed above, the Company must leverage those touchpoints to create new levels of long-term engagement with as many customers as possible.

Bringing new concepts and applications to market in a way that engages customers requires an integrated, cross-functional approach within the Company. This engagement starts with empathy-based ethnographic research in order to understand the customer emotions and values that will drive action, as described further in Section 5.3. That research will then serve as a springboard, enabling the Company to deliver innovative program, product, and customer experience opportunities unlocked by AMI through a human-centered design thinking approach.[8]

With that focus, the Company considered a variety of analyses in building the approach set forth in this plan. For example, recent research from the United Way using 2018 data defines three household income categories:

- Poverty, defined as households that earn less than the Federal Poverty Line;
- **A**sset **L**imited, **I**ncome **C**onstrained, **E**mployed ("ALICE"), defined as households with income above the Federal Poverty Level but not high enough to afford a Household Survival Budget of essentials in the communities where they live (the ALICE threshold); and
- Households that earn more than the ALICE threshold.[9]

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[6] *See* National Grid's *Net Zero by 2050 Plan* at https://www.nationalgridus.com/media/pdfs/our-company/netzeroby2050plan.pdf (last visited June 25, 2021).
[7] *See* National Grid's *Responsible Business Charter* at https://www.nationalgridus.com/media/pdfs/our-company/usnationalgridresponsiblebusinesscharter2020us.pdf (last visited June 25, 2021).
[8] *See* https://mitsloan.mit.edu/ideas-made-to-matter/design-thinking-explained (last visited June 25, 2021).
[9] United for ALICE, *On Uneven Ground: ALICE and Financial Hardship in the U.S.*, December 2020 at https://www.unitedforalice.org/national-overview (last visited June 25, 2021)

The following figure provides a breakdown of the three categories for the Company's customers across the Commonwealth of Massachusetts:

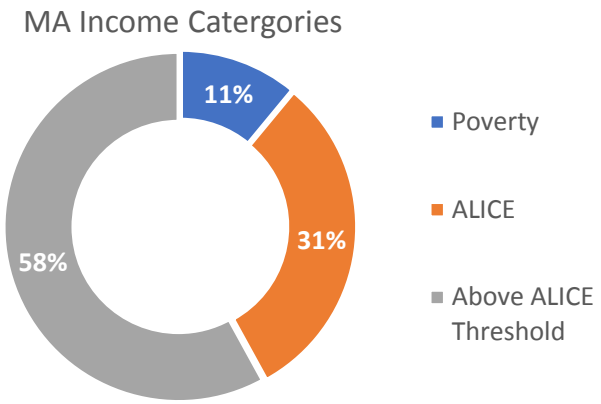


Figure 3-2: Percentage of Customers in Poverty, ALICE, and Above Alice Threshold Categories[10]

For many families, the COVID-19 pandemic has caused significant social and economic disruption. The Company understands the pandemic has impacted customers in different ways.[11] These disruptions worsen existing economic challenges, one of which for many people is home energy burden, defined as the percentage of household income spent on energy (*i.e.*, electricity and heating) bills.

As shown in Table 3-1 below, there are many factors (*e.g.,* physical, economic, behavioral, and policy) that drive energy burden and these factors are often compounding. For example, the same population that faces disproportionately high energy burden due to economic drivers is also disproportionately likely to experience physical drivers. This trend was quantified in a 2016 research report by the American Council for an Energy-Efficient Economy ("ACEEE"), which found that low-income households[12] in major U.S. metropolitan areas pay approximately 20% more per square foot than non-low-income households, with median annual utility costs per square foot of $1.41 versus $1.17, respectively.[13]

[10] Data available at: https://www.unitedforalice.org/national-overview. For more ALICE research details, see the Methodology Overview at: https://unitedforalice.org/Methodology
[11] The Company has made resources available to help customers impacted by the effects of the pandemic. *See* https://www.nationalgridus.com/MA-Home/COVID19/COVID19.aspx (last visited June 25, 2021).
[12] Households with income at or below 80% of area median income.
[13] ACEEE, *Lifting the High Energy Burden in America's Largest Cities*, 2016 at 4. https://www.aceee.org/research-report/u1602.

Table 3-1: ACEEE Drivers of Household Energy Burdens[14]

Drivers	Examples of factors that increase energy burden
Physical	Housing age and type (*e.g.*, manufactured homes)
	Heating system, fuel type, and fuel cost
	Poor insulation, leaky roofs, inefficient and/or poorly maintained HVAC systems, and/or inadequate air sealing
	Inefficient large-scale appliances (*e.g.*, refrigerators, dishwashers) and lighting sources
	Weather extremes that raise the need for heating and cooling
Economic	Chronic economic hardship due to persistent low income
	Sudden economic hardship (*e.g.*, severe illness, unemployment, or disaster event)
	Inability to afford (or difficulty affording) up-front costs of energy efficiency investments
	Difficulty qualifying for credit or financing options to make efficiency investments
Behavioral	Lack of access to information about bill assistance or energy efficiency program options
	Lack of knowledge about energy conservation measures and impacts/cost savings
	Increased energy use due to age, number of people in the household, or disability
Policy	Insufficient or inaccessible policies and programs for bill assistance, weatherization, and energy efficiency for low-income household
	Certain utility rate design practices, such as high customer fixed charges, that limit customers' ability to respond to high bills through energy efficiency or conservation

More holistically, the physical drivers affecting building characteristics that lower total building performance, significantly impact health, productivity, comfort, and overall wellbeing.[15] At its worst, energy inequality is a public health crisis – poor building envelopes, poor ventilation management, and aging fossil-fuel equipment can result in harmful indoor environmental quality, leading to increased occurrences of short- and long-term health conditions.[16]

Understanding these issues and the impact on customers is key to building out the Company's strategy for delivering AMI value across all customer segments. Moreover, such considerations have only grown in importance in the wake of the COVID-19 pandemic, when working from home and schooling from home became the "new normal" for many.

AMI is not a silver bullet; however, it represents a new data and technology platform for the Company to identify opportunities, such as enhancing building efficiency, that help customers improve their health, comfort, and productivity, while lowering energy burdens. Progress in

[14] ACEEE, *The High Cost of Energy in Rural America*, 2018, at 9. https://www.aceee.org/research-report/u1806 (last visited June 25, 2021).
[15] V. Hartkopf, V. Loftness, and P. Mill, *The Concept of Total Building Performance and Building Diagnostics*. Ed. G. Davis STP901-EB Building Performance: Function, Preservation, and Rehabilitation. West Conshohocken, PA: ASTM International, 1986. 5-22. Web. 26 Apr 2021. https://doi.org/10.1520/STP23009S (last visited June 25, 2021).
[16] U.S. Environmental Protection Agency, *Introduction to Indoor Air Quality at* https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality (last visited June 25, 2021).

these areas will be maximized by animating the market, working collaboratively with innovation leaders, and inviting customers to help build positive change in their communities. In addition to the benefits discussed above, helping customers use AMI data and analytics to identify retrofit opportunities and accelerate the deployment of today's portfolio of existing clean energy technologies will make the economy stronger and healthier.

For example, the 2020 ACEEE report recognizes that "[w]eatherization can reduce low-income household energy burdens by about 25%, making it an effective strategy to reduce high energy burdens for households with high energy use while also benefiting the environment."[17] The Company believes there is opportunity to use AMI data to generate new engagement with existing energy efficiency programs, like MassSave's Enhanced Residential Program.[18]

Leveraging AMI to better serve historically underserved populations is a key consideration in the development on this plan. A recent white paper from the Smart Energy Consumer Collaborative based on surveys of approximately one thousand low- and moderate-income energy consumers show strong customer appetite for many of the opportunities highlighted above.[19] Enabling the energy transition for all will require creative new solutions and helping customer's leverage the intelligence gained through AMI will help make it happen.

Likewise, for the commercial sector, especially small- and medium-business customers, the Company will be able to use AMI data analytics in the future to help customers find energy savings opportunities, reducing energy costs, and improving profitability. Regardless of whether the business is a pizza shop, hair salon, dry cleaner, hardware store, auto repair shop, bowling alley, farm, or nearly any other business, every dollar saved on energy bills goes straight to the bottom line.[20] As such, the benefits of energy efficiency and clean energy technologies that impact total building performance go beyond simply saving on energy bills. Improving employee health or productivity, customer comfort, process efficiency, real estate value, or rentability can deliver significant results to business performance. Moreover, long-term, granular energy use data can provide support for companies working to achieve environmental, social, and governance ("ESG") imperatives.

In short, deployment of AMI is a significant advancement in the Company's current metering environment, deepening the Company's relationship with customers, and enhancing its focus on equitably providing affordable, safe, and reliable energy service.

3.2. AMI Enables a Modern Energy Experience

Retail consumers today are enjoying new and higher levels of service and convenience thanks to the application of advanced technology and "big data" across industries. Understanding

[17] ACEEE, *How High Are Household Energy Burdens?*, 2020 at ii. https://www.aceee.org/energy-burden
[18] *See* https://www.masssave.com/en/saving/energy-assessments/enhanced-residential-program (last visited June 25, 2021).
[19] Smart Energy Consumer Collaborative, *Racial Disparities Among Lower-Income Energy Consumers*, 2021 at 8. https://smartenergycc.org/download/seccs-racial-disparities-among-lower-income-energy-consumers-white-paper/
[20] This has a similar economic outcome as increasing revenue by the inverse of the profit margin. For example: $50 monthly savings for a business with a 5% profit margin would produce a similar economic result as an additional $1,000 in monthly revenue ($50/0.05 = $1,000).

customers' diverse and evolving needs is key to developing a more modern energy experience that creates sustainable value. While reliability and affordability remain foundational for customers, the Company has found that it must also respond to an expanding range of customer expectations regarding visibility, control, choice, and convenience in their energy experience. According to an extensive study of customer expectations, including a survey of customers across National Grid's U.S. footprint, the modern energy experience, enabled by AMI, must address numerous customer needs, including:

- **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.[21]

- **Visibility:** Customers express a need for personalized insights and information on specific actions that can help reduce their energy usage.[22] They also expect this information to be easily accessible and available through numerous channels (*e.g.,* the Company's website, mailings, Customer Service Center). With greater visibility into energy usage and cost information, customers can better manage their energy consumption and achieve cost savings.[23] This is particularly valuable in a future environment where pricing plans evolve from a traditional flat rate to a TVR rate structure.

- **Control:** Customers want better control over how and when they use power in their homes, businesses, and facilities.[24] A majority of both residential and commercial customers express interest in tools and devices that can help them manage energy use, such as connected thermostats that can learn a customer's usage patterns and be controlled remotely.[25] The Company has already taken initial steps in this field through its existing multi-sector energy efficiency and Dynamic Load Management ("DLM") programs and it expects AMI to further address customer expectations using granular usage data to develop personalized energy efficiency and demand response offerings.

- **Choice:** Greater levels of choice, whether in energy management or adopting clean energy solutions, empower customers.[26] For customers, the modern energy experience also includes choosing what communications they receive, as well as when and how they receive them. While consumers express an interest in greater levels of choice, behavioral science research also suggests that overloading consumers with too many choices can

[21] National Grid, *Value Proposition Research: A Study of 3 Energy Solution Areas* (2017); *see also* the Company's New York affiliate's, Niagara Mohawk Power Corporation's, Clifton Park Demonstration and the Company's Smart Energy Solutions Pilot, where participants had the opportunity to respond to CPP events to achieve bill savings.
[22] Opower, *Five Universal Truths About Energy Consumers* (2013).
[23] National Grid, *Value Proposition Research: A Study of 3 Energy Solution Areas* (2017).
[24] *Id.*
[25] *Id.*
[26] *Id.*

result in decision inertia and less satisfaction with an eventual choice.[27] Default options help facilitate better customer decision making as opt-out settings drive higher participation levels,[28] such as with dynamic pricing plans like TVR.[29]

- **Convenience:** Building upon "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. However, the Company is also cognizant that not all customers prefer or have access to digital tools, and thus a multi-channel outreach strategy throughout smart meter deployment is critical.

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-and-forget" features. An industry study on "The New Energy Consumer" showed that 60% of those surveyed would be interested in technology that could completely automate the management of their electricity or gas use.[30] The type of complete automation sought by customers requires an enabling AMI foundation and a platform that can connect with smart devices.

3.3. Customer Experience Transformation

3.3.1. Overview

National Grid initiated a comprehensive Customer Experience Transformation initiative that aims to fundamentally change how the Company interacts, serves, and communicates with customers via a digital engagement strategy. The initiative is structured around delivering maximum customer value during "Moments that Matter," as illustrated in Figure 3-3 below.

Figure 3-3: Customer Experience Transformation: Customer "Moments that Matter"

[27] Sheena S. and Mark R. Lepper, *When Choice is Demotivating: Can One Desire Too Much of a Good Thing?* Journal of Personality and Social Psychology, 2000, Vol. 79, No. 6, at 995-1006; *see also* Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions About Health, Wealth, and Happiness* (2009).
[28] Richard H. Thaler, *Unless You Are Spock, Irrelevant Things Matter in Economic Behavior*, The New York Times (online), May 8, 2015; *see also* Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions About Health, Wealth, and Happiness* (2009).
[29] Opt-out default options significantly increase participation, as seen in the Smart Energy Solutions Pilot, where 95% of participating customers stayed on the default CPP rate plan and did not opt out. See Navigant, *National Grid Smart Energy Solutions Pilot Final Evaluation Report* (May 2017).
[30] Accenture, *The New Energy Consumer Architecting for the Future* (2014).

The Customer Experience Transformation is a key component of the Company's multi-channel AMI customer engagement strategy. Developing and expanding digital capabilities will better enable the Company to meet the needs of its diverse customer base during and after the deployment of smart meters. Indeed, with continued expansion of high-speed broadband internet, the increasing prevalence of smart mobile phones and tablets, as well as the new functionality enabled by smart meters, the Company expects an enhanced digital experience to be a growing priority for customers.

The multi-year Customer Transformation Experience initiative seeks to deliver "best-in-class" service by continuously enhancing the customer experience through new capabilities, technologies, and product management strategies. The initiative's key focus areas (those aimed at delivering maximum customer value across the Customer Experience Product portfolio) include:

- Web self-service;
- Interactive voice response ("IVR")/telecommunications;
- Preference management & communications;
- My Business Account (pilot program); and
- Distributed generation/new connections portals (electric and gas).

Furthermore, the deployment of smart meters offers opportunities for more sustainable and deeper customer engagement by enabling the Company to deliver a superior experience during the aforementioned "Moments that Matter." Such an AMI-enhanced customer experience will help deliver:

- Improved awareness of consumer needs and behaviors;
- A 360° view of the customer;
- Improved digital platforms and communications experience; and
- Personalized energy and billing solutions.

3.3.2. Customer Experience Products Work Streams

National Grid's Customer Experience Products ("CXP") work streams have embarked on a journey to make it easier for customers to do business with the Company by improving processes, delivering experience improvements, and creating consistency across all channels within an agile delivery framework.[31] The CXP core program objectives are:

- Implement technology upgrades through customer interaction channels to significantly increase ease of use and improve customer experience;
- Deliver an effortless experience for customers with choice and flexibility, reducing frustration, and creating value to build trust;

[31] Agile is a way of working that focuses on iteration, delivering large-scale projects or change in small, but more consumable increments.

- Adopt agile methodologies to enable teams to be deployed in a flexible way to maintain pace and accelerate customer benefits and value;
- Drive operational efficiencies through process improvements; and
- Mitigate operational risk associated with outdated technology platforms.

The CXP portfolio is currently focused on four work streams:

Web Self-Service:

- Delivering a unified web portal ("UWP") with a streamlined transaction experience, improved user experience, and new self-service capabilities (currently in development with a target release of Summer 2021);
- Single Sign-On ("SSO") across all regions and customer segments (including dual fuel) with enhanced Identity Access Management Platform ("IAM") enabling customers to manage all online accounts with a single log-in experience with improved security (foundational layer for UWP); and
- Continuous improvement of enhanced capabilities through delivered technology and agile framework.

Preference Management & Communications:

- Enabling channel of choice through digital preference center capabilities;
- Delivering enhancements and new offerings to proactive two-way communications for outages and billing; and
- Driving enhancements in email and digital communications channels and continuing to align with UWP.

My Business Account (Pilot Program):

- Online portal with enhanced digital account management and billing platform for large commercial and industrial ("C&I") customers;
- Improved experience to manage and transact across multiple business accounts/premises;
- Pilot program will continue through 2021 and be integrated with UWP, based on growth in customer utilization experienced so far.

Interactive Voice Response:

- Core contact center technology infrastructure and workforce management and quality tool set improvements; and
- Completed on-boarding with internal call centers and currently working on enhancements and third-party onboarding.

3.3.3. AMI-Enabled Enhancements

AMI will enhance the Company's capability to deliver on key focus areas by helping to achieve previously noted customer benefits. Toward that end, an important component of the Customer Engagement Plan is building on the current CXP by developing a Customer Energy Management Platform ("CEMP") to provide customers access to AMI data. The CEMP will serve as an integrated hub of energy data, insights, and actions available to all customers. The CEMP will allow customers to access 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 AMI meters. Some CEMP components, like monthly energy summaries with average usage in smaller increments or broken down by end-use, will likely also be layered into non-digital communications such as the customer bill or bill insert.[32]

The Company will coordinate the deployment of the CEMP to ensure that the initial release is fully operational and functional when new meters are installed. This includes 18 months of back-office work that will align with other pre-meter deployment efforts, process design, and communications planning. The CEMP-related back-office work will focus on detailed design and procurement of the main CEMP features, as well as testing, implementation, and deployment in advance of initial meter installations. Additional schedule details are provided in Section 4 below. The Company plans to expand and update the CEMP over time with future feature releases as necessary to meet evolving customer needs.

Overall, the delivery of enhancements across the CXP portfolio, in conjunction with AMI deployment, is a significant step change that can best empower and enable customer energy management. The CEMP (comprised of personalized insights, tools, and integrated customer actions) that results from these capabilities is described in more detail in Section 5.7.

4. Customer Engagement Timeline and Milestones

The Company plans to follow a four-and-one-half-year AMI deployment program as shown in Figure 4-1, below, while also seeking opportunities to accelerate the delivery of smart meters and their associated benefits/functionalities, when possible. The initial ramp-up phase will include project sanctioning, onboarding resources, and contract execution. The 18-month period following project kickoff will address detailed design, additional procurement activities, and the installation of the back-office systems. This period will also include key activities for further refinement of deployment planning.

[32] *See* Section 5.6: Phase III (Empowerment and Enablement) for more detail on how the Company plans to educate and empower customers to use and benefit from the CEMP.

Figure 4-1: National Grid AMI Program Implementation Schedule

The Company anticipates installing approximately 30% of the 1.4 million AMI meters in the first year of deployment, followed by 40% in the second year, and 30% in year three. As depicted in Figure 4-1, the Company plans a soft launch approximately three months in advance of the start of large-scale meter deployment. The soft launch will be used to test and refine deployment processes, with iteration and refinement expected to continue throughout the deployment period.

Customer Engagement Milestones

The timeline shown in Figure 4-2 provides an initial high-level breakdown of the Company's approach to the three customer engagement phases and the corresponding employee training.

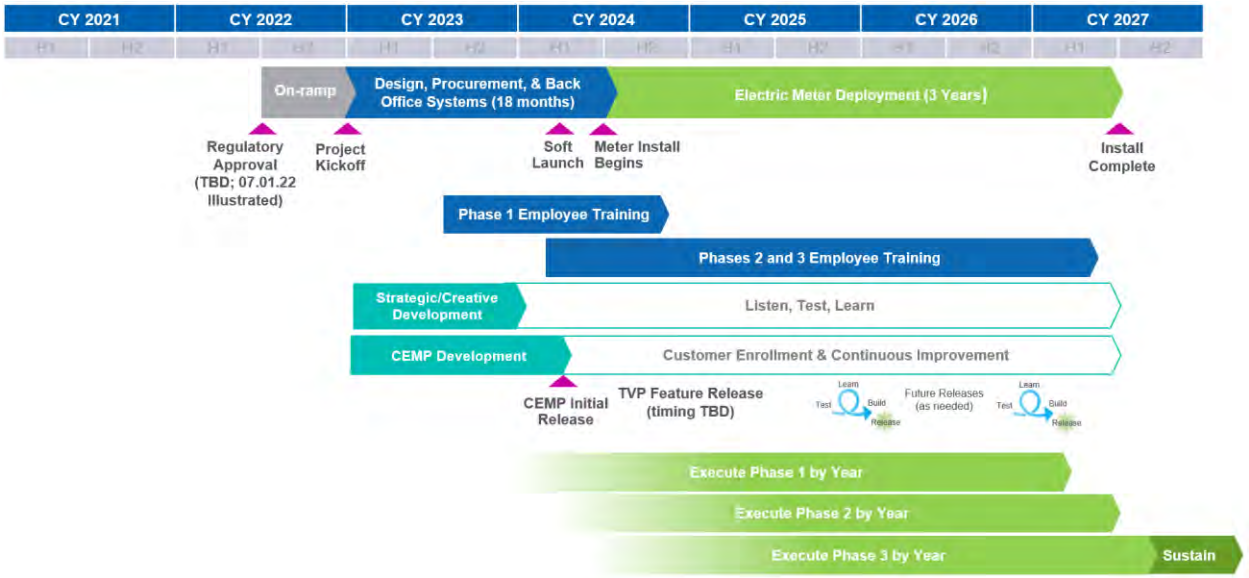


Figure 4-2: Illustrative Customer Engagement Plan Timeline

The Company intends to onboard an external marketing agency to support content development, assist with media buys, and facilitate execution of all three customer engagement phases. The detailed scope of work for the external marketing agency will be developed upon project kickoff. The procurement event is anticipated to require up to six months and the timing of the event will precede the meter soft launch.

Similarly, the Company is coordinating efforts to develop the CEMP. Recent years have seen an increase in market activity and there are currently a number of vendors with product offerings in this space. The Company plans to evaluate these offerings and leverage a third-party vendor to deliver the CEMP features in a cost-effective and timely manner, aligned with the CXP workstreams described in Section 3.3.

National Grid intends to de-risk the CEMP deployment by utilizing an agile delivery framework. This model is driven by customer and stakeholder value to deliver iterative and incremental feature updates. One goal is to create small and simple deliverables through proof-of-concepts to limit dependencies and help prioritize work. The Company anticipates having an initial CEMP minimum viable product ("MVP") available for appropriate testing in advance of meter deployment. The following section provides additional detail of the key activities highlighted above and provides an overview of the corresponding customer experience via customer journey maps.

5. Phases of the Customer Engagement Plan

The overall objective of the Customer Engagement Plan is to inform and educate the Company's customers and interested stakeholders on the benefits of smart meters, promote acceptance of the new technology, and facilitate the introduction of new AMI-enabled products and services (*e.g.,* personalized energy insights). The increased granularity of energy usage data and reduced data latency enabled by smart meters, coupled with products and services designed to take advantage of this information, will enhance customers' energy experience, providing greater convenience, choice, and control.

To achieve this, the Company will focus on the three phases of AMI customer engagement: (1) building awareness, transparency, and interest through education and outreach; (2) managing the customer experience through AMI meter deployment to foster customer participation; and (3) engaging customers to access new tools and options that will unlock the benefits of more actionable information and enhanced energy management, access to third-party services, enhanced customer alerts and personalization tools, and enablement of smart-home devices.

- **Phase I (Awareness):** The Company will build an internal foundation of resources to support communication and engagement activities, educate and train employees, and initiate a territory-wide customer and stakeholder outreach effort to build awareness of the smart metering program, generate interest and support, and proactively address customer concerns prior to meter installation.

- **Phase II (Deployment):** The Company will build on the broad education initiated in Phase I and narrow the focus of communication toward individual customers with information that will guide customers leading up to and through the day of smart meter installation, including the timeline of events, what to expect, and alternate choices available.

- **Phase III (Empowerment and Enablement):** After smart meters are installed, customers will be able to take full advantage of the CEMP functionalities and future TVR rate structures enabled by AMI meters. The sustaining nature of this phase will focus on empowering and enabling customers, including how to access energy consumption data and manage/optimize their energy usage to reduce energy and costs. This phase also includes animating the market for energy products and services by connecting customers (*e.g.,* via Green Button Connect My Data ("Green Button Connect")) to third-party vendors who can help supplement customer needs with new and innovative offerings.

5.1. Customer Outreach and Education

As illustrated in Figure 5-1, this phased approach 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 acceptance, and drive customer engagement. The materials will reach a diverse audience and be presented with customer-friendly messaging (*e.g.,* easily understandable text and images).

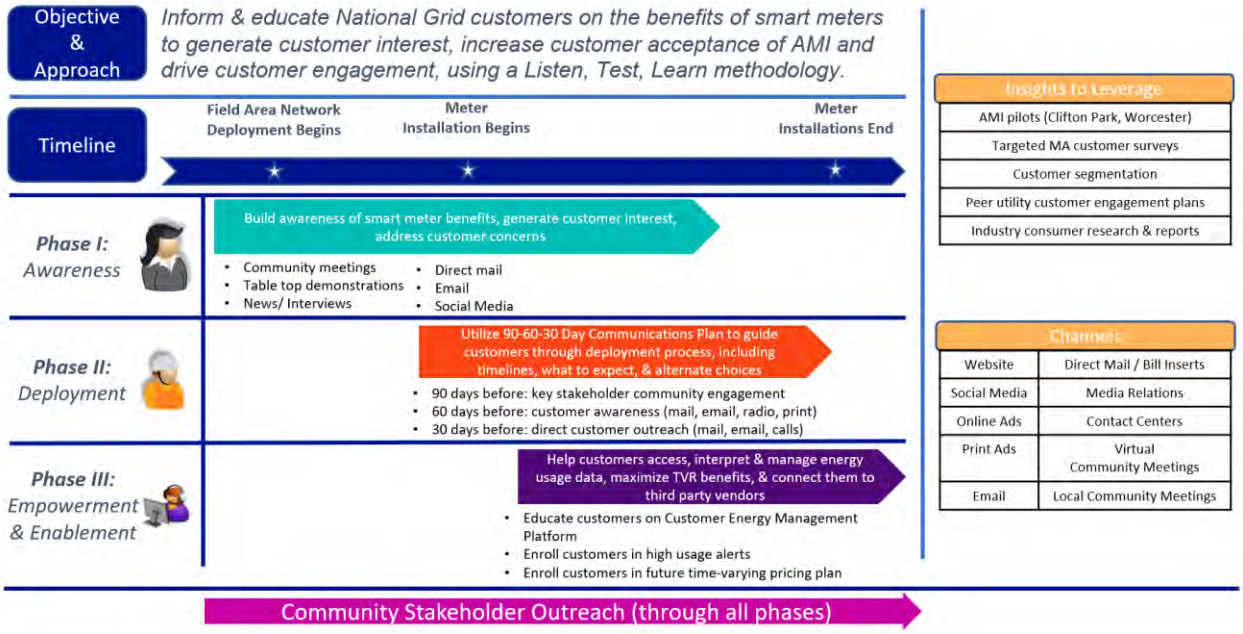


Figure 5-1: Customer Outreach and Education Timeline

Throughout each phase, the Company will apply a "Listen, Test, Learn" methodology that was useful during the Worcester Smart Energy Solutions Pilot to ensure the messages are being received by customers as expected. The "Listen, Test, Learn" methodology will be supported by ongoing customer surveys, allowing the Company to continue refining the messages and outreach strategies – messages that do not resonate will be adjusted.

5.2. Customer Choice and Opt-out

National Grid is committed to customer choice. During all phases of deployment, customers will be able to choose to opt out of a smart meter at any time. If a customer chooses to opt out, the Company will seek to understand the reason the customer is declining to participate in the program. This will allow the Company to focus additional resources toward other regions, sectors, or specific customer groups that may consider opting out. Customers choosing to opt out of a smart meter will initially 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 potential future TVR plans). Customers will also be made aware that meter reading fees will be incurred if they opt out of receiving an AMI meter. Customers will not be charged a meter change out fee if they choose to later have a smart meter installed. However, customers who initially receive an AMI meter and then opt-out of the program, will incur a one-time meter change out fee. Table 5-1 summarizes the goals of each phase and the communication channels the Company will use to convey key messages and options to customers on their ability to opt out.

Time	Before Deployment	During Deployment	After Deployment
Goal	**Education Outreach** • Inform customer of program benefits and information on privacy/security policy to minimize opt-out rates	**Mitigating Opt-out** • Mitigate opt-out decisions, facilitate calls, questions, and drive retention	**Encourage Opt-in** • If customer has opted-out in the past, provide information on program benefits, privacy/security policy and path to opt-in
Channels	• Direct mail, bill inserts, email • Website, FAQs • Community meetings, town halls, lunch-n-learns, advocacy groups • Social media • Paid media • Media relations • Customer Service support	• Direct mail, bill inserts, email • Website, FAQs • Deployment team/installers • Social media • Media relations • Customer Service support	• Website, FAQs, email • Customer Service support

Table 5-1: Opt-Out Communication by Phase

5.3. Surveys and Customer Research

National Grid is committed to understanding evolving customer preferences and is continuously collecting customer feedback and opinions on its ongoing operations, services, programs, and offerings. The Company also uses a variety of methodologies such as surveys, in-depth interviews, focus groups, both in-person and online, as well as customer forums, to receive customer feedback. The feedback from these ongoing efforts will enhance the Company's overarching approach to smart meter deployment, and aid in continually improving the customer experience. For example, the Company is planning future research/studies to gain additional insights in the following areas:

- Monitoring customers' awareness of smart meters and their overall sentiment throughout all three phases of customer engagement;
- Optimizing communications throughout the entire customer engagement journey to prioritize transparency with customers and to help mitigate meter opt outs;
- Identifying customer attitudes and perspectives toward TVR structures to assist with detailed design of future pricing plans and ensure maximum customer participation and benefits;
- Understanding unique needs of vulnerable communities; and
- Gauging customer interest in potential new service offerings to inform future design and implementation.

As the Company deploys smart meters across its service territory, it will continuously monitor the customer experience. The Company will develop valuable baselines prior to deployment, measure any changes post-deployment, help identify valuable trends, and, most importantly, continue tracking customer insights and feedback over time, especially as TVR plans are introduced. Furthermore, it allows the Company to generate insights about the customer experience throughout the AMI journey. The Company can then quickly translate such insights into program enhancements or revisions in the Company's overall outreach and education efforts. The progression of the insight gathering will generally follow the three AMI customer engagement phases, as follows:

- **Phase I (Awareness):** The first in the series of Customer Experience Surveys. Designed to get a baseline measure of awareness, interest, and attitudes towards the program. To be conducted up to 6 months prior to deployment of a given cohort at twice-annual intervals.
- **Phase II (Deployment):** Smart Meter Deployment Monitoring (one to two months following installation). Monitor customer awareness of, and satisfaction with, the deployment of smart meters through post-installation surveys. This initial measurement

following installation allows for ongoing review of recent deployment, a comparison to pre-deployment activity, and quick insights into the initial customer smart meter experience, which will inform the remainder of the Company's deployment across the service territory.

- **Phase III (Empowerment and Enablement):** Ongoing tracking of awareness, interest, satisfaction and attitudes towards the program. To be fielded at six-month intervals. Potential to add specific questions in "flex section" of questionnaire to address topics of relevance at a given time.

As smart meters are deployed across the service territory, customers will be grouped into cohorts based on the dates they are scheduled for deployment. Awareness, deployment, and enablement research will be conducted among each cohort to allow ongoing tracking of the customer experience. While the exact sizes of the cohorts will vary depending on the pace of deployment, they are expected to be large enough (*e.g.,* more than 100,000 customers per cohort) to allow a statistically valid readout without inducing survey fatigue. Results will be reviewed at the aggregate level, per cohort, by language, and by other vulnerable customer groups as needed.

In addition to the customer experience research described above, the Company will also conduct customer needs research, as well as communications testing.

- **Customer Needs Studies:** Low-income; senior/medical hardship; non-English speaking; other as needed. Methodology will be optimized for target customer group – focus groups, in-depth interviews, online or in-person. Insights used to optimize program deployment, communications and education. Seek to understand interest in programs, barriers to participation, opt-outs, and motivations for participation.

- **Communications Testing:** Qualitative or quantitative studies to be conducted to gauge customer sentiments towards planned communications. Methodology will be reflective of communications channel. Testing different messages to maximize the impact of collateral development and dissemination. Insights used to optimize messaging and customer acceptance. Refresh content to ensure messaging remains applicable to customer expectations and needs.

In short, the Company 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. Figure 5-2 explains a proposed research timeline across the deployment period. It provides an illustrative timeline for measuring and monitoring insights and can be adjusted as insight needs evolve.

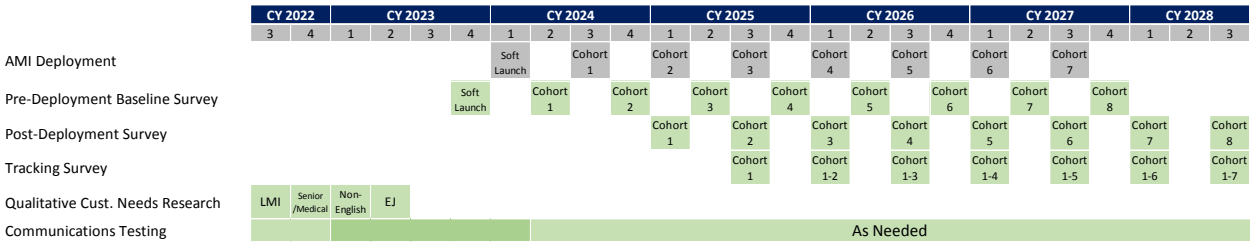


Figure 5-2: AMI Journey Customer Research

5.4. Customer Journey Approach

As the Company progresses through the managed ramp up process to project kickoff, it has developed a customer journey approach to guide the development of customer engagement materials closer to the time of meter deployment. The customer journey approach is the process of creating a customer journey map, which is a visual story of customers' interactions with the Company during AMI deployment. Customer journey mapping is important to the development of customer education and awareness materials along with employee training, because it is a strategic approach to better understanding customer expectations. In this way, the journey mapping is critical to optimizing the customer experience. Throughout this section, the Company will provide illustrative customer journey maps for the following customer groups:

- Residential;
- Income-Eligible;
- Seniors
- Indoor Meters
- Life Support;
- Small & Medium Business; and
- Commercial & Industrial.

5.4.1. Residential and Income-Eligible Customers

The residential (*see* Figure 5-3) and income-eligible (*see* Figure 5-4) customer journeys begin with the project and continue through meter installation. The residential and income-eligible customer journeys will be similar with income-eligible customers having access to customer advocates who can assist with any questions throughout deployment, while also advising about

additional programs for income-eligible customers.

Meet Isabel, Age 61, Medford, MA
Residential Customer

Demographics	Behaviors and Actions	Pain Points

• Homeowner
• Married
• One child in 20s living at home while attending community college
• Education: College Graduate
• Employment: Realtor, full time
• Current Income: $75K
	• Highly organized
	• Does plenty of research on a product/service before I buy it
	• Weighs trade-offs between environmental friendliness and price when buying products and services
	• Very open to adopting more smart technology to simplify life and be as efficient as possible with time and energy
	• Digital phone is main communication and organizational tool for: Social contact (mainly texting, calling and Instagram; some email) Time management (calendar, alerts/notifications/alarms)
	• Regularly uses laptop/desktop/tablet when larger screen is needed:
	  • Reading (news and books)
	  • Shopping (increasingly going online as first resort to buy everything)
	  • YouTube viewing (increasingly useful resource for instructional videos, travel videos, music, entertainment)
		• Always on the lookout for ways to make her home more energy efficient, for both environmental and financial reasons
		• Believes that climate change is one of the most important issues our world is facing, though she is unconvinced of the reasons or best way forward
		• There are a lot of unknowns (with National Grid), and the nature of our products she finds to be non-trustworthy, because of the physical stuff in her neighborhood, e.g., when her street was dug up for field work

Stages	Phase I (Field Communication network Installation)			90 Days to install			60 Days to install		
Timeline	18 Months Before Deployment	9 Months	7 Months	90 Days		61 Days	60 Days		31 Days
Steps	Isabel has seen news/media coverage about Smart Grid Plans.	She is seeing crews working all over the neighborhood.	It's been a few weeks, the crews are gone.	She is seeing/hearing news/info about Smart Grid coming to my community.	Received info about Smart Meters, Benefits, FAQs, Roll Out. She is looking for more information.	National Grid is speaking at her Community Board meeting tonight. She has been seeing posts on her Social Media feeds about Smart Grid/ Smart Meters.	Received information with more details advising me of the timeline & meter	She is looking for more information.	She has been seeing posts on her Social Media feeds about Smart Grid/
Communication Channels									

COMMUNICATION CHANNEL KEY

AGENT · EMAIL · WEBSITE · MAIL · DOORBELL · VIDEO · CONSUMER ADVOCATE · TOWN MEETING · NEWS · CALL · PAID SOCIAL

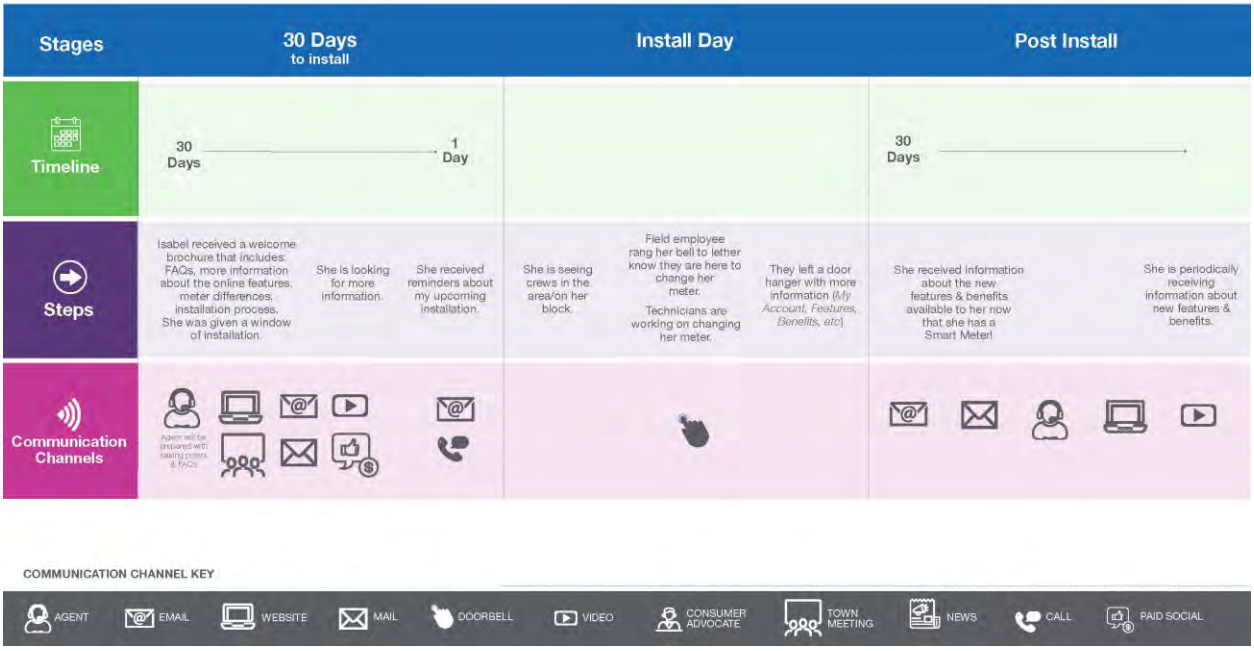
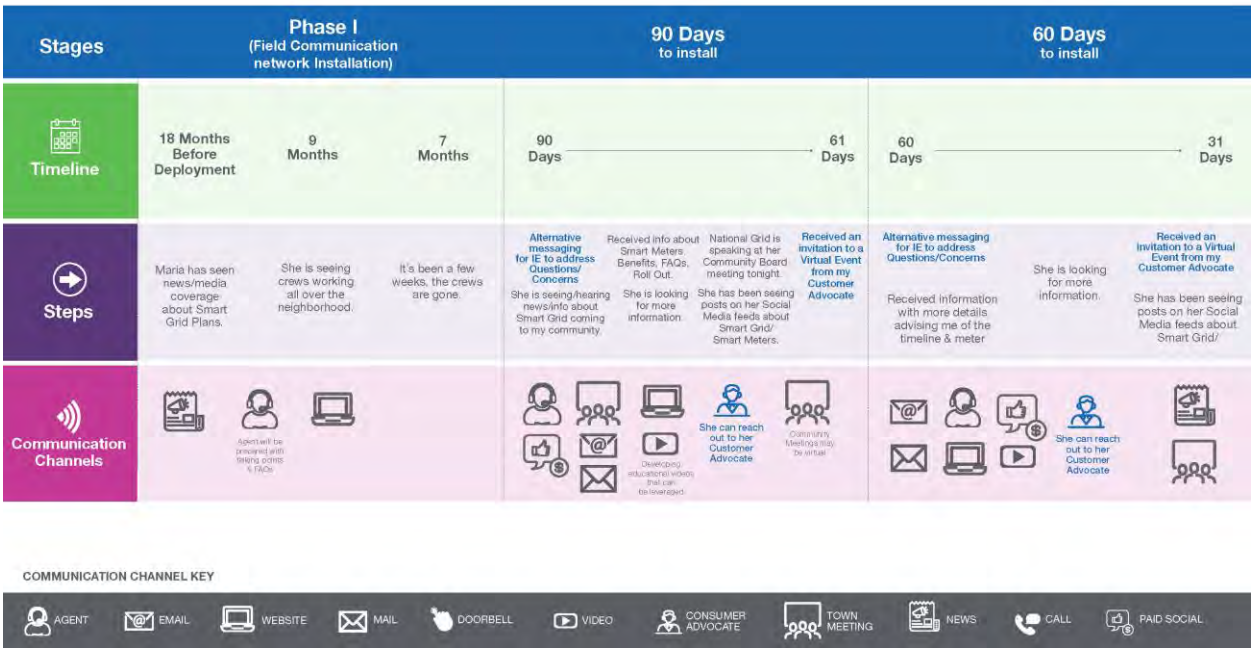


Figure 5-3: Residential Customer Journey

Meet Maria, Age 37, Lynn, MA
Residential Customer

Demographics	Behaviors and Actions	Needs and Pain Points
• Renter • Mother of 2 under 12 • Shares apartment with them and significant other • Employment: Fulltime bookkeeper • Current Income: $45K	• Closely tracks all spending in detailed spreadsheet; uses promotions and multiple shopping apps to "reduce my final costs" on everything from everyday necessities to discretionary purchases (cash back, rebates, discounts/sales) • Uses mobile phone to communicate, connect, track, manage all parts of life • #1 Apps for bill pay, information, shopping #2 Live phone customer service for when digital channels are fruitless – not preferred, but critical as backup #3 Paper bills for record keeping • Obsessive about not wasting even small amounts of electricity and the money it represents	• Finding discounts, sales, rebates and other promotions to reduce any and all day-today expenses • Low prices and good, reliable deals on things she needs • Offer to send her (more) information to be more efficient, save on her bill



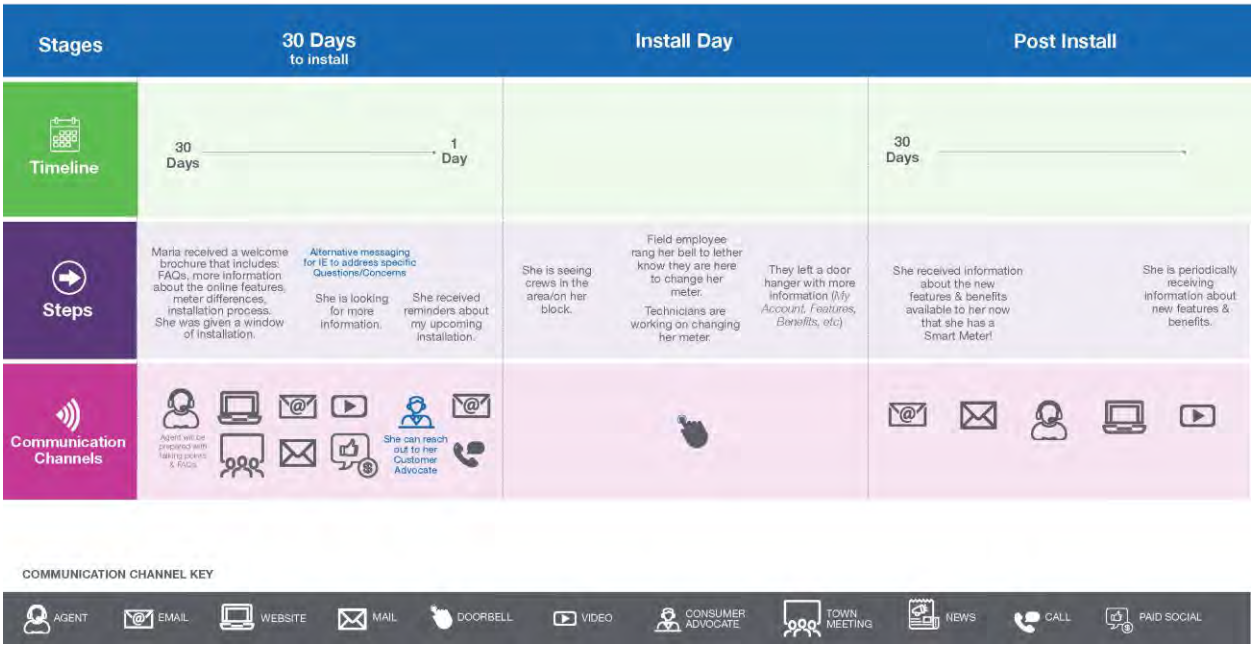
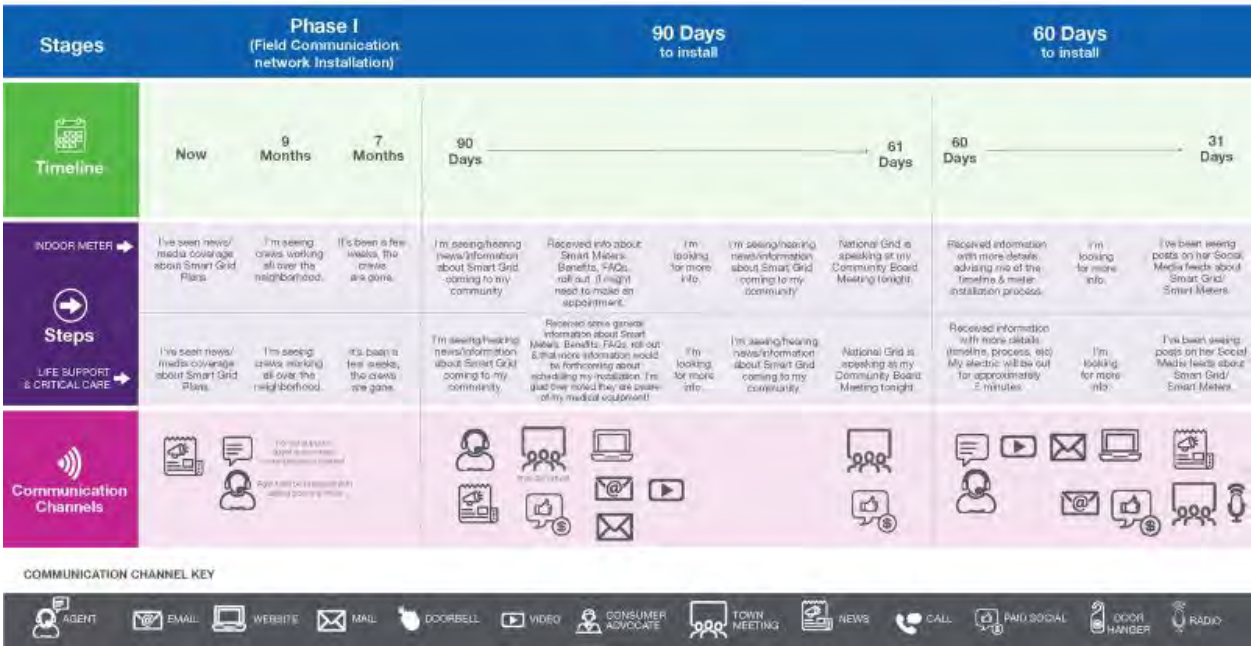


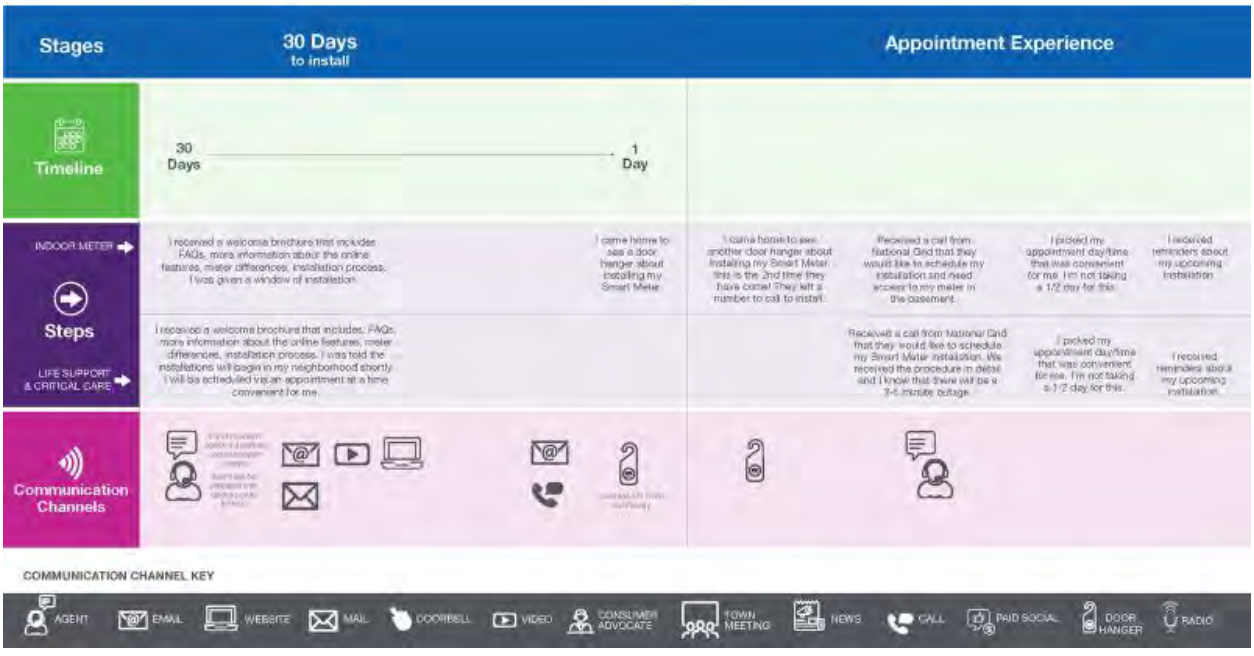
Figure 5-4: Income-Eligible Residential Customer Journey

5.4.2. Indoor Meter and Life Support Customers

For indoor or inaccessible meters (*i.e.*, a meter in a basement), customers will need to grant the Company access into their home to change the meter. The Company will make at least two in-person attempts to connect with the customer. On the second attempt, the Company will leave a doorhanger explaining why access is needed and how to contact the deployment team to schedule an appointment at their convenience to install the new AMI meter.

For customers identified in the Company's systems (or with on-premise markings) 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-approved meter change appointment. The Company will provide dedicated communications (including doorhangers) for life support/critical care customers with information about scheduling an appointment to have their AMI meter installed, and multiple attempts will be made to reach the customer to schedule the meter change. Such customers will not be included with the general deployment population until they make (and the Company confirms) an appointment. Please see Figure 5-5 below for the indoor meter and life support/critical care customer journey map.


Stages
Phase I
(Field Communication network Installation)
90 Days
to install
60 Days
to install
Timeline
Now
9 Months
7 Months
90 Days
61 Days
60 Days
31 Days
INDOOR METER
Steps
LIFE SUPPORT & CRITICAL CARE
Communication Channels
COMMUNICATION CHANNEL KEY
AGENT
EMAIL
WEBSITE
MAIL
DOORBELL
VIDEO
CONSUMER ADVOCATE
TOWN MEETING
NEWS
CALL
PAID SOCIAL
DOOR HANGER
RADIO


Stages
30 Days
to install
Appointment Experience
Timeline
30 Days
1 Day
INDOOR METER
Steps
LIFE SUPPORT & CRITICAL CARE
Communication Channels
COMMUNICATION CHANNEL KEY
AGENT
EMAIL
WEBSITE
MAIL
DOORBELL
VIDEO
CONSUMER ADVOCATE
TOWN MEETING
NEWS
CALL
PAID SOCIAL
DOOR HANGER
RADIO

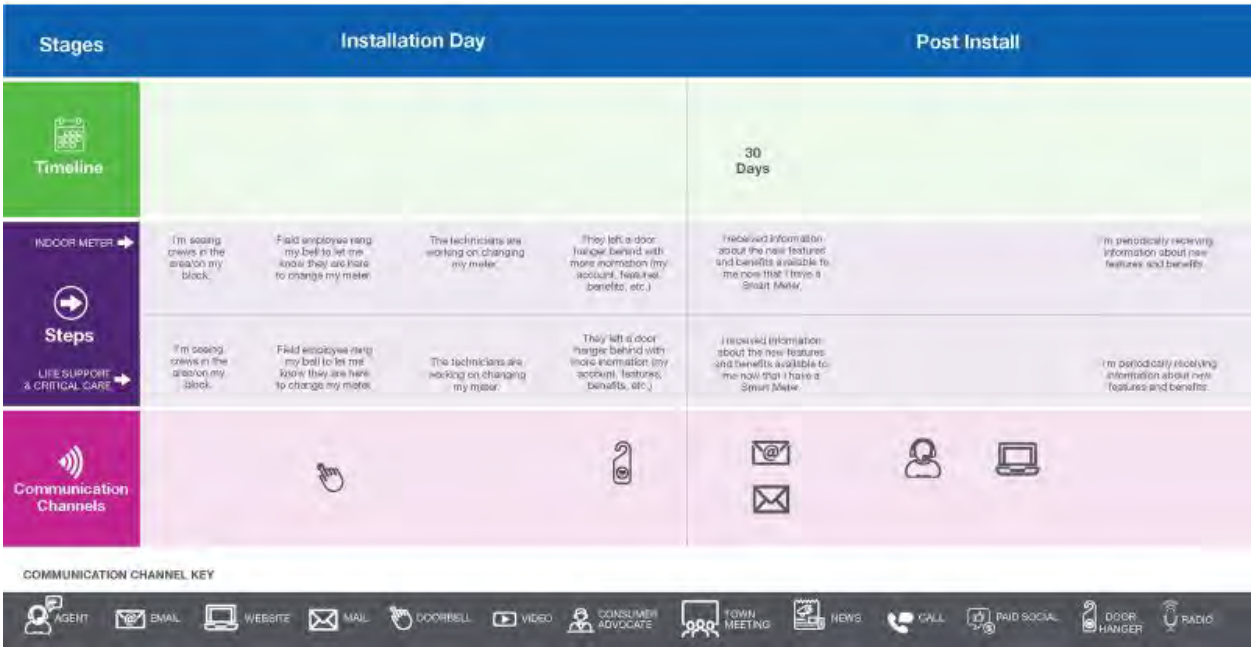


Figure 5-5: Indoor Meter and Life Support/Critical Care Customer Journey

5.4.3. Seniors

The Company recognizes that older customers may have different needs and communication preferences than other customers. As such, the Company will develop a non-digital delivery format as part of its multi-channel communication strategy. In addition, the Company will partner with local social councils through town hall meetings to build smart meter awareness among senior customers, and help them to understand the deployment process and benefits of the new technology. Please see Figure 5-6 below for the customer journey map for seniors.

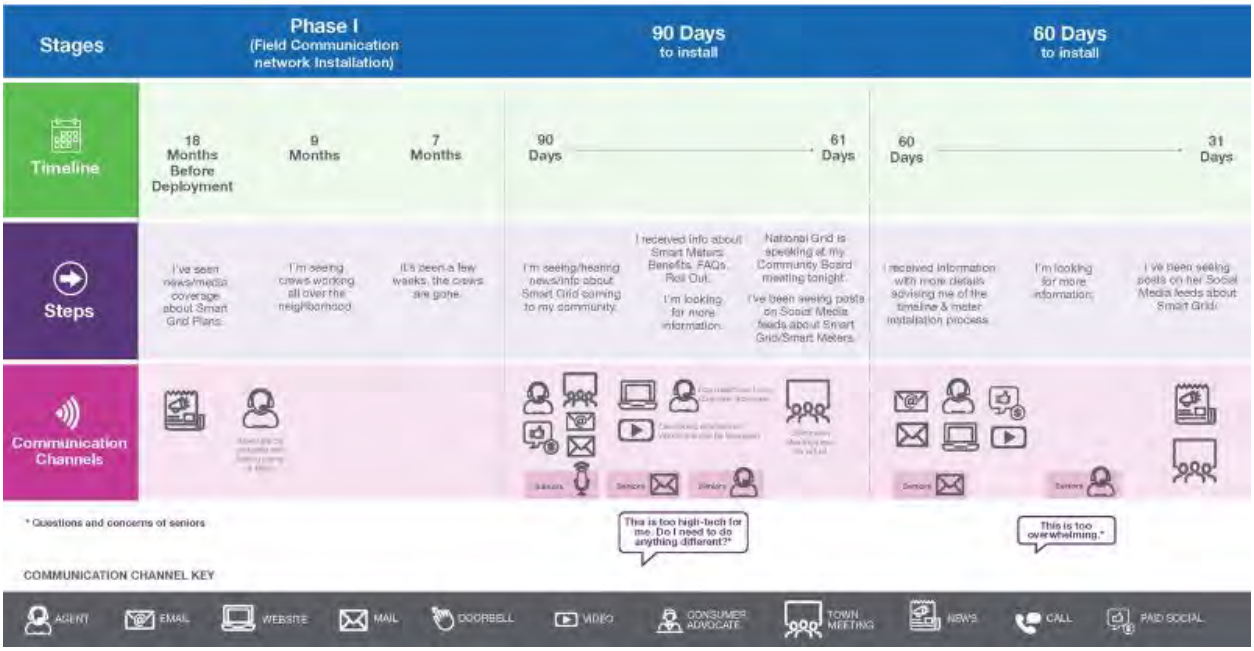


Figure 5-6: Customer Journey for Seniors

5.4.4. Small & Medium Business & C&I Customers

The Small & Medium Business and C&I Customer journeys will begin with the project and continue through meter installation. Please see Figures 5-7, 5-8, and 5-9 below for the Small & Medium Business and C&I Customer journey map.

Meet Rob, Age 54, MA
Small Business Customer

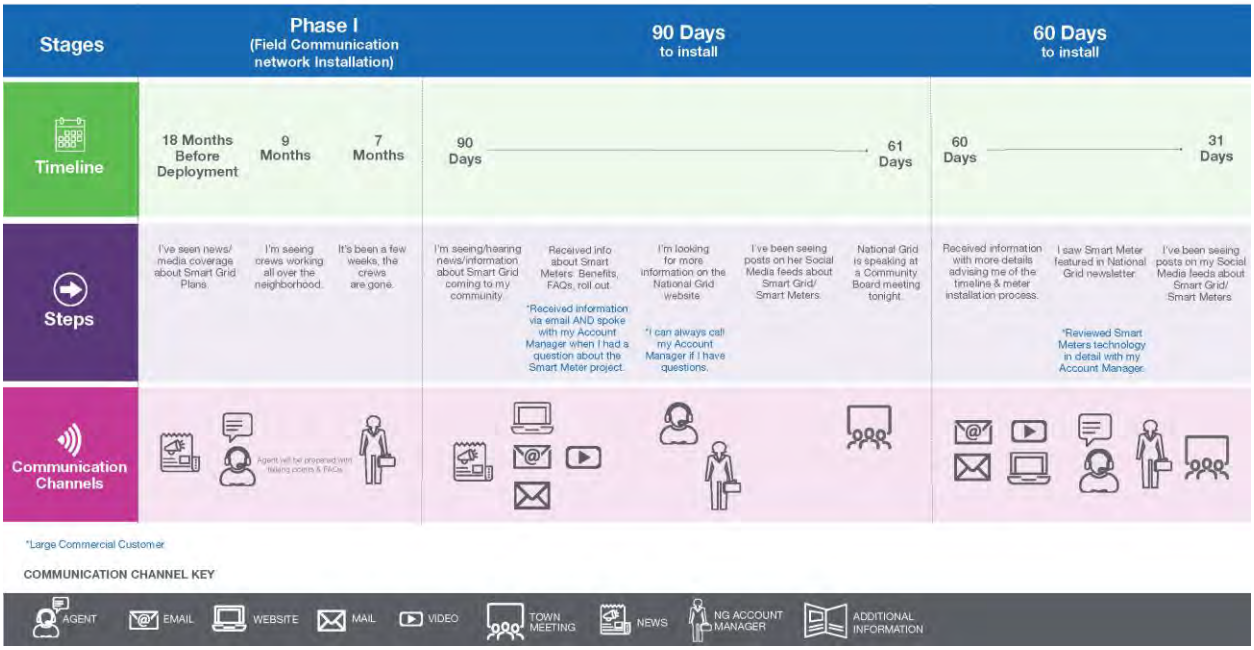
Demographics	Behaviors and Actions	Needs and Pain Points
• Age 54 • Employment: Owner/Partner in 3-location barbeque restaurant • About 90 employees seasonally • $3-10K monthly energy spend	• My business is local, and word-of-mouth makes or breaks us. • I am very connected and involved in my community as an individual and business owner. • Brand interaction channels: #1. Email typically used for initital contact #2. Live phone conversation for follow-up and problem resolution #3. Online accounts for some brands visited once in a while just to check on something	• I value vendors who are highly responsive and willing to go the extra mile for us. • Keep me posted via monthly newsletter with program and contact information.

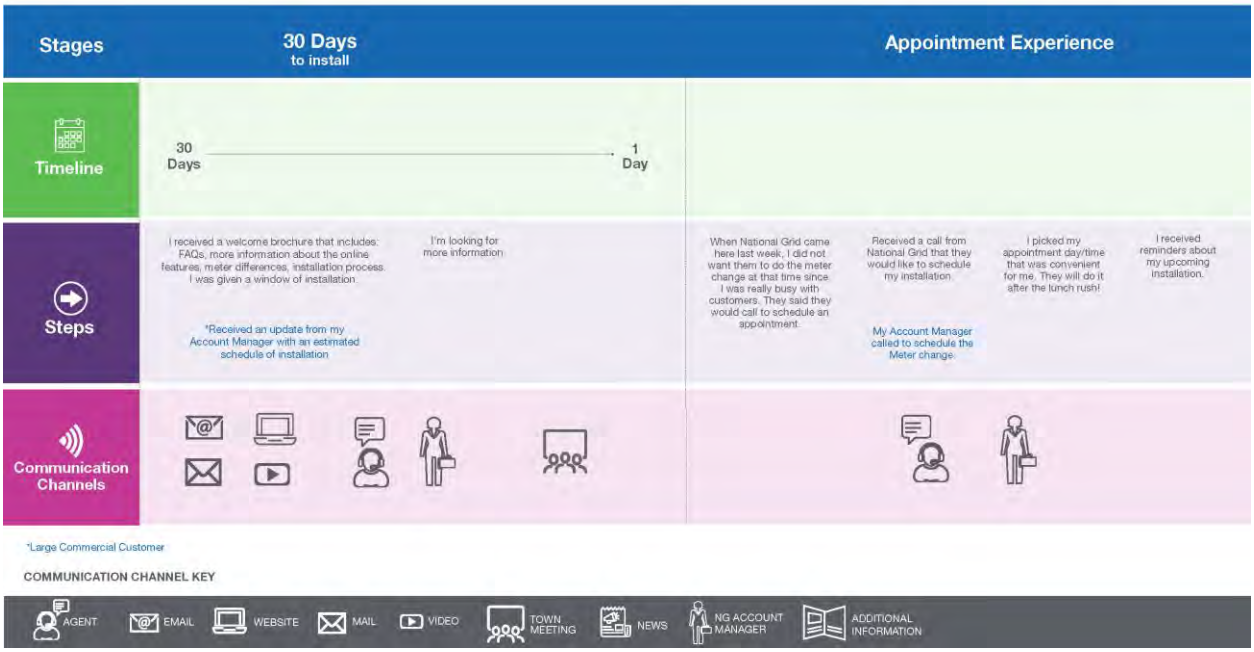
Figure 5-7: Illustrative Small Business Customer Persona

Meet Paul, Age 47, MA
Large Commercial Customer

Demographics	Behaviors and Actions	Needs and Pain Points
• Age 47 • Employment: Commercial and residential property management owner • Nine employees • $3K monthly energy spend	• "Because we answer to both owners and tenants, my job can sometimes feel like a delicate balancing act between competing priorities." • Mobile: heavy use for texting and voice calls with tenants and vendors, checking email and work voicemail when out of the office. Limited use of apps except GPS. • Other: Heavy use of desktop in office for emailing and managing aspects. • Brand interaction channels: #1. Email for routine communications #2. Live phone conversation or text when time sensitive #3. Vendor websites for account management, bill pay	• I need to balance demands between owner's budget expectations and tenant needs. • I need vendors who are very reliable and thorough, but also very well priced in their products and services. • Promote your programs in clear and simple terms.

Figure 5-8: Illustrative Large Commercial Customer Persona


Stages
Phase I
(Field Communication network Installation)
90 Days
to install
60 Days
to install
Timeline
18 Months Before Deployment
9 Months
7 Months
90 Days
61 Days
60 Days
31 Days
Steps
I've seen news/ media coverage about Smart Grid Plans.
I'm seeing crews working all over the neighborhood.
It's been a few weeks, the crews are gone.
I'm seeing/hearing news/information about Smart Grid coming to my community.
Received info about Smart Meters: Benefits, FAQs, roll out.
*Received information via email AND spoke with my Account Manager when I had a question about the Smart Meter project.
I'm looking for more information on the National Grid website.
*I can always call my Account Manager if I have questions.
I've been seeing posts on her Social Media feeds about Smart Grid/ Smart Meters.
National Grid is speaking at a Community Board meeting tonight.
Received information with more details advising me of the timeline & meter installation process.
I saw Smart Meter featured in National Grid newsletter.
*Reviewed Smart Meters technology in detail with my Account Manager.
I've been seeing posts on my Social Media feeds about Smart Grid/ Smart Meters.
Communication Channels
Agent will be prepared with talking points & FAQs
*Large Commercial Customer
COMMUNICATION CHANNEL KEY
AGENT
EMAIL
WEBSITE
MAIL
VIDEO
TOWN MEETING
NEWS
NG ACCOUNT MANAGER
ADDITIONAL INFORMATION


Stages
30 Days
to install
Appointment Experience
Timeline
30 Days
1 Day
Steps
I received a welcome brochure that includes: FAQs, more information about the online features, meter differences, installation process. I was given a window of installation.
*Received an update from my Account Manager with an estimated schedule of installation
I'm looking for more information.
When National Grid came here last week, I did not want them to do the meter change at that time since I was really busy with customers. They said they would call to schedule an appointment.
Received a call from National Grid that they would like to schedule my installation.
My Account Manager called to schedule the Meter change.
I picked my appointment day/time that was convenient for me. They will do it after the lunch rush!
I received reminders about my upcoming installation.
Communication Channels
*Large Commercial Customer
COMMUNICATION CHANNEL KEY
AGENT
EMAIL
WEBSITE
MAIL
VIDEO
TOWN MEETING
NEWS
NG ACCOUNT MANAGER
ADDITIONAL INFORMATION

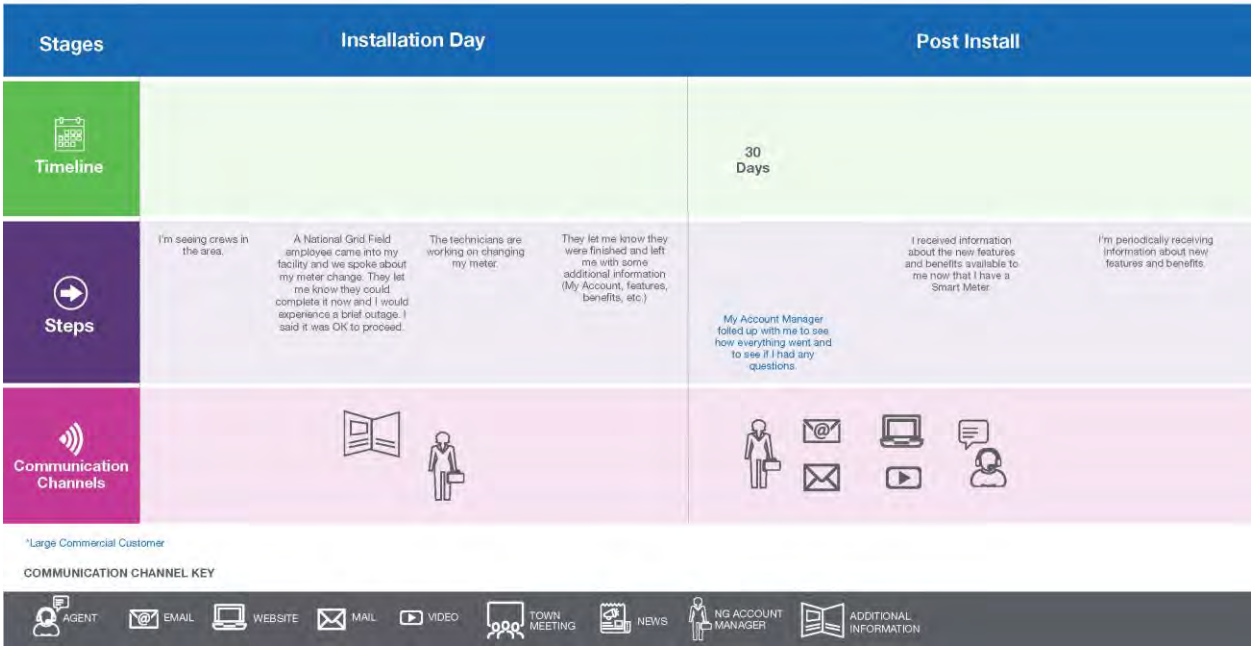


Figure 5-9: Commercial Customer Journey Map

5.5. Phase I (Awareness)

5.5.1. Objectives

The Phase I objectives are to:

- Develop customer and stakeholder trust through continuous communication and transparency;
- Build customer-facing assets and collateral for outreach and education efforts;
- Educate and train National Grid employees on AMI deployment, including customer service representatives, customer and community managers, account managers, and corporate communications;
- Engage stakeholders including community leaders who will interact with customers throughout the deployment process;
- Initiate general mass-market outreach efforts to build smart metering awareness and commence education; and
- Explain the benefits of smart meter installation and the enabling tools and options that will be available upon deployment.

5.5.2. Approach

During Phase I, the Company will use a two-pronged approach to educate and engage customers by building a strong foundation internally and initiating proactive and transparent outreach efforts. As National Grid learned from the experience of its affiliate's Clifton Park

Demonstration in New York and the Smart Energy Solutions Pilot in Worcester, 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 help build awareness of AMI, generate interest and support, and mitigate any potential barriers to adoption.

5.5.3. Development of Customer-Facing Assets and Collateral

To ensure an efficient smart meter transition, the Company will utilize outreach that has been previously successful to support the multi-phase, multi-channel outreach and engagement approach.

A summary of select Company outreach activities includes:

- Develop relevant and motivating messages tailored to customer segments and channels based on insights from customer surveys, best practices from the Company's smart meter pilots, and findings from other utility smart meter deployments (*see* Figure 5-11 for an example of how the Clifton Park Demonstration translated demographic insights into tailored messaging).

- Finalize residential outreach efforts and channel strategies, including billboards, radio ads, online ads, print ads, social media, the Company's website, community official/stakeholder meetings and forums. The Company will develop a variety of educational materials to reach customers including both residential and C&I customers through traditional and online channels. This approach has been tested during pilot programs and has proven successful. Outreach will be targeted by customer group and will use appropriate channels to include direct mail letters, videos to educate customers and help them better manage energy use, creating a "Getting Started Guide" to provide step-by-step instructions and visuals for customers, testimonials, engaging via social media (*e.g.*, Facebook, Twitter, YouTube), and creating case studies to make the process more relatable for customers. All educational materials will be available in top three languages based on customer demographics. Throughout Phase I, the Company will regularly solicit feedback on material and channels to provide improvements and refinements. Education materials will include:

    - FAQs for stakeholders, community leaders, customer service representatives, residential customers, small and medium businesses, commercial customers, income-eligible customers, and seniors;
    - Welcome brochures;
    - Step-by-step guides including how to opt-out, CEMP, and creating account information;
    - Opt-out communications;
    - Fact sheets;
    - Digital assets: web banner and social media;
    - Emails/direct mailers based by customer type/segmentation;

- Introduction letters; and
- Call center training manuals and scripts.

- The Company's website will have a dedicated section on smart meters to serve as a resource for information. The website will contain fact sheets and FAQs, and will be regularly updated to ensure timely and accurate information including up-to-date information for customers prior to and during meter deployment. Other important topics that this resource will address include information on smart meter security and privacy, data access policies and functionalities, and general information about smart meter benefits.

- The Company will create a sustainability hub, reflecting the success of the Sustainability Hub[33] developed as part of the Worcester Smart Energy Solutions Pilot, to bring information to hard-to-reach customers in a fun and inviting manner. The sustainability hub will provide personal contact between customers and the Company, educating customers about smart meters, and providing a hands-on experience of the benefits unlocked by the new technology.

5.5.4. External Outreach to Stakeholders and Customers

External outreach to key stakeholders will continue through all three AMI customer engagement phases. This will ensure everyone is aware of the AMI plan, the benefits to all stakeholders, what to expect throughout the smart metering program, and the timelines associated with receiving meters that enable a new level of customer energy usage insights and action.

Based on the experience of peer utilities with AMI deployments, the Company will prioritize engagement with community leaders and specific customer groups (*e.g.,* income-eligible consumer advocacy organizations), prior to initiating broader customer outreach. Table 5-2 includes an overview of the stakeholder messages, channels and materials, which will include face-to-face meetings, phone discussions, and written communications. This prioritized engagement will continue throughout all three phases.

Messaging	Channels	Materials
• Intro to Smart Meters • Customer Benefits • Deployment Process	• Invitation • Email •Customer and Community Managers/Account Managers • Fliers/Leave Behinds	• Education Campaign • "Hands On" Experience • Instructional Videos • FAQs • Fact Sheet

[33] The Company's Worcester Sustainability Hub served as a permanent physical place where customers, the community, and interested stakeholders could learn about the Worcester Smart Energy Solutions Pilot and how a smarter grid can deliver greater choice, control, and convenience.

Table 5-2: Stakeholder Campaign

Following key stakeholder education on smart meters, the Company will initiate a residential media campaign to begin proactive outreach, marketing, and education and continue to leverage existing Customer and Community Managers/Account Managers' relationships with C&I customers for more direct education and engagement (*See* Table 5-3). In major area hubs, the Company will schedule additional community events to help match the mass media efforts, with targeted outreach to more rural communities as needed. Mass media efforts may include billboards, radio ads, online and print ads, social media, and the Company's website.

Messaging	Channels	Materials
• Intro to Smart Meters • Customer Benefits	• Website • Out of Home Ads • Social Media • Online/Print Ads • Customer and Community Managers/Account Managers	• Education Campaign • Instructional Videos

Table 5-3: Customer AMI Awareness Campaign

5.5.5. Addressing Customer Concerns

The Company plans to leverage existing customer-facing materials and communications from pilot experiences to develop new materials to address customer concerns related to privacy, security, data sharing, and the perceived health impacts of smart meters. The Company has developed a broad repository of various customer concerns raised in both pilots, which will help ensure distribution of information across different customer touchpoints, including FAQs, customer service scripts, media materials, website posts, and town hall materials.

5.5.6. Customer Opt-Out in Phase I

The goals for managing opt-out will vary based on the engagement phase. In Phase I, the aim will be to inform customers of program benefits, provide privacy information, minimize meter opt-out fees using direct mail, email, the Company's website, community meetings, advocacy groups, social media, paid media, and customer service support.

Customers will be able to choose to opt out of a smart meter at any time. The opt-out process can occur 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 and provide additional information, as appropriate. The Customer Service Center will communicate to the customer that a monthly meter reading fee will be assessed if an AMI meter is not installed, and the representative will send the customer the appropriate forms to confirm that they do not wish to participate in receiving an AMI meter, thereby forgoing future benefits that are unlocked by the installation of a smart meter. If the request to opt out of an AMI meter is made after the AMI meter is installed, the customer will be informed that a one-time meter exchange fee as well as a monthly meter reading fee will be assessed for the removal of the AMI meter and installation/reading of the non-AMI meter.

5.6. Phase II (Deployment)

5.6.1. Objective

The Phase II objectives are:

- Expand outreach and education efforts on AMI meters and benefits across multiple customer touchpoints;
- Inform customers of the AMI deployment plan and transparently communicate how they will be impacted;
- Ensure that customers understand the installation process and available choices (*e.g.*, opt out) as well as address any concerns (*e.g.*, safety or privacy);
- Provide customers with timely notifications of installation; and
- Preview tools and options that will be available to customers following smart meter deployment.

5.6.2. Approach: 90-60-30-Day Communications Plan

The Company will leverage the numerous residential communication and education strategies utilized during Phase I as a foundation for focusing the message throughout Phase II. Targeted customer communications 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 90-60-30-Day Communications Plan is summarized in Table 5-4 below.

90 days before deployment	60 days before deployment	30 days before deployment
Stakeholder/Community Engagement	Customer Awareness	Direct Customer Outreach
• Enable AMI/smart meter web presence • Jurisdictions/Account managers continue meeting with community leaders and local stakeholders • Fact sheets, outlining key messages distributed to call centers and other customer-facing employees • Small business customer engagement • Community meetings • Targeted income-eligible, seniors, non-English speaking, and medical hardship customer outreach • Residential outreach such as billboards, out-of-home advertising	• Customer mailings (*e.g.*, Introductory Welcome Letter) • Proactively contact local media and provide information along with town meetings • Radio, print, email, and online banner ads • External affairs continues meeting with community leaders and local stakeholders • Instructional videos	• Customer mailings and emails - Welcome brochure with preview of new tools and options • Electronic calls to remind customers of upcoming meter installations • Doorknob hanger upon installation • Respond to media inquiries • Monitor paid and social media

Dates will adjust with meter deployment roll-out
Ad-hoc meetings and activities will be added as time and need permits for each deployment area

Table 5-4: 90-60-30-Day Communication Plan

5.6.3. 90 Days Prior to Deployment

As regions are scheduled for AMI meter installation, the Company will build on the steady education of, and engagement with, community leaders from Phase I to begin direct and targeted education. 90 days prior to deployment, the Company will enhance its community outreach by hosting in-person and virtual town hall meetings. The Clifton Park Demonstration has shown this type of engagement to be particularly successful in reaching customers. The outreach will include:

- Orchestrating meet-and-learn events at local venues with customers, community leaders, press and external stakeholders. Events will take place at various times (*e.g.,* daytime, evening, weekday, weekend) to accommodate varied customer schedules;
- Developing targeted presentations focused on customer benefits;
- Offering customers a "hands-on" experience with the new CEMP functionalities; and
- Providing step-by-step guides as take-home materials for customers after the events.

Additional Channels

Within this 90-day engagement period, the Company will continue to modify the 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 subject matter experts and representatives who can assist in answering customer questions.

The Company will launch a series of messages that provide customers with more specific information about the smart meter rollout in their area. As part of this effort, the Company will begin deploying home and business advertising, email, and social media content.

The messaging throughout Phase II will build upon initial education on smart meters and their benefits and will be ongoing and continue beyond deployment (*See* Table 5-5). The Company will continually adjust outreach and messaging based on feedback from customer focus groups and surveys.

Messaging	Channels	Materials
• Intro to Smart Meters • Customer Benefits	• Website • Out of Home Ads • Social Media • Online/Print Ads	• Education Campaign • "Hands On" Experience • Instructional Videos

Table 5-5: Customer Deployment Campaign

5.6.4. 60 Days Prior to Deployment

Continuing with proactive outreach, the Company will build customer awareness of smart meter deployment through direct mail letters and emails with detailed information about the technology, benefits, and deployment process/timeline with a call to action to drive customers to the Company's website approximately 60 days prior to deployment. Bill inserts, social media posts, and digital ads will also be activated with updates, timelines, and links to more detailed information on the web as shown in Table 5-6.

In addition, the Company will clarify in these communications what it will be responsible for in the new meter replacement (*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, cable).[34] If the Company encounters an issue that could be unsafe for the customer, the Company will notify the customer of the safety hazard. Based on the prior AMR deployment, the Company does not expect a high volume of safety issues. In such instances, the Company will work with

[34] 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 to fix the issue. 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.

the customer to identify a time in the future to complete the AMI meter installation after the necessary safety repairs are complete.

Messaging	Channels	Materials
• Deployment Process/Timeline • Customer Benefits	• Email • Direct Mail/Bill Inserts • Community Meetings • Social Media • Digital Ads • Press Release	• FAQs • Getting Started Guide • Welcome Brochure • "Hands On" Experience • Fact Sheet • Instructional Videos • Introduction Letter

Table 5-6: Deployment Area Outreach at 60 Days

The channels will be supplemented with print advertising and broadcast media channels to continue to provide information and increase program awareness. The goal is to reach as many customers and participants as possible so that knowledge of smart meter deployment becomes commonplace among neighbors and friends. There will also be continued engagement with local stakeholders.

The Company will organize educational events to speak directly with customers about the installation and benefits of smart meters. The Company found this channel particularly useful and helpful with the Clifton Park Demonstration. The outreach will include the following:

- Orchestrating meet-and-learn events at local venues with customers. Events will take place at various times throughout the day to accommodate varying customer schedules.
- Providing customers with a "hands-on" experience with the new CEMP functionality that will be enabled by AMI meters.
- Providing step-by-step guides as take-home materials for customers after the events.

Table 5-7 highlights campaign details associated with educational events.

Messaging	Channels	Materials
• Deployment Process • Benefits	• Email • Direct Mail • Community Meetings	• FAQs • Welcome Brochure • "Hands On" Experience

Table 5-7: Educational Events at 60 Days

Participating in community meetings allows the Company to connect with customers directly and share the benefits of the smart metering program, help explain future pricing plans, and provide awareness and training on the new platform.

Outreach for C&I customers will occur primarily through jurisdictional representatives and account managers and will leverage preferred communication channels. The communication channels will include direct conversations, the Company's business website, bill inserts, and emails as illustrated in Table 5-8.

Messaging	Channels	Materials
• Deployment Process • Benefits	• Jurisdictional/ Account Managers • Website • Bill Inserts • In-Person Training	• FAQs • Welcome Brochure • "Hands On" Experience • Instructional Videos

Table 5-8: C&I Outreach at 60 days

5.6.5. 30 Days Prior to Deployment

Within 30 days of deployment, communication will continue with customers to further reinforce both transparency of the process and customer awareness of smart meter benefits. As the Company approaches deployment in regional areas, customers will receive materials such as a welcome brochure, FAQs, data use and safeguard statements, emails, and postcards (Table 5-9). The messaging will build upon education and proactive outreach to emphasize smart meter benefits and opportunities to give customers more insights and control over their usage. The Company will provide press releases, respond to media inquiries, post reminders to social media, and proactively monitor and respond to social media comments in the respective deployment areas.

Messaging	Channels	Materials
• Deployment Schedule • Benefits	• Website • Email • Social Media • Direct Mail	• FAQs • Welcome Brochure • Data Use and Safeguard Statements • Welcome Brochure • "Hands On" Experience • Press Releases • Instructional Videos

Table 5-9: Stakeholder and Customer Outreach at 30 Days

Additional outreach targeting specific customers, such as seniors, will be included in local newspapers and direct mail pieces. These channels will highlight ways and locations in which such customers can ask questions and receive answers as to how the smart meter deployment will directly affect them. Based on learnings from the Worcester Smart Energy Solutions Pilot, the Company recognizes that older customers tend to prefer face-to-face interactions. Therefore, the Company plans to facilitate this interaction through direct conversations (*see* Table 5-10).

Messaging	Channels	Materials
• Deployment Process • Benefits	• Newspaper Ads • Direct Mail • Community Meetings • Senior Events	• FAQs • Data Use and Safeguard Statements • Welcome Brochure • "Hands On" Experience • Instructional Videos • Introduction Letter

Table 5-10: Senior Outreach

5.6.6. Day of Meter Installation

On the day of meter installation, field workers will first attempt to contact the customer before installing the AMI meter. Service will be reconnected after the new meter is installed. Following meter installation, the Company will provide the customer with a doorknob hanger that confirms services have been performed, as well as a supporting "Welcome Brochure." This information will also include the toll-free number for customers to call and website addresses if they have questions about their new electric AMI meter and/or general questions about the smart meter program.

In the event the Company is unable to upgrade a meter, the field worker will leave information at the residence providing the reason installers were unable to upgrade the meter, as well as any actions the customer may need to take for the meter installation 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 will 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 meter. Based on the learnings from the Clifton Park Demonstration, field workers will be equipped with FAQs, "Welcome Brochures," and meter completion doorknob hangers to support the customer experience.

Messaging	Channels	Materials
• Benefits • Next Steps	• Website • Email • Social Media	• Welcome Brochure • FAQs • Door Hangers for "missed appointments" and "meter completion"

Table 5-11: Day of Installation Outreach to Customers

5.6.7. Customer Opt-out in Phase II

If, on the day of installation, a customer chooses to opt-out when the Company representative makes initial contact, the technician will not install the new electric meter at that location. Instead, the representative will contact a supervisor and the Company will provide the customer

with a form to confirm their choice to not receive the new equipment, with an acknowledgement that the customer will incur future meter reading fees.

The Company will aim to learn as much as possible from the customer during this time, including why they are choosing to opt out of receiving the new meter and forgoing the opportunity to participate in future benefits. Such customer feedback will inform future messaging and outreach strategies to help limit meter opt outs.

If the customer still chooses to opt out and submits the opt-out form, 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 (*i.e.,* the monthly meter reading fees).

5.7. Phase III (Empowerment and Enablement)

5.7.1. Objectives and Approach

For the benefits of smart meter technology to be fully realized by both the customer and the Company, the Company must pair the new technology with proactive customer and market engagement initiatives that occur prior to and following AMI deployment. As noted in Section 2, the Company will develop and implement a CEMP. The CEMP is a long-term, holistic approach that will incorporate digital channels to educate and engage customers (primarily residential) in their modern energy experience that is triggered by the installation of a smart meter. With the changing customer expectations, the rise in cloud computing capabilities, and the need for new customer systems capable of fully leveraging the massive amounts of future smart meter data, there is a significant opportunity to provide new value to customers. This necessitates a more cohesive and integrated digital solution and justifies developing the CEMP to meet changing customer needs while ensuring access to valuable information for all customers.

The envisioned customer benefits that originate post-installation are made possible by several enabling technologies. The deployment of the smart meters and associated communication network will provide significantly more granular data than is available with current AMR technology. It will establish a two-way communication pathway between the Company and customers, a grid-edge computing platform, and smart home/business technology integration. The third-party data sharing enabled through the Green Button Connect functionality will enable increased market participation and competitive customer offerings. The CEMP will synthesize these many data sources and offerings to provide a simple, easy-to-use customer experience. To ensure maximum awareness and utilization, the Company plans to deploy and educate customers about the CEMP prior to smart meter installation (*i.e.,* prior to beginning of Phase II).

The following section provides an overview of customers' current web experience, the vision for and key features of the CEMP, as well as illustrative customer journeys (residential, commercial, industrial) to visualize the future customer experience enabled by smart meters.

5.7.2. Objectives

The Phase III objectives are:

- Provide access to new online CEMP functionality;

- Educate customers early and often about CEMP functionality and other tools and options that will be available post-meter installation;
- Encourage customers to interact with CEMP functionality to better understand energy usage and modify energy consumption;
- Provide follow-up communications on new features to customers; and
- Introduce and educate customers on new TVR plans, when available.

5.7.3. Summary of Key Activities for Both Digital and Non-Digital Delivery

As previously noted, the Company recognizes that not all customers will seek to engage digitally with the benefits enabled by smart meters. Although the CEMP functionality is a digitally focused tool that supports the modern energy experience for customers, the Company will develop educational and engagement materials that 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 develop relevant and motivating messages tailored to customer segments and channels based on best practices from the Company's previous smart meter pilots, which provided insights into how to deliver an omni-channel engagement strategy.

As the Company enters the sustained activity of Phase III, it will draw on the successful channels used in Phases I and II (*e.g.,* fact sheets, welcome brochures, and the mobile sustainability hub). Additional strategies planned for Phase III include developing videos to educate customers to help them understand bill statements, creating a "Getting Started Guide" to provide step-by-step instructions and visuals for customers about the post-deployment experience (*e.g.,* CEMP), developing testimonials and case studies, and engaging with customers via social media (*e.g.,* Facebook, Twitter, YouTube). All educational materials will continue to be available in various languages based on customer demographics. The Company will continue to use feedback throughout this phase to refine and improve the customer engagement materials.

5.7.4. Approach

The Company will begin educating customers on the new post-deployment tools and services, including the CEMP, beginning in Phase I with broad awareness, continuing through deployment in Phase II, and reinforced in Phase III upon meter installation. This will allow both the meter and the new tools and services it provides to be top of mind for customers to help enable their engagement. For example, customers will be able to enroll in electric high-usage alerts based on customer-selected preferred communication methods and applicable laws. AMI-enabled 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. Educational material, both traditional and digital, describing these types of features as well as other aspects of the CEMP will be supplied on a frequent basis over the first four weeks following AMI meter installation.

The Company will monitor customer utilization of these new tools and services, including the CEMP, and will adjust messaging and channels by segment to drive increased utilization. Table 5-12 is an example of analysis of customer awareness and energy usage segmentation conducted as part of the Clifton Park Demonstration. This type of data helps the Company to refine messages through the "Listen, Test, Learn" approach. As customer engagement increases over

time, customers are better targeted by segments to maintain and improve engagement as shown in Table 5-12.

Engagement

Awareness

Messaging & *Channels*	No NG Web ID	NG Web ID - NOT Logged in Past 6 Months	NG Web ID Logged in Past 6 months – No Portal	NG Web ID + Logged into Portal
Unaware	*Direct Mail* *Online Banner Ads* *Print Ads*	*Online Banner Ads* *Print Ads*	*Online Banner Ads* *Print Ads*	*N/A*
Energy Conscience	*Direct Mail* *Google AdSense** *Social Media Ads*	*Google AdSense** *Social Media Ads**	*Google AdSense** *Social Media Ads**	*N/A*
Aware / Not Participating	*Direct Mail* *Google AdSense** *Social Media Ads**	*Google AdSense** *Social Media Ads**	*Google AdSense** *Social Media Ads**	*N/A*
Aware / Participating	*N/A*	*N/A*	*N/A*	*Google AdSense** *Social Media Ads**

* Key phrases will be changed based on level of awareness

Channel Across All Segments

- Emails
- Meetings
- Social Media
- Videos
- WeConnect
- Bill Inserts, On Bill / Envelope Messaging
- Out-of-Home
- IVR / Contact Center

Table 5-12: Example of Clifton Park Demonstration Platform Awareness by Customer Segment

5.7.5. Customer Energy Management Platform Overview

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 AMI meters.

The CEMP, as part of the UWP, 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. The same information will be made available for customer service representatives to share with customers who prefer to call in and speak to a live representative. Figure 5-10 below shows how current web components are available to customers today.

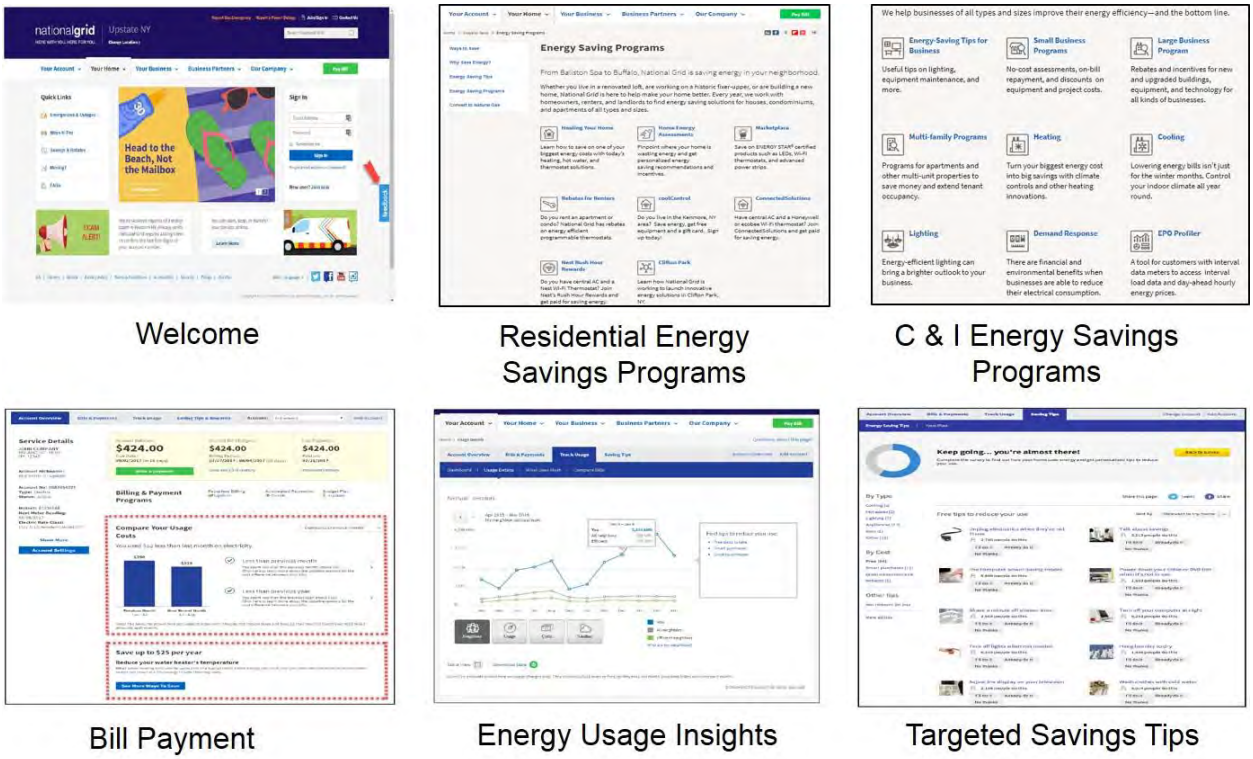


Figure 5-10: Current Customer Webpage Highlights

Today, customers can access two-years of their historical energy usage data by either logging into their account online and viewing their current consumption, downloading their usage data through Green Button Download My Data, or by contacting the Company directly. The Company also provides historical energy usage as part of the customer's bill each month. The Company's AMI solution contains new ways of generating and sharing this data with customers. Four key advanced metering elements, as shown in Figure 5-11, that establish a pipeline for customer data are as follows:

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

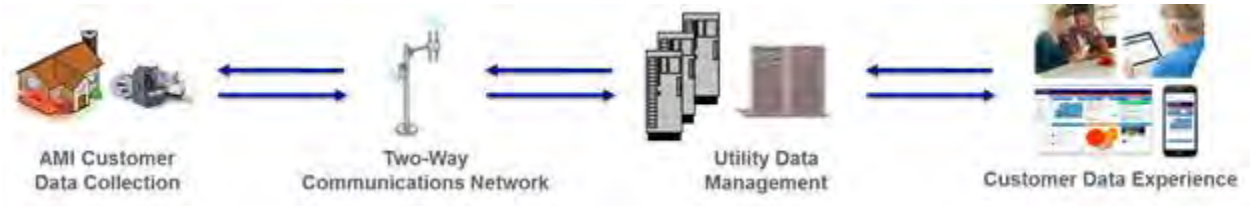


Figure 5-11: Customer AMI Data Access

The Company plans to offer 15-minute interval data available to customers on the CEMP every 30 to 45-minutes, with bill quality data available after 24 hours. The Company intends to provide interval data at a granularity consistent with future TVR designs.

As shown in Figure 5-12 the CEMP is comprised of three main components: personalized insights, tools, and integrated customer actions.

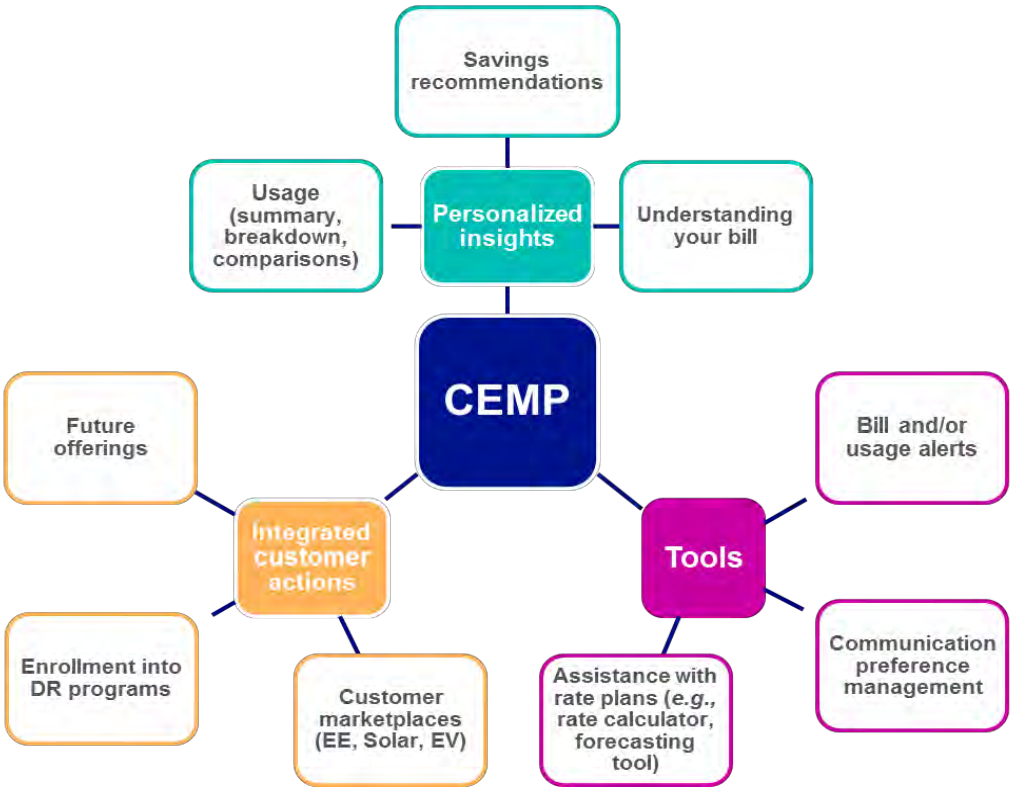


Figure 5-12: Customer Energy Management Platform Overview

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 reviewing and analyzing an energy bill; and
- The ability to share billing and energy consumption data with third parties via Green Button Connect.[35]

C&I customers will have access to new features, such as a portfolio-level view allowing them to seamlessly access information across multiple accounts. Personalization will leverage usage data, load profile, customer-selected preferences, account activity, load disaggregation, and other factors to enable meaningful insights for an individual 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 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.,* CPP 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,[36] and other actions can all occur in one convenient location on the CEMP. As illustrated in Figure 5-13, 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. Figure 5-13 provides an illustrative example at what a CEMP view might look like across web and mobile platforms. Additional feature details are provided in Appendix A: CEMP Features.

[35] *See* Section 4.2, *Third-Party Data Access*.
[36] *See e.g.*, National Grid Solar Market Place, https://www.nationalgridus.com/MA-Home/Ways-to-Save/Learn-About-Solar.

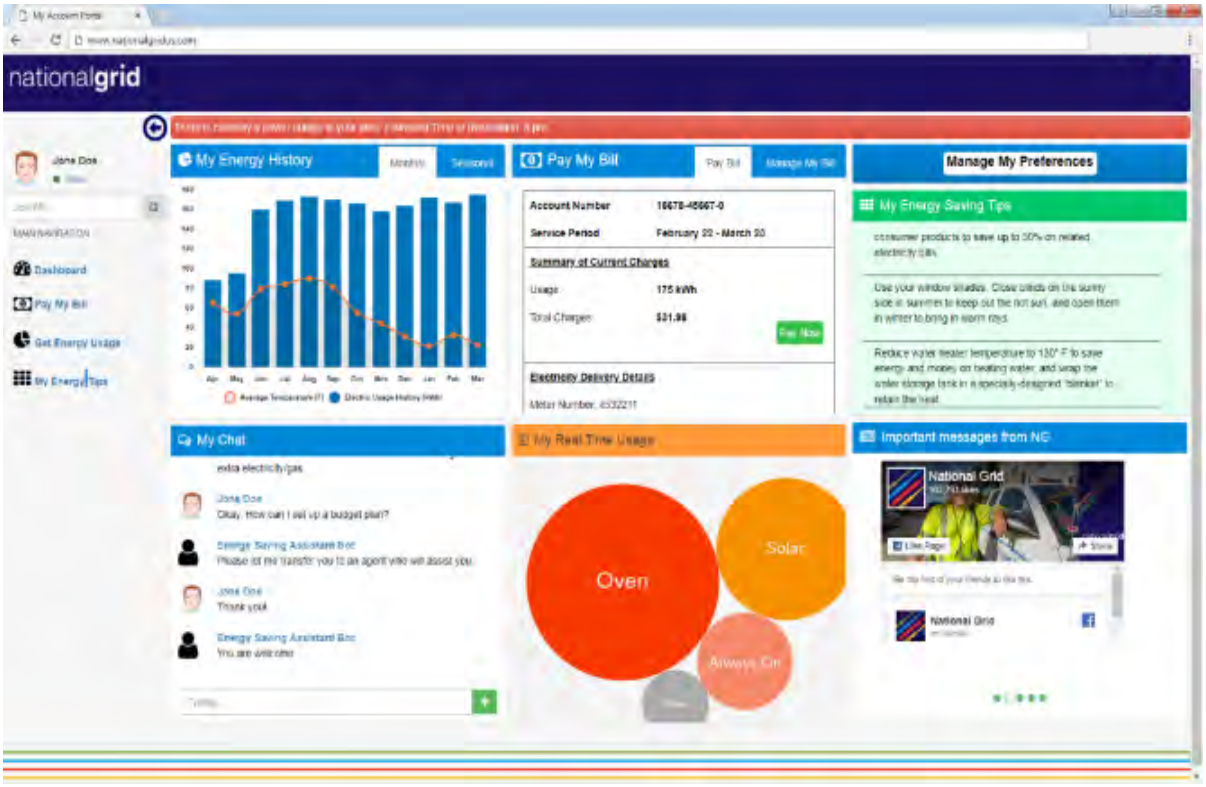

nationalgrid
My Energy History
Pay My Bill
Manage My Preferences
My Energy Saving Tips
Account Number
Service Period
Summary of Current Charges
Usage
Total Charges
Pay Now
Electricity Delivery Details
My Chat
My Real Time Usage
Important messages from NG
Oven
Solar
Always On
National Grid

Figure 5-13: 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 communications. For example, tools for program managers, account managers, and marketing teams will enable targeted program information and offerings to improve energy efficiency program participation and performance rates for 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 data analytics to review with customers during high-bill calls and then providing summary follow-up information on the subsequent bill. Customers will be able to enroll in electric high-usage alerts based on customer-selected preferred communication methods and applicable laws. The Company envisions enabling several outbound high-usage alerts, considering multiple timescales and triggers, available to customers on an opt-in basis through their online accounts or delivered over a customer-selected communication channel via Preference Center (as described in Section 3.3.2). AMI insights 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 act to manage energy usage.

nationalgrid

SERVICE FOR
JOHN SMITH
1010 ANY STREET
ANYTOWN, MA 99999

BILLING PERIOD
Oct 22, 2019 to Nov 19, 2019

PAGE 1 of 2

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
99999-99999	Dec 13, 2019	$ 279.85

www.nationalgridus.com

CUSTOMER SERVICE
1-800-322-3223
CREDIT DEPARTMENT
1-888-211-1313
POWER OUTAGE OR DOWNED LINE
1-800-465-1212
CORRESPONDENCE ADDRESS
PO Box 960
Northborough, MA 01532-0960
ELECTRIC PAYMENT ADDRESS
PO Box 11737
Newark, NJ 07101-4737
DATE BILL ISSUED
Nov 19, 2019

▶ DID YOU FORGET? ◀

The total amount due includes an unpaid balance from a previous bill. If you have already paid this balance, please disregard this message. Thank You.

ACCOUNT BALANCE

Previous Balance		137.87
Payment Received	*No payments have been received during this billing period*	- 0.00
Balance Forward		**137.87**
Current Charges		+ 141.98
	Amount Due ▶	**$ 279.85**

➢ **Payment concerns?** We are here to help. To learn about solutions to help you take control of your energy use and bills, visit www.ngrid.com/billhelp.

➢ **Go paperless!** Electronic billing and payments make managing your monthly bill easier. Save time, money, and natural resources www.ngrid.com/paperless.

DETAIL OF CURRENT CHARGES

Delivery Services

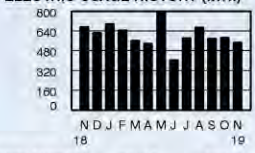
Service Period	No. of days	Current Reading	–	Previous Reading	=	Total Usage
Oct 22 - Nov 19	28	66697 *Actual*		66148 *Actual*		549 kWh

METER NUMBER 12345678 NEXT SCHEDULED READ DATE ON OR ABOUT Dec 19

RATE Residential Regular R-1

Customer Charge		6.52
Dist Chg	0.06671924 x 549 kWh	36.63
Transition Charge	-0.00103 x 549 kWh	-0.56
Transmission Charge	0.03164 x 549 kWh	17.37
Energy Efficiency Chg	0.01805 x 549 kWh	9.91
Renewable Energy Chg	0.0005 x 549 kWh	0.27
Distributed Solar Charge	0.00146 x 549 kWh	0.80
	Total Delivery Services	**$ 70.94**

ELECTRIC USAGE HISTORY (kWh)



Daily Averages	Nov 18	Nov 19
kWh	21.8	19.6
Cost	$ 5.32	$ 5.07

■ Actual ☐ Estimated

KEEP THIS PORTION FOR YOUR RECORDS.

RETURN THIS PORTION WITH YOUR PAYMENT.

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
99999-99999	Dec 13, 2019	$ 279.85 *Includes amount past due*

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PO Box 960
Northborough MA 01532

ENTER AMOUNT ENCLOSED

$ _____

Write account number on check and make payable to National Grid

NATIONAL GRID
PO BOX 11737
NEWARK NJ 07101-4737

Figure 5-14: Representative view of electric bill with monthly summary usage

5.7.6. Complementary Enabling Technologies

In addition to the digital and non-digital CEMP features described above, customers will have access to additional technologies to enable real-time data access, connect smart home/business devices, and third-party data sharing. These additional technologies can help customers unlock additional value and enrich the customer experience.

Foundational to these customer experience enhancements is the ability for customers to access and share their energy data. The table below provides a summary of the customer data access channels and the associated data granularity and latency.

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** • **This same information will be available at bill quality data within 24 hours.**
Green Button Connect	**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)**

Figure 5-15: Customer Data Access Channels

AMI Home Area Network

The proposed AMI solution will include a Wi-Fi radio and associated firmware to provide a wireless signal to a home-area network ("HAN"). This technology will allow customers to monitor and/or control their energy usage instantaneously. Using open and secure communication standards, customers will be able to leverage third-party vendor technology to achieve real-time energy awareness and control of connected devices.

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 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 the HAN device, such as an in-home display or smart phone application. 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.

One of the first applications to utilize this HAN architecture will be an application running on customers' smart devices, such as smart phones, to provide customers with near real-time data. The cost of the application is included in the overall solution cost, meaning customers will not

have to pay an additional fee for this added functionality. The approach will help remove barriers for customers to access information and engage in cost-saving behaviors and customer programs. The Company believes this innovative technology will maximize engagement, providing a scalable model for addressing the needs of, and providing new value to, a wide variety of customer segments. Improving access for income-eligible customers is particularly important, as these customers pay disproportionately high percentages of household income to energy bills.[37]

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. 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, helping the demand-side become more dynamic and responsive to changing grid conditions. 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 set points to reduce peak demand during peak hours on particularly hot and humid summer days.

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. The Company will continue to promote the use of such technologies through its evolving energy efficiency and demand response programs. If this approach demonstrates results at scale, programs where customers can participate to reduce and/or shift load could be incorporated into new customer programs, such as non-wire alternatives. Scaling the customer capabilities described above become increasingly important as the electric power system becomes increasingly dependent on intermittent renewable generation.

Green Button Connect

The industry-led Green Button initiative is the most common method for customers to grant access to their energy data to authorized third parties. Green Button Download My Data and Green Button Connect solutions (Figures 5-16 and 5-17, respectively) 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.

[37] National Grid, *NGUSA Customer Strategy Customer Data Book* (2019).

Figure 5-18: Green Button Download My Data

The Green Button Connect functionality takes this process further by allowing customers to automate the data sharing process. With Green Button Connect, customers can securely authorize both National Grid and designated third parties to send and receive data on the customer's behalf. The Company's Upstate 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.

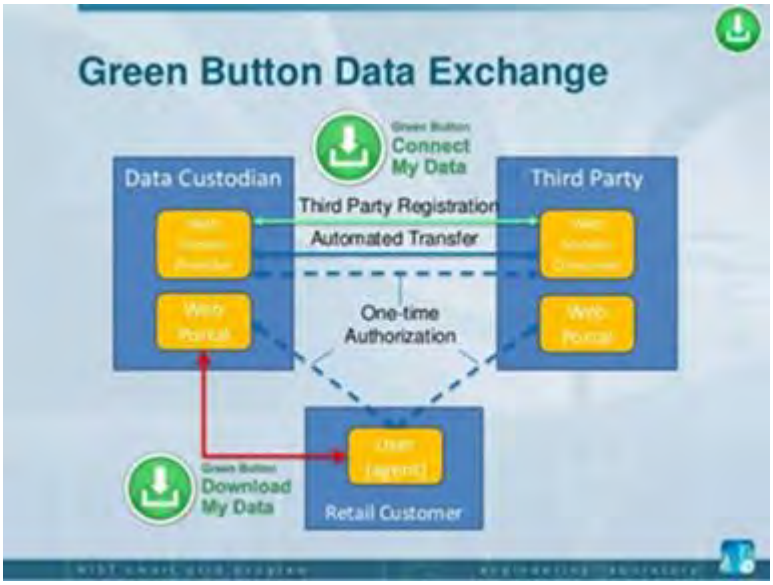

Figure 5-19: Green Button Connect My Data – Data Exchange

In general, the onboarding process will involve third parties submitting their Green Button Connect registration form online, and 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 Data Security Agreement, vendor risk assessment form, and registration forms. The third party will then be listed on the Green Button Connect 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 5-20: Green Button Connect Third Party Onboarding Process below.

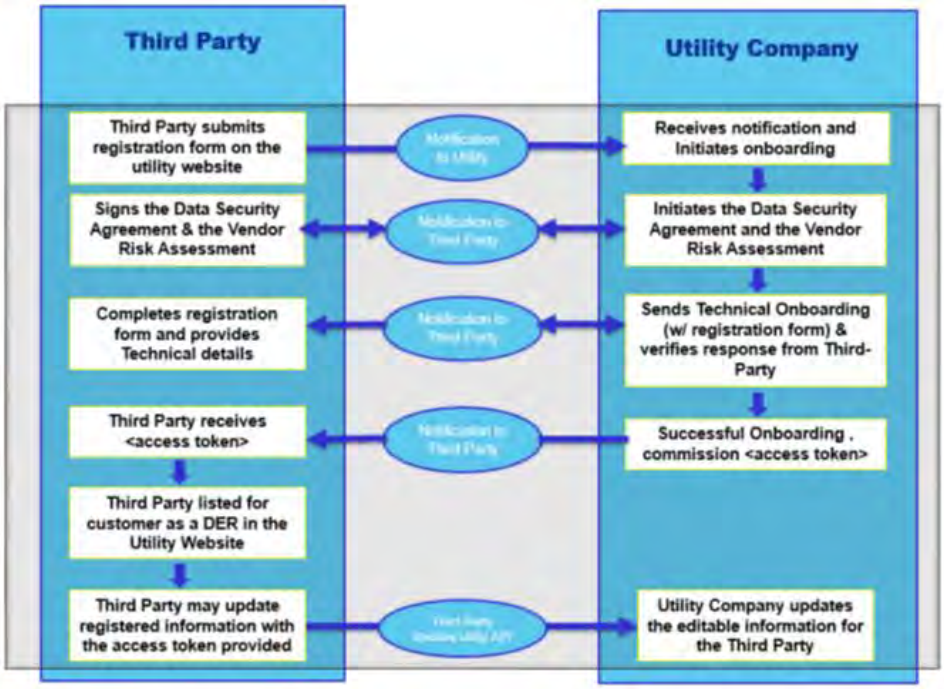

Figure 5-20: Green Button Connect Third Party Onboarding Process

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 by 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 (*see* Figure 5-21).

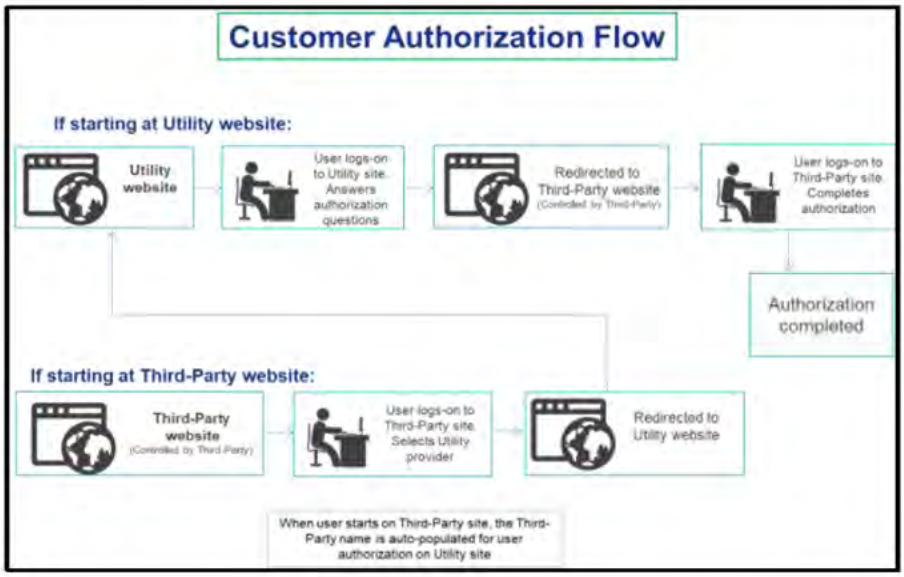

Figure 5-21: Green Button Connect Authorization Process Flow

5.7.7. Leveraging the Power of Energy Efficiency and New Program Design

The Company recognizes the deployment of smart metering as a unique opportunity to accelerate the innovation and delivery of its existing portfolio of customer-facing programs and services, ranging from offerings such as residential and commercial energy efficiency and demand-side management ("DSM") programs to its comprehensive electric transportation initiative. The deployment of AMI will also animate the market for third-party technologies and services, providing opportunities for third-party innovation and delivering additional benefits for customers under policies and programs set forth by the Green Communities Act. These developments go beyond the scope of the AMI program and will require future regulatory consideration. The following discussion is included to highlight future opportunities for cross-program alignment and reiterate the shared vision of the clean-energy future, in support of the shared carbon reduction and equity goals outlined in the Climate Act and the Company's Responsible Business Charter.

AMI also opens the door to increasingly sophisticated DSM programs. Deeper customer engagement is enabled by 15-minute interval data as part of behavioral energy efficiency and DSM programs, remote home energy audits, and continuous whole-home energy optimization, and contributes to improving program outcomes. Granularity in data also contributes to higher accuracy in the evaluation, measurement and verification of energy efficiency savings impacts, and potential administrative cost savings for customers.[38]

[38] ACEEE, *Leveraging Advanced Metering Infrastructure to Save Energy*, 2020. https://www.aceee.org/research-report/u2001 (last visited June 25, 2021).

The following list of examples highlight a few of the ways that the AMI deployment can support DSM programs by facilitating:

- Identification and enrollment of customers that provide the biggest program benefits and energy savings opportunity (factors may include site location, large consumption size, weather correlation, past program participation, locational constraints, *etc.*);
- Improved marketing metrics by reducing customer acquisition cost through targeted engagement, improving open/click/conversion rates, and employing data driven sales and communication strategy;
- Improved customer experience, choice, satisfaction, and personalization of offerings and services;
- Improvement in program participation;
- Reduced localized peak load due to data availability that could support energy efficiency, demand response and DER programs targeting specific feeders or geographic regions;
- Enhanced employment of performance-based energy efficiency technologies and delivery mechanisms, such as Pay-For-Performance, with higher accuracy of energy savings and verification methods; and
- Overall increased cost-effectiveness of DSM programs using data-driven propensity modelling for streamlined energy efficiency delivery.

The Company envisions that current and future program offerings will leverage AMI towards delivering data driven programs and increasing program efficiency and portfolio energy savings, thereby facilitating long-term cost effectiveness.

5.7.8. Data Privacy, Security, and Protection

National Grid is committed to protecting data that is generated by its customer and system operations. Providing customers and third-parties with access to more granular energy information comes with the inherent responsibility to secure, protect, and manage the data. Additional detail regarding National Grid's data privacy policies, standards, and guidelines, as well as the Company's commitment to protecting customer data, can be found in the Company's AMI Data Governance Plan. The Company's overall approach centers on three key components: a commitment to core data-privacy principles; regular assessments of the Company's performance in accordance with the principles; and constant vigilance. To address the consumer view into data privacy practices at National Grid, the Company also developed a Data Privacy Policy that explains how customer data is used at National Grid.[39]

6. Employee Awareness & Training Plan

6.1. Employee Training Overview

The employee training plan for the Company's AMI implementation is part of a robust change management approach that will engage employees and customers to increase support for the smart meter program. The employee training component will include early learning communications and activities to increase employee awareness and understanding of the AMI

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

program and a detailed, role-specific training program where employees will learn about specific changes impacting their jobs. Employees and other stakeholders have been classified to identify learning needs. The change management team will conduct a detailed stakeholder analysis and change impact analysis, and those insights will inform the training plan. Preliminary assessments indicate there are approximately 33 impacted stakeholder groups that will require communication regarding the program.[40] Approximately half of the impacted groups will require formal training to perform some job-specific tasks in a new way. Figure 6-1 provides a summary of the Company's Employee Awareness and Training Plan.

Figure 6-1: Employee Awareness & Training Plan Executive Summary

6.2. Stakeholder Identification and Analysis

Stakeholder identification is an important first step in cascading relevant communications to impacted groups, to understand the information needs and level of involvement required for each of the different stakeholder groups, to ensure the right people receive the right information, at the right time, in the right way, to proactively manage the pace and amount of change that each stakeholder group must undergo to avoid "change saturation," and to build buy-in, commitment and capacity for change. To identify stakeholders, the project team considers who is impacted by

[40] The number of groups may change, and some of the stakeholder groups may be reclassified from one classification to another based on the results of the stakeholder and change impact assessments.

or has influence over or benefits from the program and what other areas and initiatives are dependent on the program.

A stakeholder is defined as a person or group of people who are leading, involved in, or impacted by the change. When identifying key stakeholders, considerations included:

- People who may be held accountable for the success or failure associated with the change resulting from the AMI deployment;
- People who will either help or hinder the change process occurring;
- People who might be impacted by changes to their role, responsibilities, and/or skills; and
- People with access to resources which can help the program team achieve its objectives.

After identifying stakeholders, the Company classified them into the following groups: project & leadership, primary stakeholders, secondary stakeholders, supporting stakeholders, and external stakeholders. As the analysis phase progresses, it is possible that some groups may change classifications, and that groups may be added or condensed based on their unique needs. Figure 6-2, below, depicts a draft example of the stakeholder groups. Those denoted with an asterisk have been identified as requiring formal training.

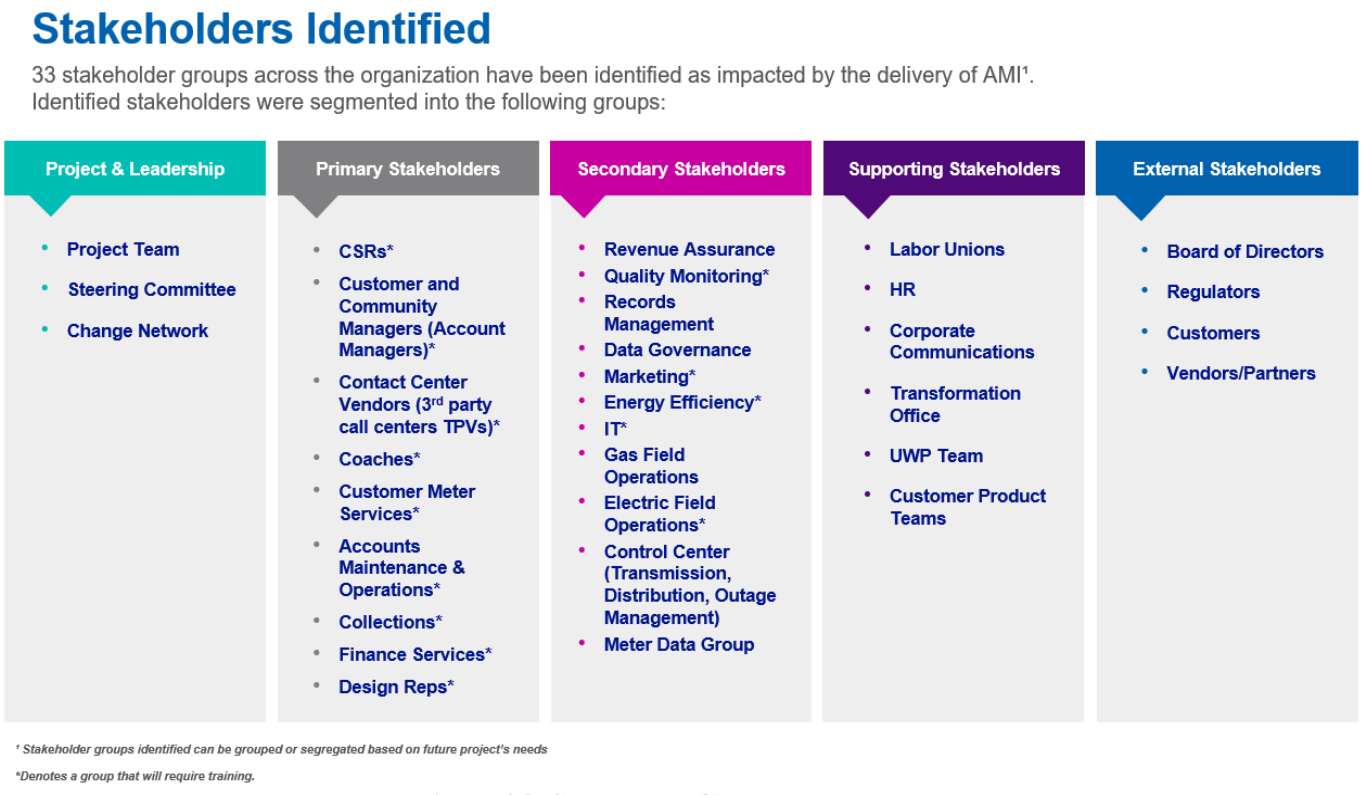

Figure 6-2: Stakeholder Groups

Individuals in the project and leadership groups are directly involved with the program. Project and leadership include the groups directly interacting with the program. This group includes the

project team and relevant leadership groups and steering committees, and the organization's change ambassadors and agents. This group will be the most informed and engaged and act as ambassadors of change throughout the organization. They will be provided with communications in advance of broader audiences to allow them to be a trusted source of information.

Primary stakeholders include Contact Center Representatives, Coaches (Contact Center Supervisors), Customer Meter Services, and others who will see a large degree of change from the AMI program. Members of the primary stakeholder groups will require frequent communication and formal training on the parts of their job-role impacted by the program.

Secondary stakeholders will also require communication, and in many cases, training, but to a lesser degree than the primary stakeholders. This group includes Marketing and Energy Efficiency groups who may gain the ability to offer new programs and services due to the AMI program but will not see a significant change in most of their day-to-day activities.

Supporting stakeholders are impacted by the program but not necessarily impacted by the solution. This group includes Human Resources, Corporate Communications, and the Labor Unions, all of whom must partner with the AMI team to launch a successful program but will not need to work differently due to the technology itself. This group will require frequent communication and will be a critical partner for the AMI team but will not require formal training regarding the technology itself.

External stakeholders are those impacted by or holding influence over the program not employed by National Grid. This group includes regulators, customers, and community leaders. This group will receive frequent communications regarding the program and anticipated changes.

6.3. Early Learning Activities

Throughout the entire program, the employee training team will coordinate with the change management and marketing teams to ensure consistent messaging throughout the organization and to our customer base. Employees will learn the basics of AMI, including the benefits for customers and the Company, early in the program. Employee early learning activities may include any or all of the following: videos; job-aids; quick reference guides; FAQs; lunch & learns; email communications; newsletters; and one-on-one or group meetings.

6.4. Training Activities and Milestones

Detailed planning, which includes the stakeholder analysis, will be performed following the anticipated project kickoff in 2023. The Company expects the planning stage to heavily leverage the AMI training being developed for the Company's Upstate New York affiliate. The planning phase will also include developing plans, such as a detailed communication plan and an employee training strategy. The full scope, governance model, team structure, and resource needs will also be developed during this stage. It is critical to account for training needs and acquire adequate resources to ensure employees are well trained for the AMI program. Lessons learned from previous programs indicate that employees prefer to learn from internal trainers, whom they trust and view as experts in the field. This will be a key consideration when selecting

and contracting with the business integrator. Planned activities and outputs of the training program are depicted in Figure 6-3 below.

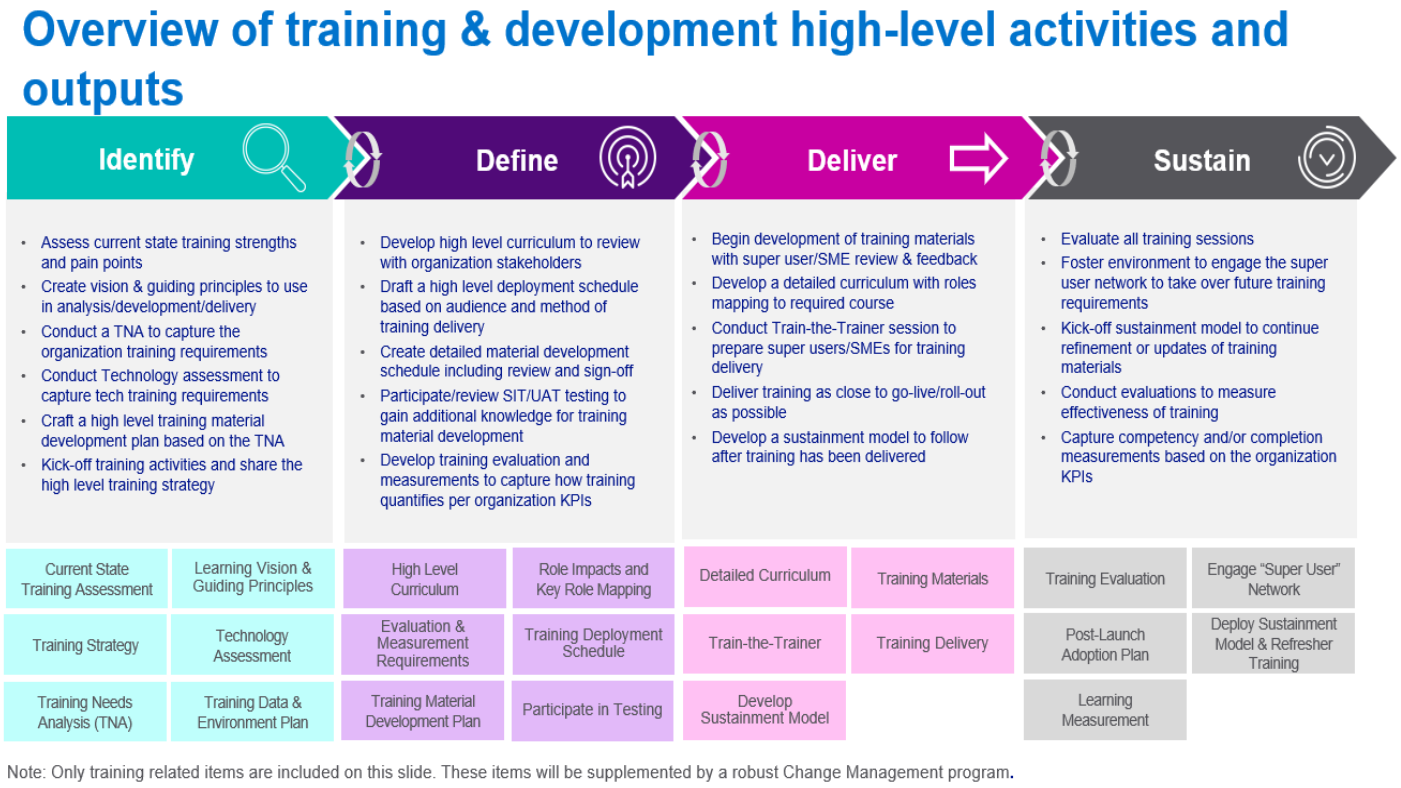

Figure 6-3: Employee Training Overview

6.5. Training Timeline

The AMI Employee Training Plan will follow a standard training model called ADDIE, which stands for Analyze, Design, Develop, Implement, and Evaluate. The phases of the ADDIE model will align to the overall project plan, working backward from the deployment of the AMI meters. These phases are depicted in Figure 6-4 below. The analysis phase will take place in 2023. During this phase, the training team will identify and understand change impacts and training needs. The training timeline may be updated and adjusted throughout the program and will continue to align with the field deployment and outbound customer communications. An example of an employee journey can be seen below in Figures 6-5 and 6-6.

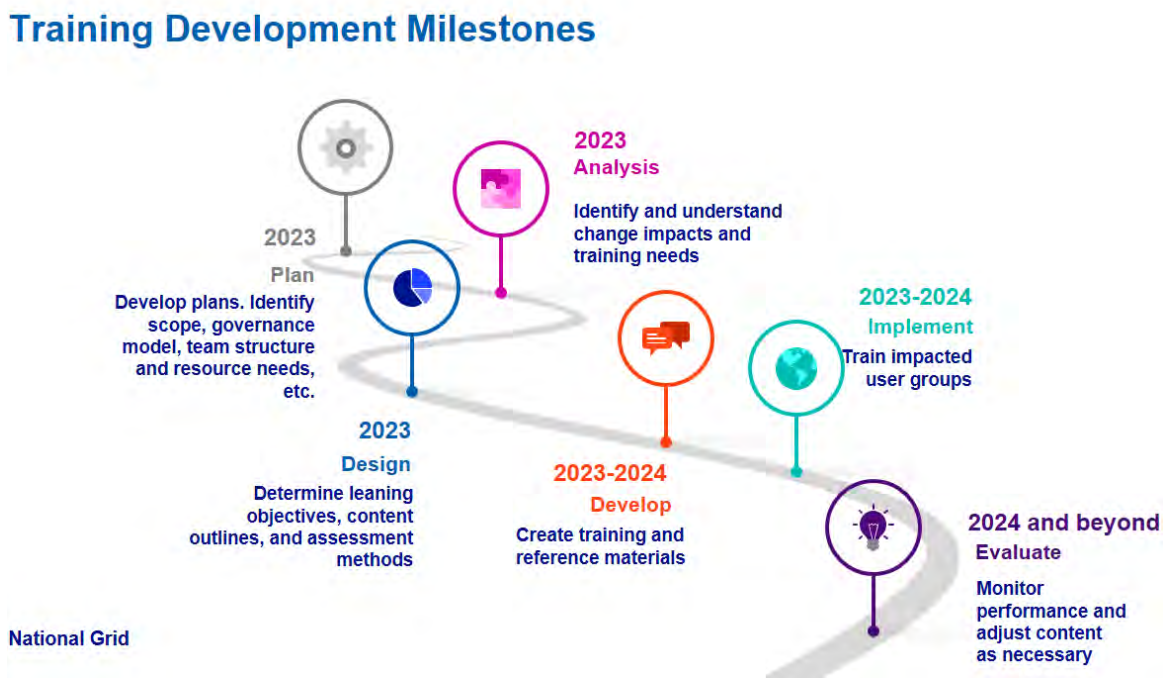

Figure 6-4: Training Development Milestones

6.5.1. Design

The design phase, beginning later in 2023, includes determining learning objectives, content outlines, and assessment methods. In this phase, the Company will develop a high-level training plan, along with role mapping and a detailed plan for the development of the training materials. Journey mapping will be conducted to gain a deeper understanding of the employee training experience for some of the most heavily impacted user groups. An example of an employee journey can be seen below in Figures 6-5 and 6-6.

Figure 6-5: Customer Service Representative Journey Map

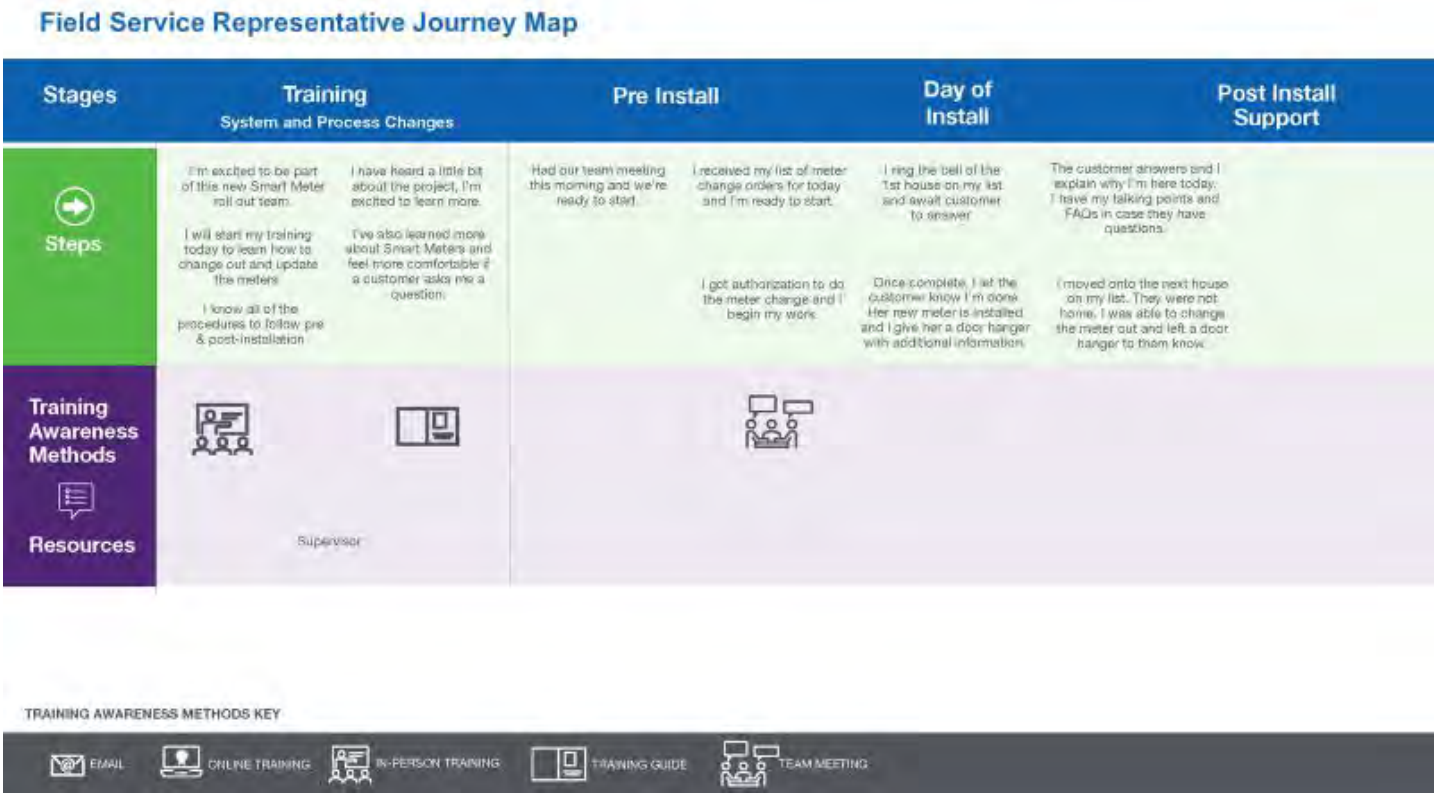

Figure 6-6: Field Service Representative Journey Map

6.5.2. Develop

In the development phase, the curriculum will be refined in greater detail, and the training materials themselves will be created. A train-the-trainer will be conducted to prepare trainers to deliver the materials. Any necessary reference materials and job-aids will be created in this phase.

6.5.3. Deliver

The delivery phase is when the end-user training will be conducted. This phase will allow for training as close as possible to the deployment of the meters. The timeline will consider the overarching project timeline and work backward from the date employees would be required to work differently, allowing enough time for thorough and comprehensive training without completing it too early, which could result in loss of skills and the need for more frequent re-trainings and refreshers.

6.5.4. Evaluate

The evaluation phase is a critical element of the overall training program, in which the effectiveness of the training program will be measured. These measurements may take place in the form of surveys and tracking of proficiency metrics. Both qualitative and qualitive evaluations will provide a holistic measurement of the efficacy of the training program. As the effectiveness of the plan is evaluated, the insights gained will be used to continuously refine and

improve the training experience. The evaluation phase will begin shortly after the initial training delivery, and will overlap much of the delivery phase. In addition, the evaluation phase will extend beyond the end of the formal training delivery phase to ensure reference and new-hire training materials are updated as necessary.

Throughout the delivery and evaluation phases, metrics and feedback will be assessed to ensure updates are made, as necessary, to training and reference materials. Employees will also be supported post-deployment as new programs may be introduced for customers based on their usage patterns. Employees will receive communications in advance of any customer-facing communications to ensure they have the requisite level of knowledge to assist customers who may have questions or require assistance understanding their interval data and/or any additional offerings for which they may be eligible.

7. Innovative Rate Design

AMI deployment enables the Company to provide TVR signals to customers. The modeled benefits to customers in the AMI Implementation Plan come from savings derived from avoided supply costs. The savings may result from access to energy insights, as well as reduced energy consumption, or more likely, shifting usage from higher-priced periods to lower-priced periods. Much of the benefit accrues to customers through avoided capacity costs. TVR is a critical component of meeting the Climate Act goals and the Department's grid modernization objectives in a cost-effective fashion.

In the AMI Implementation Plan, the Company includes an illustrative TVR package for supply rates using simple TOU pricing to capture the variation in energy prices and CPP to capture some of the variability of capacity costs. The TOU periods would be pre-defined and relatively static. On the other hand, the CPP periods would cover the 70 hours in the year most likely to capture that year's ISO-NE annual system peak hour, which sets the capacity obligation and costs for customers. CPP events would be called on a day-ahead basis. Customers could save money and create benefits under TOU or CPP pricing by shifting their usage away from the peak period or lowering their usage overall.

The number of customers who participate in a TVR program is a key input in determining the actual magnitude of the associated benefits. Generally, more participants will yield higher benefits. For this reason, the Company's preference is to work with stakeholders to ultimately develop an appropriate default TVR package (*i.e.*, opt-out) rate. In general, opt-out rates have far higher participation than those that require an affirmative choice from customers to "opt-in." To this end, the Company would collaborate with municipal aggregators and competitive suppliers to inform the development of a TVR structure. However, for the purposes of the high-level BCA supporting this filing, the Company's base case relies on an illustrative "opt-in" TOU/CPP rate, demonstrating how benefits of AMI outweigh the costs.

The approach for engaging customers will depend on the rate design or designs offered and their applicability. Notably, the level of engagement and targeting may differ if the Company proposes an opt-in rate versus a default rate. The Company will develop a structured approach

using its available customer outreach channels to educate customers about their options and the benefits associated with moving to innovative cost-reflective rate designs.

8. Appendices

Appendix A: CEMP Features

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") 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 low income customers, this provides data to make informed choices regarding energy consumption and opportunities to lower bills with adjustments in usage patterns.	Residential, C&I	**Enhanced** with CEMP	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.
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	Residential, C&I	**New** with CEMP	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.	Residential, C&I	**New** with CEMP	Disaggregation allows customers to better understand their energy usage and creates a foundation for personalized and actionable insights and recommendations.	Load disaggregation enables better load forecasting, improved $/kWh savings from DSM and energy efficiency programs, increased customer satisfaction, and operations and maintenance O&M savings.
Personalized Energy Insights and Tips	Suggested personalized actions that help reduce consumption and/or shift usage to less expensive periods (with TVR plans in place).	Residential, C&I	**Enhanced** with CEMP	Customized tips based on customer consumption, pricing plan specifics, load patterns, and	Increased customer engagement and participation drives greater load shift/shed, reducing peak risks, and the

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
				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).	subsequent usage of Peaker plants. Personalized information and notifications enable increased customer satisfaction and reduced high-bill calls.
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 CEMP	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.
Carbon Footprint Calculator	Ability for customers to calculate carbon footprint based on usage data and actions to better manage usage.	Residential, C&I	**New** with CEMP	Improved energy awareness and engagement.	Provides an engagement mechanism for customers who are motivated by their environmental impact; expands customer engagement.

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Configurable and Proactive High Bill/High Usage Customer Alerts	Proactive alerts for variety of customer needs, including projected high bill (consumption and/or costs), prediction of high usage during critical peak pricing 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.	Residential, C&I	**New** with CEMP	Proactive alerts provide customers with a personalized understanding of their energy consumption, improving awareness and management of usage within a TVR plan, driving higher customer EE and peak demand savings.	Increased O&M savings, improved customer response to TVR (especially critical peak usage), and higher customer satisfaction.
Critical Peak Pricing Virtual Coach	Provide proactive notification of upcoming critical peak pricing events by user-selected communication channel (call, email, text, push notification, etc.). Offer personalized coaching tips on peak reduction strategies during CPP events based on insights from load profile analytics and load disaggregation, as feasible.	Residential, C&I	**New** with CEMP	Customers will achieve greater savings by receiving timely and customized notifications based on disaggregation that is specific to their unique consumption patterns. An omni-channel approach will ensure they receive the communication via their preferred channel, in a way that is actionable and easy to understand.	Increased system wide efficiency. Improved customer participation will benefit the utility by shifting more peak load, leading to a more reliable grid, fewer capacity restraints, reduced carbon emissions from Peaker plants, and increased customer satisfaction.
Participation in Energy Efficiency and Dynamic Load Management Programs	Information and direct linkage to/enrollment in Company's existing energy efficiency and Dynamic Load Management programs. For example, an offer to immediately enroll within a DLM program would be facilitated with purchase of smart thermostat from the National Grid Marketplace. Future automated recommendations could be based on load disaggregation functionality.	Residential, C&I	**Enhanced** with CEMP	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

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
					personalized channels, rather than mass marketing efforts.
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.[41]	Residential	**Enhanced** with CEMP	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) with vetted third parties. Requires customer's authorization to facilitate data exchange with third parties.	Residential, C&I	**Enhanced** with CEMP	Ability to interact with consumption data offline and share with third parties for additional insights and services.	Data access provided via Green Button can help facilitate innovative third-party solutions.

[41] https://www.nationalgridus.com/MA-Home/Ways-to-Save/Learn-About-Solar

Detailed Feature, Functionality, or Tool	Description	Target Audience	Offering Status	Customer Benefit	Utility Benefit
Electric Transportation Initiative ("ETI")	Information on electric vehicles and linkage to Company's Electric Transportation Initiative ("ETI") Customer Outreach & Education efforts (vehicle information, pricing, charging station location and hosting details, TVP rate, etc.).[42] Commercial programs focused on electric vehicle supply equipment ("EVSE") and fleet charging programs.	Residential, C&I	**Enhanced** with CEMP	Better facilitated access to information on electric vehicles and accompanying information.	Enable easier access for customers to electric vehicle information and options.
Electric Heat Initiative ("EHI")	In concert with EE programs, provide information on efficient electric heat technology (e.g., heat pumps) to help spur conversion from delivered fuels (oil/propane).	Residential, C&I	**Enhanced** with CEMP	Better facilitated access to information on efficient electric heat technologies and available incentives for conversion.	Enable easier access for customers to view efficient electric heat information and options.

[42] https://www.nationalgridus.com/MA-Home/Ways-to-Save/Electric-Vehicles

Appendix B: Draft National Grid Smart Meter 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 used in many 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 by providing them 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 meters.

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 mailing the Company to request the data; or
- By emailing 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: 1) 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 2) 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: _____

Massachusetts Electric Company and
Nantucket Electric Company
d/b/a National Grid
D.P.U. 21-81
July 1, 2021
H.O. _____

Exhibit NG-AMI-4

AMI Data Governance Plan

Advanced Metering Infrastructure (AMI) Data Governance Plan

For

Massachusetts Electric Corporation
and
Nantucket Electric Corporation
each d/b/a National Grid

July 1, 2021

Contents

1. Introduction

On May 21, 2021, the Massachusetts Department of Public Utilities ("Department") issued Order D.P.U. 20-69-A, requiring Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid ("National Grid" or the "Company") to file a grid modernization plan, including an implementation plan for full-scale deployment of advanced metering infrastructure ("AMI").

The Company, building on the AMI proposals of its affiliates, developed this Data Governance Plan to accompany its AMI Implementation Plan filing. The Data Governance Plan includes a comprehensive set of principles for the customer and system data that will be generated by the deployment of electric AMI meters. The guiding principles are designed to ensure that the data generated 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 operational requirements, as well as grid modernization and clean energy objectives. The plan also addresses system data as it pertains to AMI in the context of ongoing grid modernization efforts. In addition, the plan includes an explanation of how the Company will provide customers with access to data, and how it will enable the sharing of that data with authorized third parties.

The Company has developed a comprehensive and integrated data governance framework designed to ensure compliance with privacy and information security regulations across all jurisdictions in which it does business. The framework is meant to ensure that customers' data is properly protected, but also readily available to them or any authorized third party with whom they wish to share their data. In striking this balance and committing to the secure delivery of AMI, the Company focuses on data privacy principles and a risk-based framework for maintaining privacy protections. The Data Governance Plan includes further detail of the Company's approach to data, privacy, and its commitment to cybersecurity, including discussions of: customer data; system data, data sharing; Green Button Connect My Data ("Green Button Connect"); home-area networks ("HAN"); and data privacy, security and protection.

2. Energy Data

There are two broad categories of energy data covered by this plan: 1) customer energy usage data; and 2) system data. Customer energy usage data includes a customer's electric usage as recorded at the meter. 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 to 45 minutes. Customers will also have the option to connect directly to the AMI meters using a HAN and receive near real-time energy usage data, which they can then share with authorized third parties using Green Button Connect.

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. System data can be accessed using the Company's Massachusetts System Data Portal.

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 AMI.[1] DOE found that "utilities need access to this energy consumption data for operational purposes…."[2] Likewise, "residential and commercial consumers should be able to access their energy consumption data and decide whether to grant access to third parties."[3]

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."[4] 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]."[5]

This Data Governance 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.

3.1 Customer Data

As described in the Company's AMI Customer Engagement Plan, the Company will enable customers to access their energy usage data and empower them to realize 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;

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[1] 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*"); *see also* DOE, *Informing Federal Smart Grid Policy: The Communications Requirements of Electric Utilities* (October 5, 2010) *available* https://www.energy.gov/gc/services/smartgrid-information.
[2] DOE, *Energy Data Access Report* at 3.
[3] *Id.*
[4] *Id.* at 10.
[5] *Id.* at 11.

- Enable access to that data via the CEMP;
- Provide opportunities for customers to enroll in potential future time-varying rate ("TVR") programs;
- Facilitate data sharing with authorized third parties through Green Button Connect; and
- Continue to protect the privacy and security of customer data through all phases of AMI deployment.

The Company's *Smart Meter Information Privacy Statement* affirms 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 AMI-enabled data access channels. 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 Enhancing Customer Access to Energy Usage Data with AMI

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 My Data ("Green Button Download"), or by contacting National Grid directly. The Company also provides historical energy usage as part of the customer's bill each month.

AMI will transform this experience through four advanced metering elements. As shown in Figure 3-1, the four elements establish a pipeline for customer data:

1) An integrated system of smart electric meters 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 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.

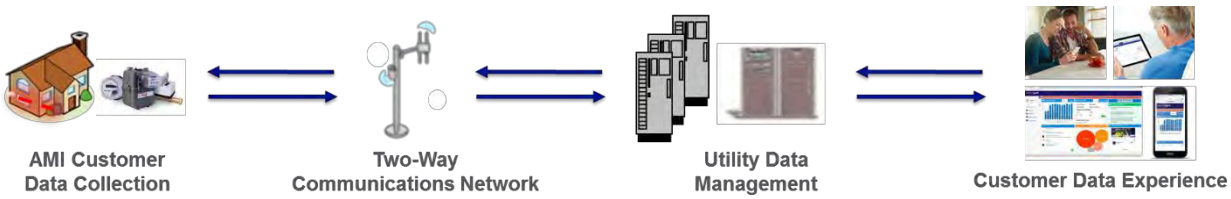

Figure 3-1: Customer Meter Data Access

AMI technology will capture 15-minute interval electric energy usage data from the meter and transmit that data every 30 to 45 minutes to the CEMP. Bill-quality data will be available every 24 hours. This is made possible by utilizing a mesh communications network and/or cellular network (in areas unsuitable for mesh) 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 Green Button Connect functionality, where, with customer consent, it can be shared with authorized third parties).

As shown in Table 3-1, the Company's AMI solution the Company is proposing provides access to energy usage information for all customer classes. The first two channels, the CEMP and Green Button Connect, require the meter usage data to traverse the end-to-end AMI 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 via the HAN. All three channels and their respective capabilities will be available to customers when they receive their new AMI 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** • **This same information will be available in bill-quality form within 24 hours.**
Green Button Connect	**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 AMI 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 Green Button Connect 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 are 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.

As part of the deployment and implementation efforts, the Company is planning for 18 months of back-office work prior to meter installation. The back-office work for the CEMP will run concurrently with back-office systems implementation and detailed design work. The CEMP-related work will focus on detailed design and development of the main features, followed by testing, implementation, and deployment in advance of the initial AMI installation. This will ensure that the CEMP is operational and ready for customers when new AMI meters are deployed.

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.

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 automated meter reading ("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. 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.

3.1.2 Data Sharing with Third Parties

Today, National Grid shares energy usage data with third parties in various formats (*e.g.*, XML, Excel, electronic data interchange ("EDI"),[6] and via open application programming interfaces ("APIs")), where the data can be aggregated at the feeder level, and often anonymized for use as part of the Company's energy efficiency and demand response programs, as part of pilots, or in non-wires alternative ("NWA") opportunities. To the extent the Company shares such data with third parties, it does so pursuant to contractual obligations, including data security agreements ("DSAs"), non-disclosure agreements ("NDAs"), and other contractual terms and conditions to ensure customer data is protected, secure, and used only for authorized purposes.

As noted, National Grid is also proposing to implement the national Green Button Connect standard as part of its AMI deployment. Green Button Connect will provide customers the

[6] EDI is a platform for the structured transmission of data between organizations by electronic means.

ability to share their energy usage and billing data with authorized third parties. Currently, the industry-led Green Button initiative is the most common method for customers to grant access to their data. Green Button Download and Green Button Connect solutions eliminate the need for third-party service providers to support various utility protocols, and they streamline the customer authorization process.

Many utilities, including National Grid, have implemented the Green Button Download functionality (*see* Figure 3-3). 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.

Figure 3-3: Green Button Download

Green Button Connect functionality takes this process further by allowing customers to automate the data sharing process. With Green Button Connect, customers can securely authorize both National Grid and designated third parties to send and receive data on the customer's behalf. The Company's Upstate New York affiliate is currently working with peer utilities to develop a streamlined onboarding process in hopes of making it even easier for customers and third parties to share data using Green Button Connect. The Company will leverage any learnings from its affiliate's experience to support the enablement of Green Button Connect in the Commonwealth.

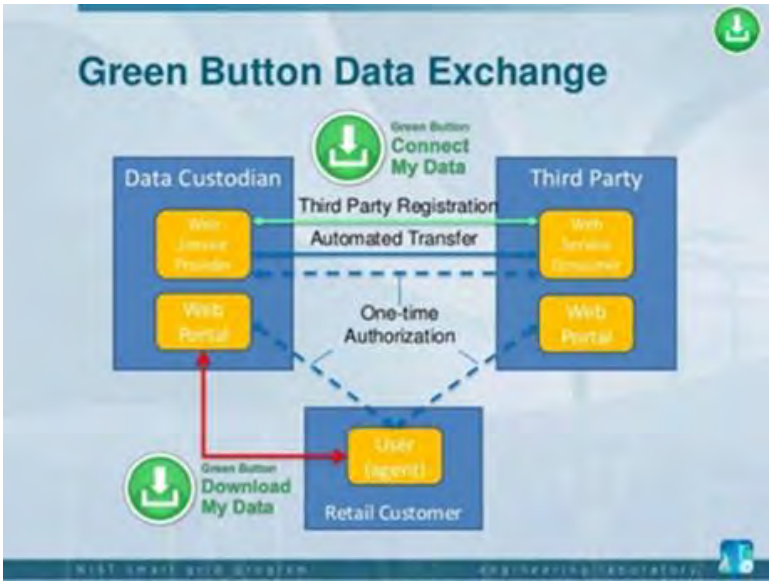

Figure 3-4: Green Button Connect – Data Exchange

In general, the onboarding process will involve third parties submitting Green Button Connect registration form, followed by a utility representative reviewing the form and contacting the third party regarding next steps (*see* Figure 3-4). Once the initial steps are complete, third parties will execute the required DSA, vendor risk assessment form, and registration forms (*see* Figure 3-5, below). The third party will then be listed on the Green Button Connect 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.

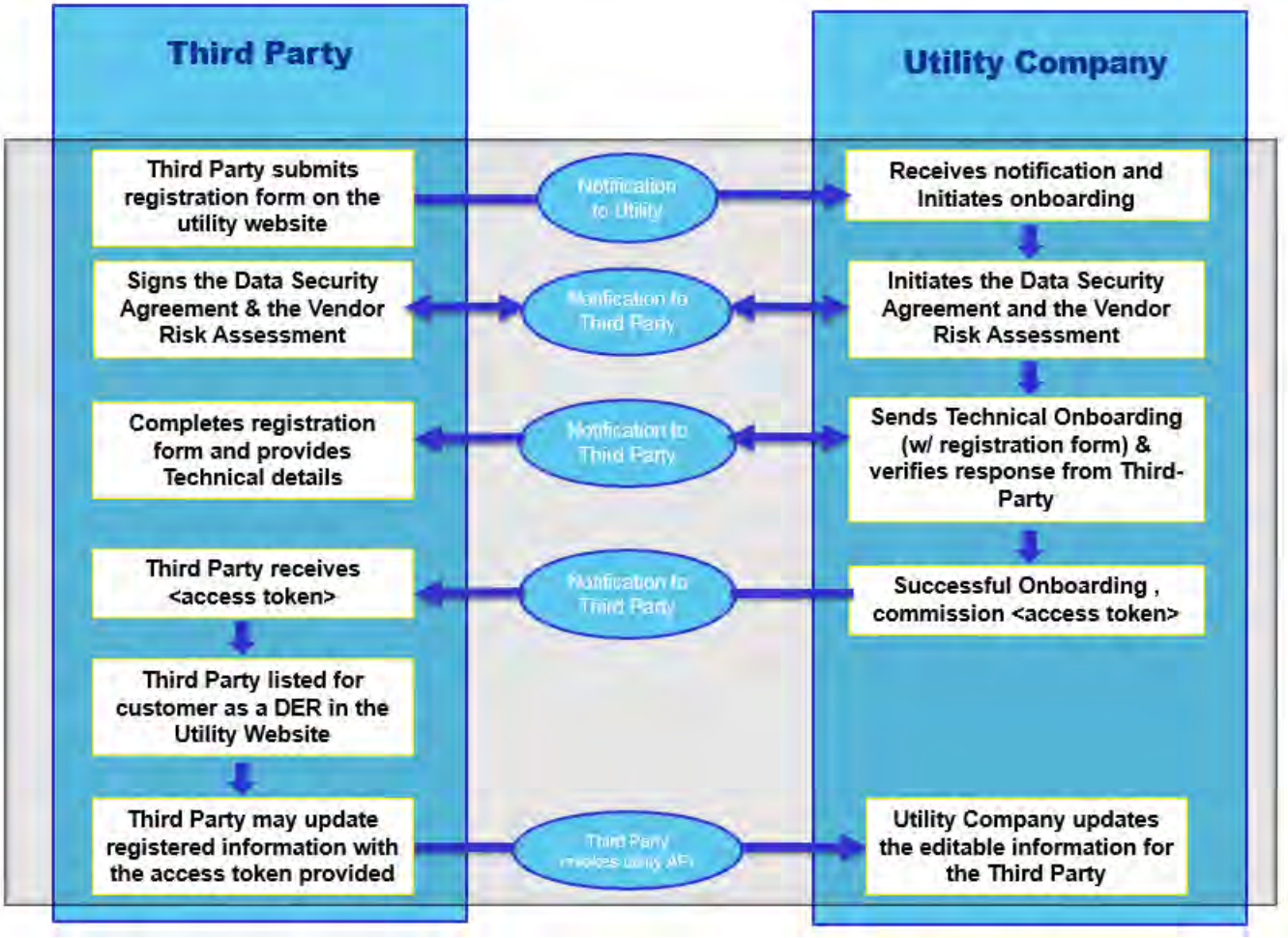

Figure 3-5: Green Button Connect Third Party Onboarding Process

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. Figure 3-6 is a depiction of the two means by 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.

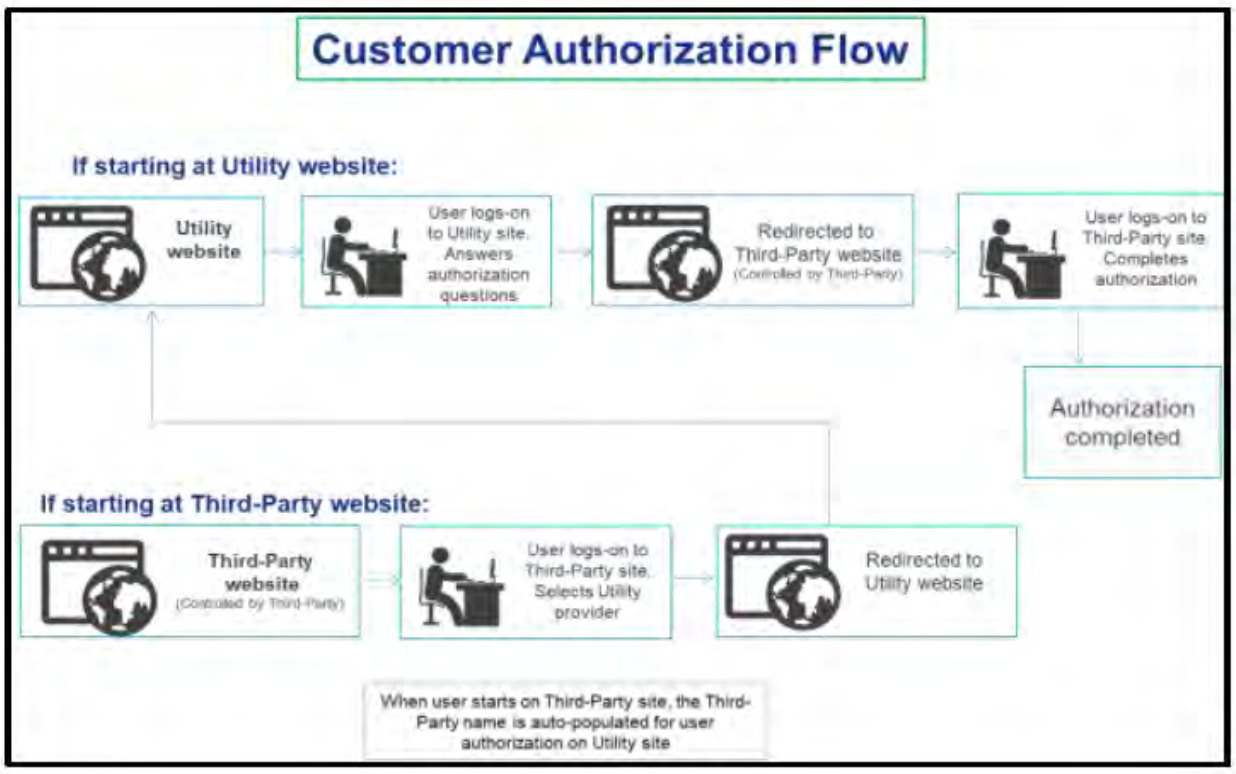

Figure 3-6: Green Button Connect Authorization Process Flow

3.1.3 Customer Access to Energy Usage Data via the HAN

The AMI solution will be designed to enable customers to connect to a HAN via WiFi and/or other commonly used communication protocols (*see* Figure 3-7). 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 have increased visibility into their energy usage and to share data with third parties.

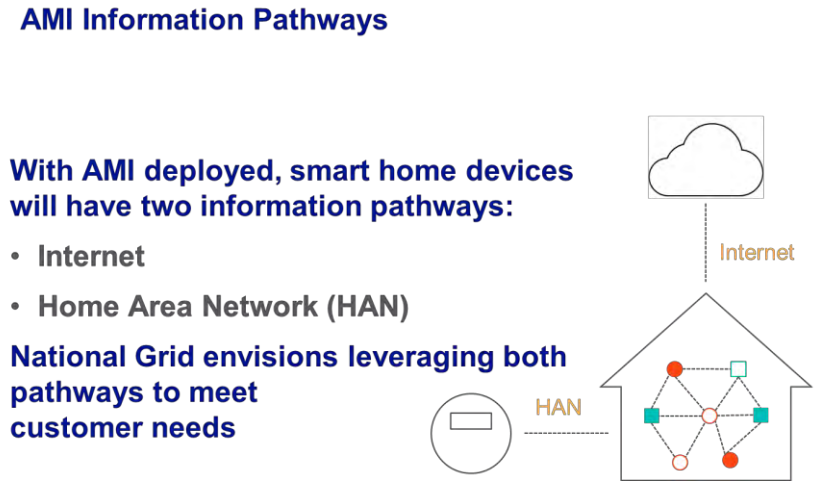

Figure 3-7: AMI Data/Information Pathways

Once AMI is deployed, future use cases can leverage the foundational infrastructure and capabilities to provide new customer solutions where feasible. For example, through the establishment of a HAN, 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 HAN can provide a secure network infrastructure to automate end-user response to potential 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 set points to reduce peak demand during peak hours on particularly hot and humid summer days.

Although the provision of in-home technologies is not included within the scope of the Company's AMI implementation plan, it will continue to promote the use of such technologies through its evolving energy efficiency and demand response programs. The Company's AMI implementation 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.

For a customer to connect a HAN-enabled 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 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 their HAN device, such as an in-home display or home energy management system. In this way, the Company can facilitate customer management of the total energy bill through the secure use of HAN technology to receive real-time energy usage information.

3.2 System Data

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 become more complicated as more DERs are integrated. Having detailed information about how electricity is consumed is key to meeting customer reliability needs.

As stated in D.P.U. 20-69-A, "In approving the Companies' grid modernization plans, the Department concluded that the grid-facing investments would make measurable progress towards meeting the Department's grid modernization objectives by reducing outages and optimizing distribution system performance, optimizing system demand, and integrating distributed energy resources."[7] AMI can further enhance the grid modernization investments in the following ways:

- **Customer Information:** AMI provides access to timely, granular energy usage information for all customer classes through the three primary channels mentioned above: 1) the CEMP; 2) Green Button Connect, which will be accessible from the CEMP; and 3) directly from the meter through a HAN. AMI 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:** AMI provides 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:** AMI improves operational efficiency by enabling the Company to reduce operation and maintenance costs associated with AMR meter reading, investigations and visits to connect and disconnect service.

- **Observability (Monitoring & Sensing):** AMI 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.

[7] D.P.U. 20-69-A at 3.

- **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 on a feeder to achieve optimal CVR performance. On average, the Company expects a 3 percent reduction in energy and peak demand on the targeted feeders. An incremental 1 percent improvement is expected from integrating granular AMI 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 AMI 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 advanced distribution management system ("ADMS") and/or DER management system ("DERMS")) to avoided thermal or voltage constraints rather than investing in traditional solutions (*e.g.*, reconductoring, substation upgrades) to relieve the constraints.

- **Grid Optimization:** AMI 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 AMI data is not the same as operational Supervisory Control and Data Acquisition ("SCADA") data from advanced field devices, AMI 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. AMI 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:** AMI can provide 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. When deployment is complete, AMI can also provide 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. AMI 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.

In addition, to facilitate the management and sharing of system data, the Company has developed the Massachusetts System Data Portal that can be accessed online.[8] The System Data Portal Includes the following types of system data:

- Company reports (*e.g.,* annual reliability reports, and planning processes and criteria);
- An overview of distribution assets (a geographic overview of distribution circuits);
- Heat maps (a geographic representation of circuit loading);
- Hosting capacity maps (a geographic representation of ER hosting capability by distribution feeder); and
- Major storms – feeder outages.

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 Massachusetts hosting capacity information. From this opening view the user can view or select a specific location to get more detailed information.

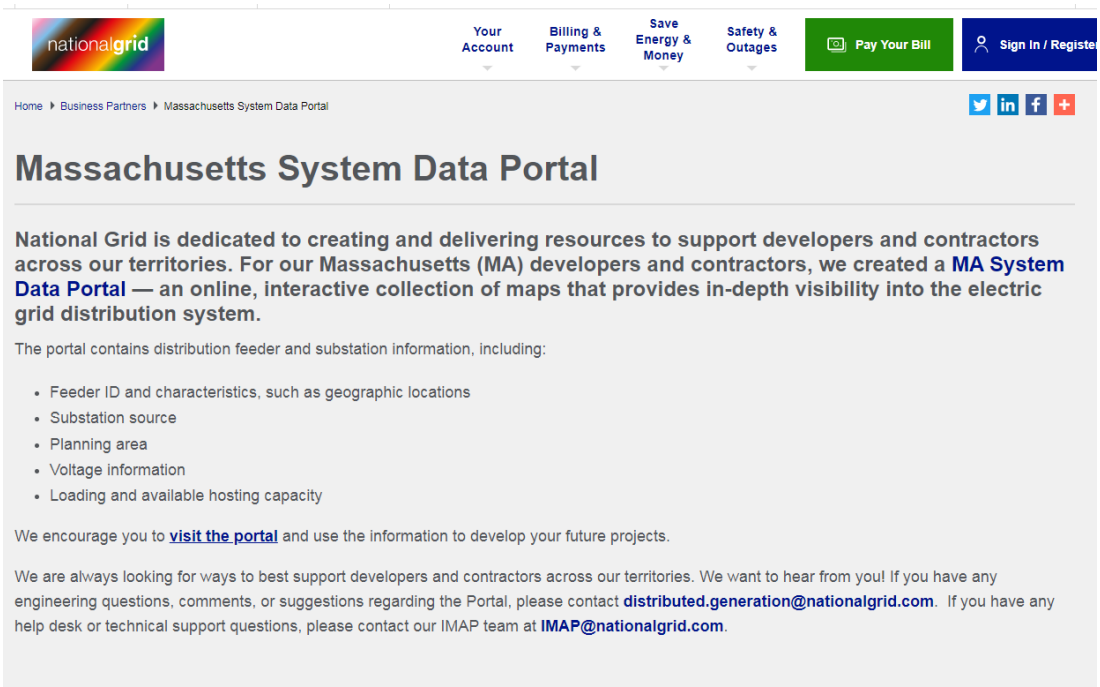

Figure 3-8: National Grid Website Landing Page to the Massachusetts System Data Portal

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

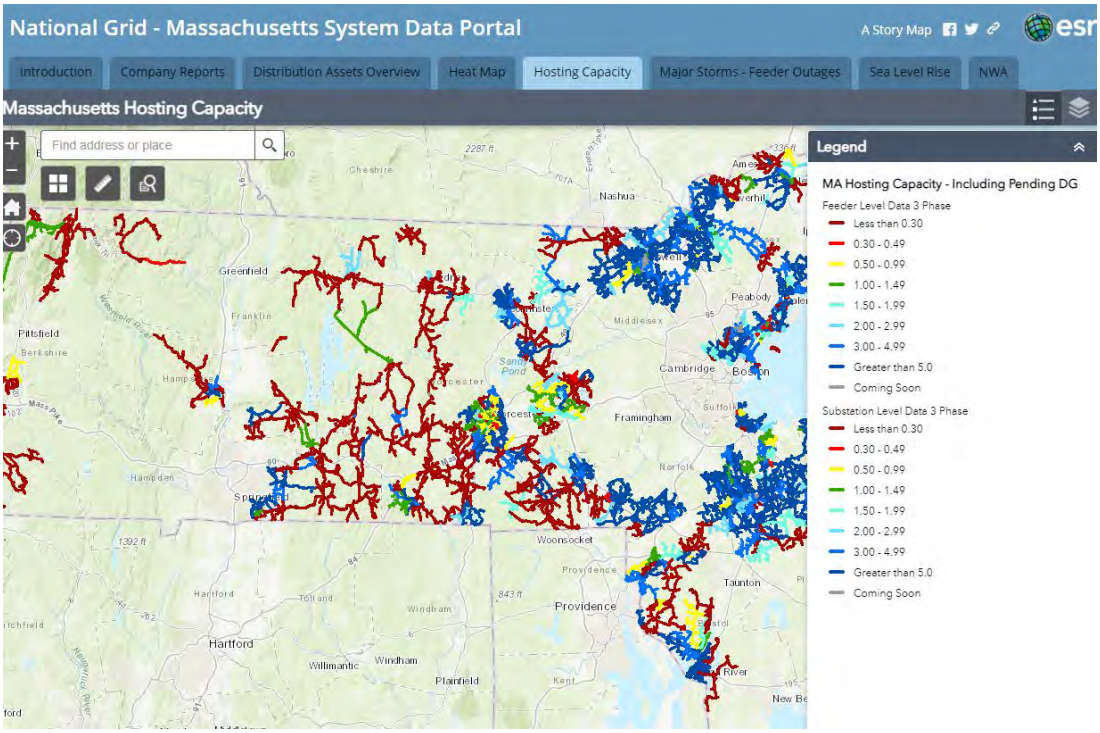

Figure 3-9: Massachusetts System Data Portal Hosting Capacity Screen Shot

4. Data Privacy, Security, and Protection

National Grid is committed to protecting all types of data generated by customers and system operations (*see* Figure 4-1). This section provides an overview of the Company's data privacy policies, standards, and guidelines.

Will these meters impact your privacy?

National Grid abides by the strictest guidelines for customer data privacy, data security and safety for our customers and employees.

The Company has protected private customer account data for decades, always improving processes and systems to meet the changing technologies. The Company will continue to do so as new advanced technologies are offered to customers.

Robust security ensures the data is safe and consumers are protected. All data transmitted via smart meters is encrypted to protect customer information.

Image Source: masstlc.org

National Grid will only be collecting smart meter energy usage data that:

- is reasonably required to provide utility services to customers
- is approved by regulatory agencies
- and is authorized by law

The Company does not collect personally identifiable information through the customer's smart meter

Figure 4-1: Data Privacy Overview

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

To that end, National Grid 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 AMI.

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 key data privacy stakeholders within National Grid allows the Company to address the latest technology and regulatory requirements related to customer data, including usage data, and any personally identifiable information ("PII"). Stakeholders, which include members of the Company's Data Privacy Community of Practice consisting of senior leaders in the Legal Department, Group Assurance (Global Data Privacy), Procurement, IT Services and Technology, and IT Digital Security and Risk (Vendor Assurance Program), provide guidance/solutions for managing and protecting information, as well as input to the Company's Data Governance/Privacy infrastructure.

Moreover, National Grid's Legal team provided guidance related to the laws and regulations of Massachusetts to ensure that National Grid's data privacy program appropriately addresses data privacy issues. The Company also has processes and solutions in place to achieve compliance with Massachusetts data privacy regulations. National Grid is prepared and ready to support the data governance requirements of the Massachusetts AMI initiative. As requirements change, the Company will address the changes with stakeholders and will implement new solutions and procedures, as necessary.

In addition, to address the consumer view into data privacy, National Grid has developed and published a Data Privacy Policy that explains how all customer data is used. The Privacy Policy can be accessed via the Company's website.[9]

4.1 Core Data Privacy Principles

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

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

The core principles of National Grid's data management standards apply to customer data that is created, collected, held, used, shared, transformed, published, or processed by National Grid; 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. National Grid'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:

1. **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).

2. **Data is fit for purpose:** Data should be of the quality required for its intended uses.

3. **Data is standardized:** In terms of its definition, format, content and categorization providing the ability to link differing forms of related data together.

4. **Data has a single authoritative source:** For all data, there shall be a single and identified authoritative (master) source.

5. **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.

6. **Data is an asset:** It has a purpose, cost value and lifecycle.

7. **Data publication:** Any data that is published should be defined, appropriate, quality assured, verifiable, and, if necessary, aggregated and anonymized.

In support of the 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.

- Restricted to designated countries unless the rights and freedom of individuals are protected.

4.2 Audits

The Company also conducts annual assessments of its data privacy control environment for the protection of customer information utilizing an independent third party. In 2018, the audit found that the Company defined and followed leading practices across the organization. The auditor further found 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 (*i.e.*, 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. In addition, the Company completed all recommendations regarding readiness for the General Data Protection Regulation ("GDPR").

4.3 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 the data lifecycle based on relevant laws and regulations and internationally recognized best practices. In implementing the framework, National Grid's employees, contractors, and vendors all have a responsibility to protect personal information as shown below in Figure 4-2.

- **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.

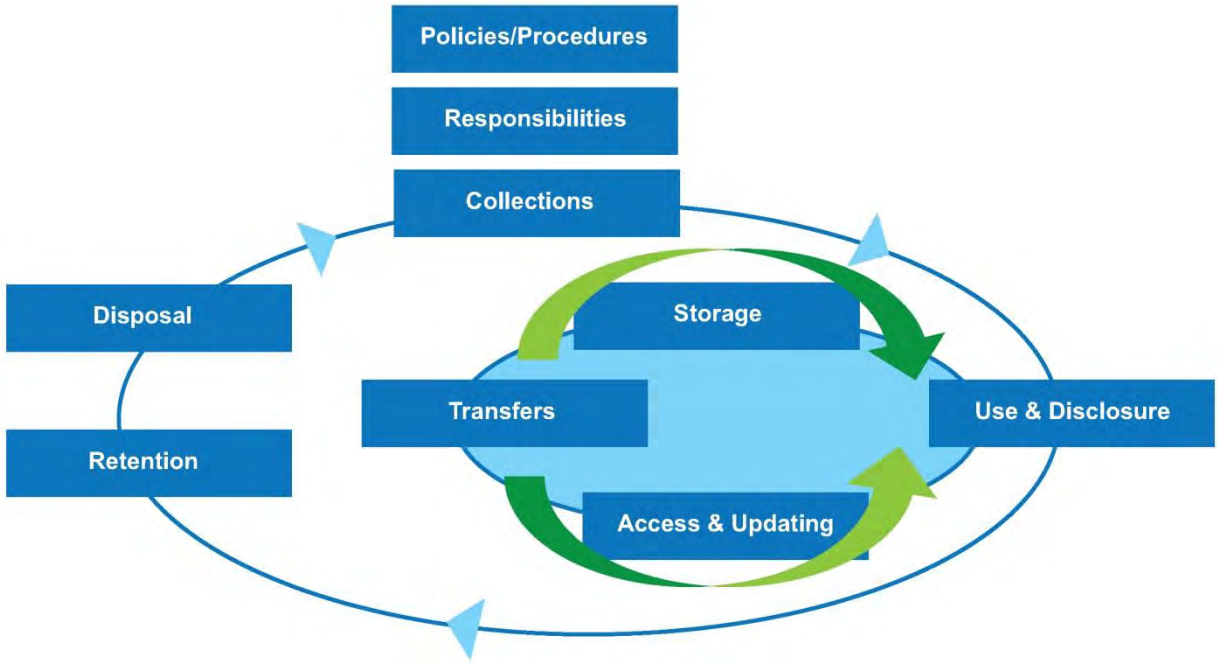

Figure 4-2: Data Lifecycle

National Grid's current Data Privacy Policy recognizes that energy usage 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, National Grid will implement controls to ensure that the processing of such information is restricted to what is necessary.

4.4 Data Governance and Privacy Program Management

National Grid'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 4-3 below, the GIRM team networks include: data privacy champions embedded in all business units controlling PII; local data controllers, 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.

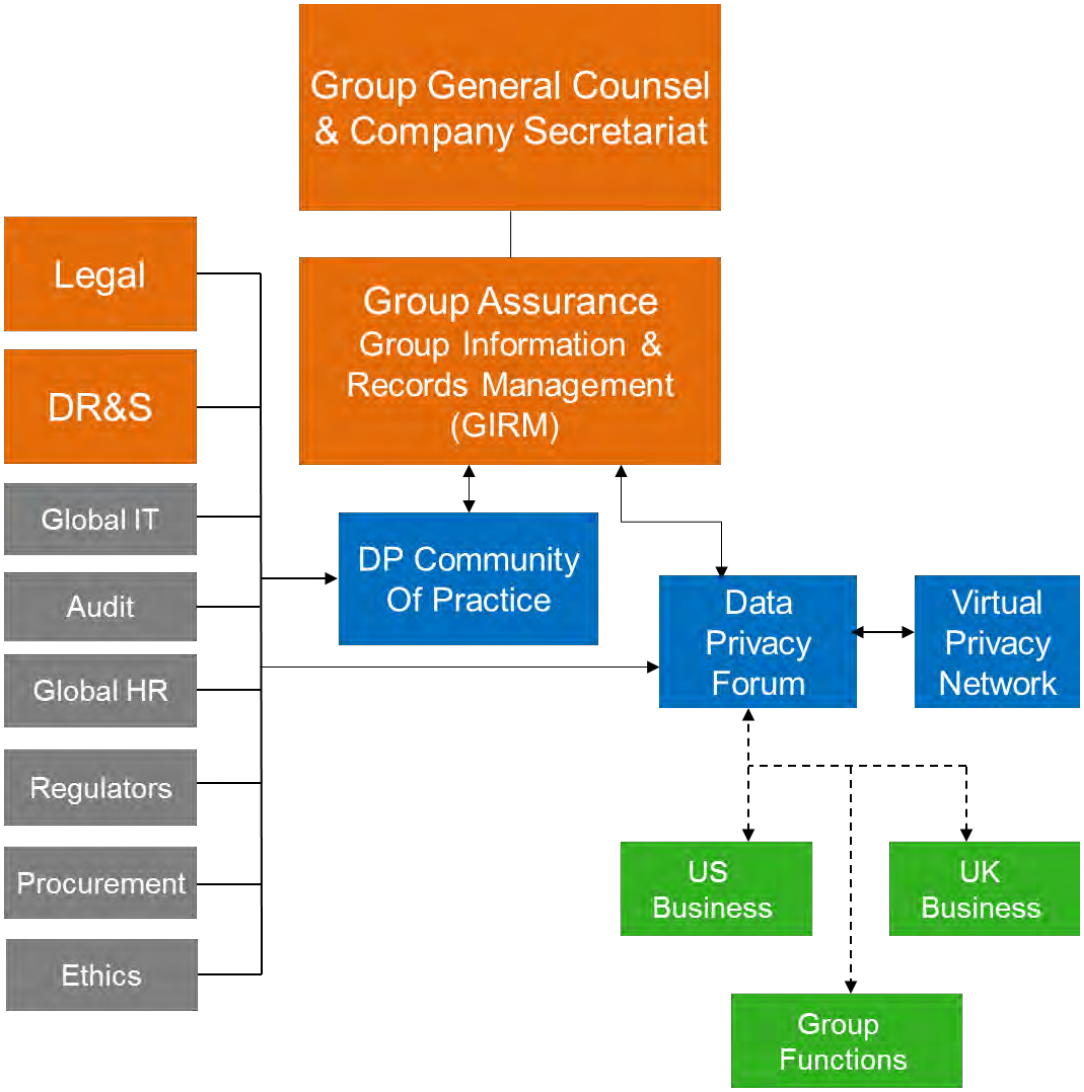

Figure 4-3: Data Privacy Governance

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 New York affiliate's Clifton Park, New York Reforming the Energy Vision Demand Reduction 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 customer billing system, CSS, where the data is combined with the applicable customer information and becomes PII. The Company's affiliate 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 4-4 and serves as a good conceptual illustration for the collection and internal management of data within a large-scale AMI deployment.

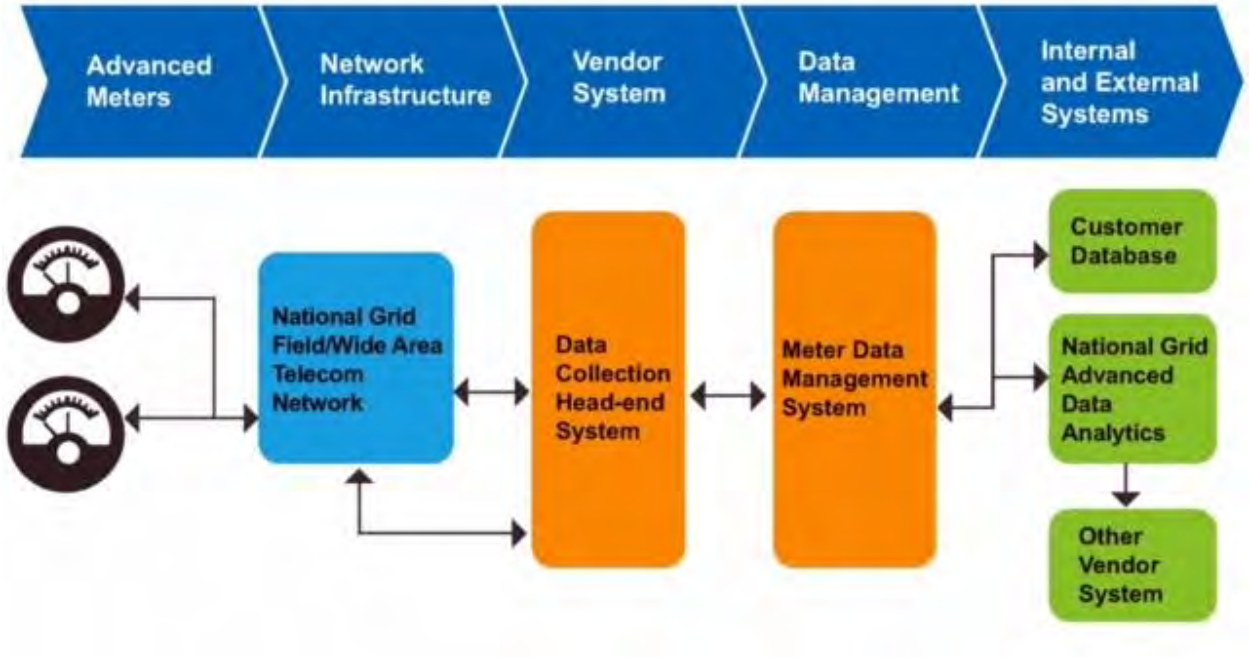

Figure 4-4: Energy Data Flow

4.5 Data Usage

National Grid 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 National Grid will only be done with the customer's consent or approval of the Department. National Grid 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 National Grid's website, and by request at any time. Please see the Smart Meter Privacy Statement (Appendix) for more details.

4.6 Third-Party Data Access

National Grid 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. National Grid's 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);
- The individual has given appropriate consent;
- 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: 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.

National Grid 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 business's 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 National Grid can provide access to customer usage information. In the event that National Grid 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 National Grid and its customers. Further, it contains provisions regarding the obligation of the third party to notify National Grid 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.

If National Grid provides access to customer usage information to an authorized third party, 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 energy service companies, 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 National Grid and its customers. Further, it contains provisions regarding the obligation of the third party to notify National Grid 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 role 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.

4.7 Data Retention

National Grid retains energy usage data for six years for the collection of the following data types:

- Meter read interval (*i.e.,* the time frame when the meter is read);
- Customer number or account number (depending on the account); and
- Actual meter read.

4.8 Regular Data Privacy Impact Assessments ("PIAs")

National Grid 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 PIAs. The PIAs are a mechanism the Company uses to assess its data collection and management practices.

4.9 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 AMI implementation.

4.10 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 on data privacy and security is also an important part of the Company's AMI Customer Engagement Plan.

4.11 Augmenting Data Privacy Principles

As National Grid moves forward with AMI, the Company will also consider how best to incorporate additional high-level principles of conduct for both utilities and third parties.[10] Such principles could augment the Company's existing policies, procedures, and statements, in particular:

- **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 DOE Voluntary Code of Conduct).

4.12 Incident Responses for PII Breaches

National Grid'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 different breach scenarios, including a Privacy Incident Playbook, which sets out how National Grid would deal with a breach response and a notification event.

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

The management of incidents involving personal information often requires close coordination among personnel from across the organization, such as the Chief Information Officer, Chief Risk 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.

5. Conclusion

National Grid's comprehensive AMI Data Governance Plan provides the standards and principles for data access, privacy, security, management, and sharing. It also details how the Company plans to create new value-added data channels, platforms, and means to share AMI-enabled customer data and utilize AMI-enhanced system data to take further meaningful steps toward achieving shared clean energy goals and enabling customers to realize the benefits AMI can enable.

6. 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 used in many 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 by providing them 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 meters.

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 mailing the Company to request the data; or
- By emailing 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: 1) 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 2) 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: _____

Exhibit NG-AMI-5 CONFIDENTIAL

AMI Benefit-Cost Analysis Model

(See Excel file)

Exhibit NG-AMI-6

Model Advanced Metering Infrastructure Tariff

MODEL ADVANCED METERING INFRASTRUCTURE TARIFF

1.0 APPLICABILITY

This Advanced Metering Infrastructure ("AMI") tariff provides for the recovery of incremental costs associated with the Company's implementation and deployment of AMI as approved by the Department of Public Utilities (the "Department").

The Company's rates for retail Delivery Service are subject to adjustment to reflect the operation of this AMI tariff. The AMI Factor ("AMIF"), as defined herein, shall be applied to all retail delivery service kilowatt-hours ("kWhs") as determined in accordance with the provisions of Section 3.0 below. The AMIF shall be determined annually by the Company, subject to the Department's review and approval. The operation of this AMI tariff is subject to Chapter 164 of the General Laws.

2.0 DEFINITIONS

2.1 Accumulated Deferred Income Taxes (ADIT) means the accumulated deferred income taxes associated with the Company's cumulative Eligible Investments as of the end of the respective AMI Investment Year. For the year in which the Eligible Investment was placed into service, the accumulative deferred income taxes will be determined on a monthly basis. The accumulated deferred income taxes for subsequent years shall be calculated based upon the average the beginning and ending calendar year balances.

2.2 Accumulated Reserve for Depreciation (ARD) means the Accumulated Reserve for Depreciation, including net salvage, associated with Company's cumulative Eligible Investments as of the end of the respective AMI Investment Year. For the year in which the Eligible Investment was placed into service, the Accumulated Reserve for Depreciation will be determined on a monthly basis. The Accumulated Reserve for Depreciation for subsequent years shall be calculated based upon the average of the beginning and ending calendar year balances.

2.3 Allowable AMI Recovery is the AMI Revenue Requirement defined below in Section 2.7. Allowable AMI Recovery can be an amount to be recovered from or credited to customers.

2.4 AMIF is the Automated Metering Infrastructure Factor that recovers or credits the annual Allowable AMI Recovery beginning _____ of each Recovery Year.

2.5 AMI Investment Year is the annual period beginning on January 1 and ending on December 31.

2.6 AMI Reconciliation is the difference between each year's Allowable AMI Recovery to be recovered or credited through the AMIF as approved by the Department and the billed revenue from the AMIF associated with the recovery or credit of the Allowable AMI Recovery. The AMI Reconciliation shall include interest on any balance, accrued at the same rate as that paid on customer deposits.

2.7 AMI Revenue Requirement is the revenue requirement associated with the Company's AMI-related plant-in-service for each AMI Investment Year prior to the Recovery Year,

including cost of removal, plus Recoverable O&M Expense. For the year in which an Eligible Investment is recorded as in-service, the AMI Revenue Requirement will be calculated on a monthly basis. The AMI Revenue Requirement for subsequent years shall be calculated based upon the average of the beginning and ending calendar year balances. The AMI Revenue Requirement will be calculated to recover (1) the monthly revenue requirement for Eligible Investments recorded as in-service in the AMI Investment Year immediately prior to the Recovery Year; (2) the average annual revenue requirement for the calendar year ending December 31 of the AMI Investment Year two years prior to the Recovery Year, for cumulative Eligible Investments placed into service in the AMI Investment Years two years prior to the Recovery Year; (3) the annual revenue requirement for the Recovery Year on Eligible Investments recorded as in-service in the AMI Investment Year immediately prior to the Recovery Year; and (4) Recoverable O&M Expense.

2.8 Company is [insert company name].

2.9 Depreciation Expense (DEPR) is the annual depreciation expense associated with the Company's average annual cumulative Eligible Investments placed into service through the end of the calendar year prior to the Recovery Year. For the year during which the Eligible Investment is placed into service, the Company shall calculate depreciation expense for use in the AMI Revenue Requirement by (1) dividing the annual depreciation accrual rates determined in the Company's most recent base distribution rate case by 12, and (2) applying the resulting rate to the average monthly plant balances during the year. Depreciation expense for subsequent years may be calculated based on the average of the beginning and end of year plant balances.

2.10 Eligible Investments are the cumulative capitalized costs directly attributable to implementation of AMI recorded as in-service, including net salvage, and are used and useful at the end of the AMI Investment Year that is prior to the Recovery Year.

2.11 Gross Plant Investments are the capitalized costs of Eligible Investments recorded on the Company's books for Eligible Investments. Actual capitalized cost of Eligible Investments shall include applicable overhead and burden costs subject to the test provided in Section 4.0.

2.12 Pre-Tax Rate of Return (PTRR) shall be the after-tax weighted average cost of capital established by the Department in the Company's most recent base distribution rate case, adjusted to a pre-tax basis by using currently effective federal and state income tax rates applicable to the period for which the AMI Revenue Requirement is calculated.

2.13 Property Tax Expense (PTE) means the property taxes calculated based on Eligible net Investments multiplied by the Property Tax Rate. Property taxes will be excluded in the AMI Revenue Requirement in the first Recovery Year following the AMI Investment Year in which the eligible taxable plant went into service. Property taxes will be included in the AMI Revenue Requirement beginning in the second Recovery Year at 50% of the annual property tax amount. In subsequent years, the AMI Revenue Requirement will reflect a full year of property taxes.

MODEL ADVANCED METERING INFRASTRUCTURE TARIFF

2.14 Property Tax Rate is the Company's composite property tax rate determined in the Company's most recent base distribution rate case, calculated as the ratio of total annual property taxes paid to total taxable net plant in service.

2.15 Rate Base (RB) is the investment value upon which the Company is permitted to earn its authorized rate of return.

2.16 Recoverable O&M Expense (O&M) is the incremental non-recurring O&M expense that is incurred by the Company as a result of implementing AMI, incurred directly by the Company or charged to the Company by its service company, including the amortization of capitalized information systems costs billed to the Company by its affiliate and recorded by the Company as expense, the cost of which is not being recovered through another cost recovery mechanism. Recoverable O&M Expense is the actual monthly AMI-related O&M expenses incurred in the AMI Investment Year prior to the Recovery Year. Recoverable O&M Expense will exclude pension and post-retirement benefits other than pension costs recovered through other reconciling mechanisms.

2.17 Recovery Period is the 12-month period during which the AMIF is in effect beginning on _____ and ending _____ of each year.

2.18 Recovery Year is the calendar year in which the AMIF becomes effective.

3.0 AUTOMATED METERING INFRASTRUCTURE FACTOR ("AMIF")

3.1 Rate Formula

$$AMIF_c = \frac{(AMI\text{-}ALLOW + PPRA) \times DRA_c}{FkWh_c}$$

Where:

c	Designates a separate factor for the following rate classes: [list rate classes].
$AMIF_c$	The Automated Metering Infrastructure Factor, by rate class, as defined in Section 2.4.
AMI-ALLOW	The Allowable AMI Recovery as defined in Section 2.3.
PPRA	The AMI Reconciliation Amount as defined in Section 2.6. Interest calculated on the average monthly balance using the customer deposit rate, as outlined in 220 CMR 26.09, shall also be included in the PPRA.
DRA_c	The Distribution Revenue Allocator representing the percentage of final revenue requirement allocated to each rate class as determined in the Company's most recent general rate case as follows:

[list of rate classes and allocation percentages]

MODEL ADVANCED METERING INFRASTRUCTURE TARIFF

$FkWh_c$ The forecasted kWh to be delivered to the Company's retail delivery service customers.

3.2 Request for GMFs

The Company shall submit annually to the Department its proposed AMIFs by _____ to become effective for usage on and after _____.

3.3 Application of AMIFs on Customer Bills

For billing purposes, the AMIF will be included with the distribution kWh charge on customers' bills.

4.0 OVERHEAD AND BURDEN ADJUSTMENTS

For purposes of AMIF calculations, the actual overhead and burdens shall be reduced to the extent that actual O&M overhead and burdens in a given year are less than the amount included in base distribution rates as determined in the Company's most recent base distribution rate case. Such reduction shall be the difference between the actual O&M overhead and burdens and the amount included in base distribution rates.

In addition, the percentage of capitalized overhead and burdens assigned to AMIF projects shall be set equal to the ratio of AMIF to non-AMIF direct costs in any given year.

5.0 FILING WITH THE DEPARTMENT

5.1 Annual AMI Cost Recovery Filing

The annual AMI cost recovery filing shall be submitted to the Department by _____ and include, but not be limited to:

(1) Project documentation of all Eligible Investment recorded as in-service by the Company [or its affiliate] during the Prior AMI Investment Year;
(2) Documentation supporting non-recurring O&M expense as part of Recoverable O&M Expense;
(3) The AMI Reconciliation; and
(4) Bill impacts.

Exhibit NG-AMI-7

Model Residential Advanced Metering Reading Opt-Out Provision Tariff (clean)

MASSACHUSETTS ELECTRIC COMPANY
NANTUCKET ELECTRIC COMPANY

RESIDENTIAL ADVANCED METER READING OPT-OUT PROVISION

Availability

Service under this provision is available to residential customers receiving metered retail delivery service under the Company's Rate R-1, Regular Residential tariff, and Rate R-2, Residential Low-Income tariff.

Description of Services

Unless otherwise determined by the Company, all residential premises shall be equipped with a meter that employs advanced metering technology (either Automatic Meter Reading ("AMR") or Advanced Metering Infrastructure ("AMI") technology) utilizing radio frequency or cellular transmitters to allow the Company to obtain meter readings remotely. However, residential customers may choose to "opt-out" by either notifying the Company of their request to not having an advanced meter installed at their location or having their advanced meter replaced with a non-advanced meter. At the customer's request, the Company shall exchange the existing advanced electric meter at the customer's location and install a non-advanced meter for the purpose of billing electric service to the customer. Upon receipt of the Customer's request, the Company shall use its best efforts to exchange meters as soon as possible after receiving the request. However, the Company reserves the right to flexibility in scheduling the meter exchange in an appropriate manner based on resource availability. Customers who choose to opt-out will be charged an initial fee for the removal of the existing advanced meter and the installation of the non-advanced meter, pursuant to the Schedule of Charges below. Customers who choose to opt-out will also be charged a monthly meter reading fee for the non-advanced meter, pursuant to the Schedule of Charges below. If the Company is unable for any reason to read the meter on the regularly scheduled monthly read date, the Company shall make a reasonable estimate of the consumption of electricity during those months when the meter is not read, based on available data, and such estimated bills shall be payable as rendered. The monthly meter reading fee will be charged on estimated bills. The Company will not assess any fees until after the Company has installed the non-advanced meter.

Any opt-out customer who subsequently wishes to have an AMI meter installed or re-installed will be charged a "re-installation fee" pursuant to the Schedule of Charges below. The re-installation fee will be charged for the removal of the non-advanced meter and the installation of an AMI meter. After an AMI meter has been re-installed, the Company will terminate billing the monthly meter reading fee.

MASSACHUSETTS ELECTRIC COMPANY
NANTUCKET ELECTRIC COMPANY

RESIDENTIAL ADVANCED METER READING OPT-OUT PROVISION

Schedule of Charges

The Advanced Meter Opt-Out Charges are as follows:

Removal of Advanced Meter/Installation of Non-Advanced Meter	$26.00
Monthly Meter Reading	$11.00
Re-installation of Advanced Meter	$26.00

Terms and Conditions

The Company's Terms and Conditions for Distribution Service in effect from time to time where not inconsistent with any specific provisions hereof, are a part of this tariff.

Exhibit NG-AMI-8

Model Residential Advanced Metering Reading Opt-Out Provision Tariff (redlined)

MASSACHUSETTS ELECTRIC COMPANY
NANTUCKET ELECTRIC COMPANY

RESIDENTIAL ~~AUTOMATIC~~ADVANCED METER READING OPT-OUT PROVISION

Availability

Service under this provision is available to residential customers receiving metered retail delivery service under the Company's Rate R-1, Regular Residential tariff, and Rate R-2, Residential Low-Income tariff.

Description of Services

Unless otherwise determined by the Company, all residential premises shall be equipped with a meter that employs advanced metering technology (either Automatic Meter Reading ("AMR") or Advanced Metering Infrastructure ("AMI") technology) utilizing radio frequency or cellular transmitters to allow the Company to obtain meter readings remotely. However, residential customers may choose to "opt-out" by either notifying the Company of their request to not having an advanced meter installed at their location or having their ~~AMR~~advanced meter replaced with a non-~~AMR~~advanced meter. At the customer's request, the Company shall exchange the existing ~~AMR~~advanced electric meter at the customer's location and install a non-~~AMR~~advanced meter for the purpose of billing electric service to the customer. Upon receipt of the Customer's request, the Company shall use its best efforts to exchange meters as soon as possible after receiving the request. However, the Company reserves the right to flexibility in scheduling the meter exchange in an appropriate manner based on resource availability. Customers who choose to opt-out will be charged an initial fee for the removal of the existing ~~AMR~~advanced meter and the installation of the non-~~AMR~~advanced meter, pursuant to the Schedule of Charges below. Customers who choose to opt-out will also be charged a monthly meter reading fee for the non-~~AMR~~advanced meter, pursuant to the Schedule of Charges below. ~~The Company, at its option, may choose to read the non-AMRmeter less frequently than once per month. In that case, or i~~If the Company is unable for any reason to read the meter on the regularly scheduled monthly read date, the Company shall make a reasonable estimate of the consumption of electricity during those months when the meter is not read, based on available data, and such estimated bills shall be payable as rendered. The monthly meter reading fee will be charged on estimated bills. The Company will not assess any fees until after the Company has installed the non-~~AMR~~advanced meter.

Any opt-out customer who subsequently wishes to have an ~~AMR~~AMI meter installed or re-installed will be charged a "re-installation fee" pursuant to the Schedule of Charges below. The re-installation fee will be charged for the removal of the non-~~AMR~~advanced meter and the installation of an ~~AMR~~AMI meter. After an ~~AMR~~AMI meter has been re-installed, the Company will terminate billing the monthly meter reading fee.

MASSACHUSETTS ELECTRIC COMPANY
NANTUCKET ELECTRIC COMPANY

RESIDENTIAL AUTOMATICADVANCED METER READING OPT-OUT PROVISION

Schedule of Charges

The AMRAdvanced Meter Opt-Out Charges are as follows:

Removal of AMRAdvanced Meter/Installation of Non-AMRAdvanced Meter	$26.00
Monthly Meter Reading	$11.00
Re-installation of AMRAdvanced Meter	$26.00

Terms and Conditions

The Company's Terms and Conditions for Distribution Service in effect from time to time where not inconsistent with any specific provisions hereof, are a part of this tariff.