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Senior Counsel II

July 27, 2017

VIA ELECTRONIC DELIVERY

Honorable Kathleen H. Burgess
Secretary
New York State Public Service Commission
Three Empire State Plaza, 19th Floor
Albany, New York 12223-1350

RE: Case 16-G-0058 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service

Case 16-G-0059 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service

NATIONAL GRID: GAS REV DEMONSTRATION PROJECTS – IMPLEMENTATION PLANS

Dear Secretary Burgess:

KeySpan Gas East Corporation d/b/a National Grid and The Brooklyn Union Gas Company d/b/a National Grid NY (collectively "National Grid") hereby submit for filing four (4) Gas REV Demonstration Project Implementation Plans as approved by the Commission in the December 16, 2016 *Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans* in Cases 16-G-0058 and 16-G-0059. The four (4) projects are as follows:

- Gas Demand Response – New York City and Long Island
- Flood Zone Packages – New York City and Long Island
- Geothermal Demonstration – Long Island
- MicroCHP Demonstration – New York City and Long Island

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National Grid looks forward to continuing to work collaboratively with the New York State Department of Public Service Staff as it proceeds with the implementation of these Gas REV Demonstration Projects.

Respectfully submitted,

/s/ Janet M. Audunson

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GAS REV DEMONSTRATION PROJECTS - IMPLEMENTATION PLANS

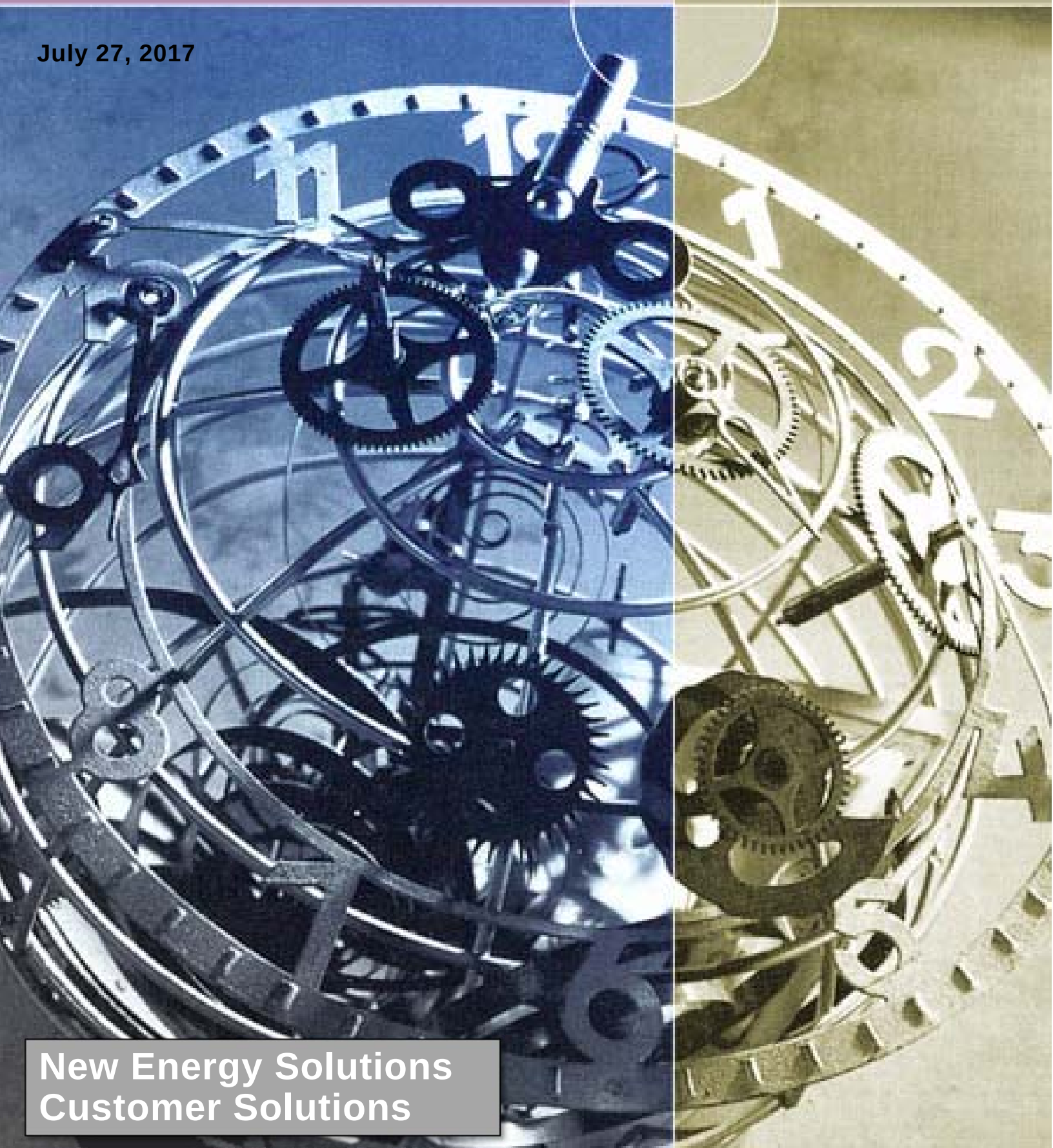
Implementation Plans for Gas REV Demonstration Projects

Gas Demand Response in New York City and on Long Island

nationalgrid

HERE WITH YOU. HERE FOR YOU

July 27, 2017



New Energy Solutions
Customer Solutions

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Executive Summary

The Brooklyn Union Gas Company d/b/a National Grid NY ("KEDNY") and KeySpan Gas East Corporation d/b/a National Grid ("KEDLI") (collectively "National Grid" or the "Companies") have used a form of demand response as a gas system management tool for decades. In New York City and on Long Island, both interruptible and temperature controlled ("TC") service is offered by tariffs whereby customers switch to a back-up fuel either upon request or automatically. However, new customer growth, extreme weather, growth of the use of gas for power generation, and a sustained price advantage for natural gas compared to fuel oil mean that the need for a responsive gas system stretches the benefits offered by interruptible and TC customers. These challenges warrant an investigation into an alternative offering. The project offering to be tested will be a customer-centric, voluntary gas demand response ("DR") program targeting large, commercial, firm gas customers in locations prioritized by predicted distribution constraints (the "Project"). Current interruptible or TC customers may also be included in the Project. The introduction of a DR offering should allow the Companies to operate their assets in the most efficient way possible. Furthermore, reducing peak demand may delay the need for the gas system to be expanded to meet the needs of our customers.

Prospective customers will be asked to participate in a new program whereby they propose a financial incentive to defer a pre-determined portion of their peak winter gas demand. During the pilot, this demand reduction will be accomplished through remote control by the Companies and is expected to vary with the nature of the customer's business. Unlike curtailments for interruptible or TC customers, the Project is being designed so that the DR activations will be predictable in terms of length and time of day which will allow participating customers to shift their demand without the need for back-up fuels. By simply shifting their usage, the Project can eliminate the need for dual fuel systems that will cause customers to rely on less-clean fossil fuels.

The Project is a test-and-learn demonstration and was designed in accordance with the principles of the New York State Public Service Commission's ("Commission" or "PSC") Reforming the Energy Vision ("REV") Proceeding.[1] The Project was approved through the 2016 KEDNY and KEDLI rate proceedings.[2] The purpose of this implementation plan is to describe National Grid's detailed execution plans for the Project.

The Project was designed to align within REV policy outcomes in several ways, including the potential to establish and "animate markets" for peak gas demand. National Grid believes that it is possible to create more mutually beneficial relationships with customers by leveraging critical infrastructure, customer outreach and engagement, energy insights, and actionable information. Toward that end, the following attributes of

[1] Case 14-M-0101, Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision ("REV Proceeding").

[2] Case 16-G-0058, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service*; Case 16-G-0059, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service et al.*, Joint Proposal (filed September 7, 2016), Sections 9.9 & 13; and Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

a successful gas DR program will be measured or estimated from the Project results:

- Cost per "Unit" (defined as 500 cubic feet per hour of demand reduction)
- Total Demand Reduction per Customer
- Market Penetration
- Gross Demand Reduction Potential
- Potential for Capital Deferral
- Customer Satisfaction

The results of the Project will be reported to the PSC and recommendations will be made for either a full-scale program or further study based on the results of the Project and the projected benefits and need at that time for a larger DR program.

1.00 Demonstration Project Design

The purpose of the Project is to assess the costs and benefits, for both customers and the Companies, of a DR program focused on process commercial gas customers with firm service. These costs and benefits will inform future rate design and will help National Grid to determine which offerings are most valuable to large customers. Participation in the Project will be on a voluntary basis and will involve the deferral, partial or total, of verifiable peak gas demand through direct control of customer equipment. The Project would be operationally similar to TC service offered by the Companies. As in electric DR, there will be no requirement for back-up fuel and/or systems. The Project will prioritize areas on the gas distribution system where current models and empirical data indicate pressure is projected to be at, or near, the minimum pressure for safe operations during a peak day. The incentives to motivate different customers will be determined along with the benefit to gas system planning, operations, and any other benefits.

The Project scope was developed with the intention of demonstrating a reduction of load in the NYC and LI service territories. To simplify discussions with customers, the goals of the Project have been described in terms of "Units," a unit of measure that represents 500,000 BTU per hour ("BTUH") or 500 cubic feet per hour ("cfh") or 0.5 dekatherms per hour ("DTh/hr"). The budget is based on a reduction of 160 Units for NYC (80 DTh/hr) and 120 Units for Long Island (60 DTh/hr). This represents roughly 0.14% of the peak hour load for each of these service areas. The scaled-up potential for both markets is described in Section 1.40. Based on the existing firm commercial and industrial ("C&I") population that is eligible for participation, it would be possible to achieve more than 2% reduction in peak hour load for each of the service areas through a DR program. This would more than offset the average annual peak day growth, thereby helping to create the capacity needed to add new customers to the system.

1.10 Project Component Details

1.101 Operational Logistics

There are two primary aspects to the operational part of this Project: equipment control and data measurement.

1.1011 Equipment Control

National Grid has years of experience in the electric DR world. Gas DR, however, is uncharted territory. It is not yet known how customers will respond and what their ability to shed load will be. In order for DR, whether electric or gas, to be useful, the reduction of demand must be reliable so that it can be used for planning. While we are ascertaining the ability of our customers to reduce demand over the course of the Project, equipment control will be accomplished via direct load control using a remote switching device.

A remote switching device, in this case, refers to a device that will receive a command, either via Wi-Fi or a cellular network, and affect an interruption in the operation of connected equipment. Ideally, the remote switching devices will feature two-way communication that will allow them to collect usage data as well. If the device features two-way communication, it will be connected to the gas metering equipment. The connection with gas metering would be of significant benefit when implementing dynamic load reduction in the scaled version of the Project. For the Project, all equipment will be controlled directly and the reduction will be based off of nameplate data.

The target for each participating customer will be a 25% reduction of peak load though isolation of a portion of the customer's process equipment, such as commercial ovens and laundry equipment. It is possible that a customer's heating system would be considered for participation but that will be determined on a case-by-case basis to ensure a safe operating condition.

The remote switching devices will provide direct control over individual pieces of equipment through integration with either the electronic controls for individual pieces of equipment or the building management system. Based on the experience gained as part of the Program, it is possible that National Grid will switch to a model that includes an offering for voluntary, variable, customer-controlled demand reduction, which would mirror the setup of an electric DR program. It will be essential to have the ability to verify the demand reduction to make a variable offering tenable, which is the reason for the rigorous data measurement setup in this Project.

1.1012 Data Measurement

Measurement will be based on either the pulse output of the gas meter or on the signal from the Encoder Receiver Transmitter ("ERT"). Based on the requirements that were

determined by National Grid's engineering team, this data must be recorded in intervals no larger than five (5) minutes. The data will be used to verify the demand reduction achieved by a specific participating customer. Data can be collected by the Companies during their normal meter reading processes or it can be transmitted by a supplemental device, such as a remote switching device. If customer usage data will be collected and transmitted by a remote switching device, National Grid will ensure that proper steps are taken to protect the customer's proprietary information. A process flow for the DR activation, and the corresponding data, was developed in collaboration with National Grid's Customer Meter Services, Meter Data Services, and Gas Control. The process map is shown in attached Appendix D and demonstrates the data flow for two of the vendors that were assessed to support the Project.

The data obtained from large participating customers will be advantageous to National Grid as this data will help to inform long-term planning and system operation. To the marketplace, this data represents a resource that could be managed to achieve operational and financial efficiencies, as we have seen on the electric DR side. Given the limited scale of the Program and the lack of industry experience for gas DR, the value of this data is not clear. One of the goals of the Project is to gain experience regarding the pricing and program structure needed to motivate the marketplace. In the future, especially if the Project is implemented at scale, it is envisioned that a marketplace would emerge surrounding gas DR. Until it is clear that gas DR is worthwhile, the marketplace will not develop an offering. As the service provider of last resort, National Grid will attempt to catalyze the market for gas DR.

The nature of the Project made a request for proposals ("RFP") with vendors the most logical approach. The RFP included a minimal amount of technical requirements to ensure that vendors had flexibility to propose a solution from within their slate of offerings that would best accomplish the Project's goals. The technical requirements offered to vendors were that their solution should address:

Required capabilities
- receive a signal, either via Wi-Fi or a cellular network
- interrupt the electrical controls for a piece of equipment

Optional capabilities:
- record customer usage data in intervals no larger than five (5) minutes
- control multiple pieces of equipment
- store usage information in the event of communication interruption

It is expected that customer usage data will be sent from the devices to data servers to be analyzed. These servers could be the property of National Grid or the vendor. In the case of the use of vendor servers, National Grid will ensure that data security is maintained and the appropriate Non-Disclosure Agreement is executed to protect confidential customer information.

In addition to the vendor, National Grid has explored the possibility of making use of a Demand Response Optimization and Management System ("DROMS"). Such systems can feature the ability to record a 10-day usage profile prior to an activation event, perform a regression based on weather, and forecast customer usage. This would assist with assessment of customer participation and system impacts related to the Project. Additionally, customers would be likely to have access to this data, which would make it a valuable resource for the customer and National Grid's sales teams and energy efficiency group.

1.1013 DR Season Specifics and Communication

The DR Season will run from December 1 through March 1. DR activations may be called at any time during the DR Season though it is anticipated that they will be called primarily on weekdays as that is the peak for process load. Activations will last from 6AM to 9AM and National Grid will call a maximum of six (6) events during a given DR Season. The Companies anticipate calling a minimum of four (4) events for the first DR Season to ensure that the system is functioning and to gather data that will inform years two and three of the Project.

Prior to the start of the DR season, the Company will conduct a "dry run" of the DR Systems to verify successful operation. The DR System comprises the National Grid owned control module, equipment control wiring and components, and metering equipment. This dry run will be conducted during the month of November. For the first year of the Project, a successful dry run need not include 100% of the participating customers as some might still be in the process of being connected when the dry run occurs. The dry run will be scheduled to include the maximum number of customers to the extent possible and will occur at 6AM to simulate an actual activation but the dry run will not necessarily last for the full three hours. At the Companies' discretion, the dry run can be ended after a sufficient length of time to verify system operation. Customer participation in the dry run will not be incentivized as part of the Project. A failure during the dry run, meaning either that the remote switching device fails or that the piece of customer equipment continues to operate, will require a site visit and remediation prior to the start of the DR Season. All customers will need to demonstrate a successful activation response annually before they will be eligible to earn incentives based on their successful performance during activations in the upcoming DR Season.

Customers will be notified for any DR activation at least 48 hours in advance, per regulatory requirements. When possible, notices can be issued in advance of the deadline to ensure customers have sufficient time to make any necessary changes. Customers will also be notified on the morning of the event as a reminder. Notification will occur via at least two of the three following methods: voicemail, email, and text message. Customers will be responsible for providing accurate contact information and for updating National Grid regarding any changes. Part of the dry run process will be to ensure that customers have received advance notification. Once the channels of communication have been confirmed with an individual customer via a successful notification receipt, a record of the issuance of a notification via the same protocol shall constitute an official notice. The Companies will explore the possibility of issuing

notifications with an acknowledgement functionality which would provide a more complete record.

At the end of each month of the DR Season, the Gas Demand Response Team, or other designated National Grid group, will produce a monthly report for each customer. This report will highlight the number of activations that occurred during a given month, the Unit reduction offered by the customer, and the incentive that was earned through participation. This data will also be aggregated in a "DR Season year-to-date summary" that allows the customer to know what they can expect in terms of a payment at the conclusion of the DR Season. There are several reasons that this will be valuable. First, it will give customers a sense of membership and community for their participation in the Project. Second, it will provide a forecast of the amount of money they could receive via continued participation. Third, it will motivate customers not to violate the Project rules and risk loss of payment. Finally, it will keep customers excited throughout the DR Season, which is the time when they will be inconvenienced. A short-time interval between a DR activation event and an update on a given customer's performance will help customers to associate the positive benefits of participation.

1.102 Competitive Bid Process

As part of the application for the Project, customers will be asked to submit a bid price for reduction of peak capacity for each piece of equipment they wish to be considered for participation. This bid price will be in $/Unit. As described above, a Unit will be 500,000 BTUH, 0.5 DTH per hour, or 500 cfh. For the purposes of the Project, the number of Units offered for a given piece of equipment will be determined based on the rated input BTU/hr requirements. Customers must submit, and have accepted, bids for a minimum of 1 Unit of demand reduction. Once a customer has crossed this threshold, bids for partial Units can be submitted. If the customer is submitting a bid for a piece of equipment that represents a partial Unit (*i.e.*, 100,000 BTUH represents 0.2 Units) the price must still be bid in $/Unit. The customer will be responsible for providing a bid that accurately represents their desired payment for a given piece of equipment.

The bids will be submitted for each piece of equipment or, if desired by the customer for a specific group of identical equipment (*i.e.*, multiple ovens). This will allow for the evaluation of each piece of equipment individually. Customers will bid with the understanding that they might have certain pieces of equipment approved for participation while other pieces are not selected. In no case will a customer be allowed to participate with less than 1 Unit worth of demand reduction. Selecting bids at the equipment level will allow National Grid to maximize participation in the Project which is critical for determining system impact, while also allowing the Companies to identify an appropriate market price for incentives. The level of granularity in the bidding process will afford National Grid insight into incentive pricing and participation according to both customer SIC code and equipment type. A draft of the Customer Application, Technical and Eligibility Requirements, and marketing flyer can all be found in Appendix B of this implementation plan. An excerpt from the draft Customer Application form displaying the table for incentive bids is shown below:

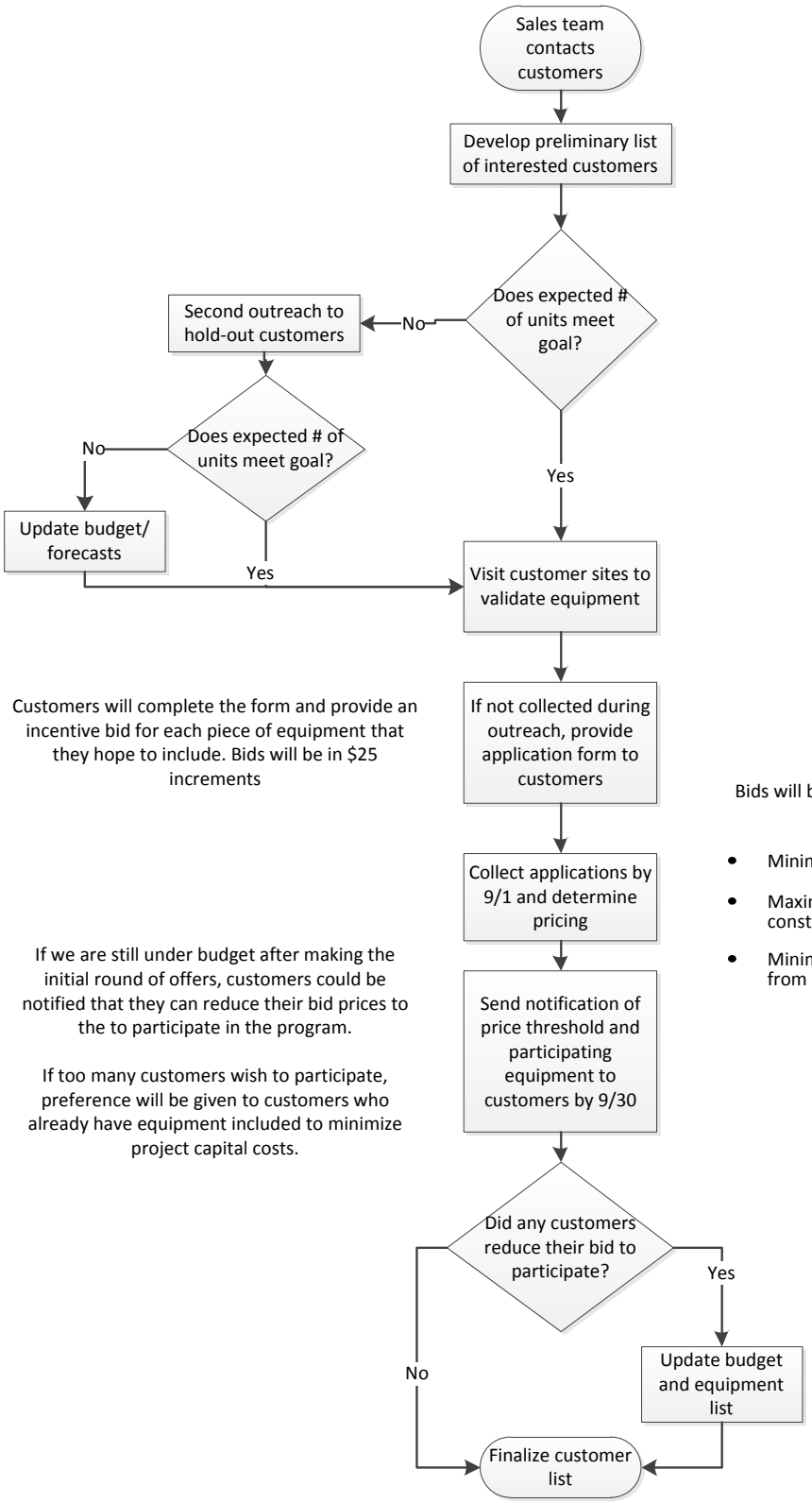
List all gas-fired equipment on the Specified Natural Gas Account to be enrolled in the Natural Gas Demand Response Program, under Direct Load Control. (Must be completed in order to participate in the Natural Gas Demand Response Competitive Bid Process.)					
Gas Fired Equipment	**Quantity**	**BTUH Input Rating/CFH**	**Customer's Indicative Desired Incentive Amt. per Unit in $25 Increments ($/Unit where 1 Unit = 1/2 DTH/HR or 500,000 BTUH or 500 CFH)**	**National Grid's Final Offer ($/Unit)**	**Customer's Initials Accepting Final Offer**
1)					
2)					
3)					
4)					
5)					
6)					
7)					
8)					
9)					
10)					
Total BTUH/CFH for Gas DR Program:		CFH			

All bids must be received by September 1st of each year for evaluation, which will commence immediately thereafter. National Grid reserves the right to accept applications after the deadline has passed. Bids will be evaluated by the Companies in a manner which, at the discretion of National Grid, maximizes the Project's benefits. To this end, preference will be given to bids that help to accomplish three specific goals:

1) Minimize $/Unit
2) Maximize participation from customers in constrained areas
3) Minimize capital costs by maximizing participation from each customer

The competitive bid process is outlined in the following process map:

Competitive Bidding Process



Customers will complete the form and provide an incentive bid for each piece of equipment that they hope to include. Bids will be in $25 increments

If we are still under budget after making the initial round of offers, customers could be notified that they can reduce their bid prices to the to participate in the program.

If too many customers wish to participate, preference will be given to customers who already have equipment included to minimize project capital costs.

Bids will be assessed by National Grid to prioritize the following criteria:

- Minimize $/unit
- Maximize participation from customers in constrained areas
- Minimize capital costs by maximizing participation from each customer

As outlined in the process map, customers will be notified as to which bids have been accepted once the evaluation is complete. Some customers may choose not to accept the offer made by National Grid. In such case, the Companies reserve the right to reevaluate bids and to issue additional offers. When possible, additional offers will prioritize customers who are already participating to minimize capital costs by not requiring another remote switching device.

All bids will be evaluated with the intention of maximizing the number of customers who are located within constrained areas of the gas distribution system. Constrained areas were determined by working with the Companies' engineering departments to produce system models, based on both empirical and theoretical data, which demonstrate any system areas that are approaching minimum allowable operating pressure during a peak day. When these heat maps were completed, the list of potential customers, identified based on their rate code and annual consumption, were overlaid on top of the heat maps. This allowed the potential customers to be placed into tiers. For the purposes of the Project, the tiers are:

1) Highly constrained area
2) Somewhat constrained area
3) Unconstrained area

1.103 Payment Logistics

For the sake of simplicity and given the temporary nature of this Project, customers will not be required to change their service class rates to participate in the Project. Customer incentives for participation will be paid via check within 90 days following the conclusion of the DR Season. A shorter payment period might be possible once there is additional automation. The system that the Companies have chosen for preparation of incentive payments for the Project relies on existing systems, which should minimize errors. If the Project is determined to be appropriate for scale-up, an analysis of the most efficient way to provide incentives to customers will be performed.

1.104 Annual Review

A key component of the Program is to assess whether or not gas DR provides a positive benefit to the gas system in terms of reducing peak period constraints and, additionally, if it is less costly than more traditional approaches to alleviating constraints, such as installing new upstream infrastructure. A review of the performance and benefits of the Project will be completed at the conclusion of each DR Season with the goal of completing the review by the end of July so that any lessons learned can be incorporated into the planning for the upcoming season.

Analysis of the operational impacts of the Project will be based on the measured pressures during peak periods, updated system models, and assessments of customer demand curves. National Grid has the ability to measure pressure at various points throughout the gas distribution system. These data points are used to refine the theoretical models that are produced by the Stoner modeling system[3], which was the basis for the Companies' heat maps. National Grid will record updated pressures during peak periods to determine the impact of gas DR. This will allow the Companies to produce new heat maps, using the same method as before, and to compare whether or not the Project has alleviated constraints and, therefore, affected the potential for adding incremental gas customers within the previously constrained area. In addition, customer load curves will be produced by the DROMS to quantify the reduction in customer demand during a DR activation. This will be can compared to the nameplate data that was provided by the customer to obtain an efficiency score for each customer, which can in turn be analyzed by customer type, equipment type, and comparing to the pre-season customer assessment.

If it is found that the benefit-to-cost ratio for a gas DR program is positive and represents a lower cost alternative to system reinforcement, the annual review will include a section regarding how to modify the program so that the marketplace can replace the gas utility for program operation. This section will include a financial assessment of the Project. The nature of the Project is such that it should always perform at or under budget and the section of the annual review that speaks about scalability should address how that could be maintained if such a gas DR program is deployed at scale. Where possible, National Grid will use existing methodologies for assessing DR programs.

1.11 Participant Eligibility

Each gas demonstration project will be documented through a brief site agreement describing the benefits, rights and responsibilities for participating customers. In addition to the general requirements for participation in all National Grid gas demonstration projects, which are:

- National Grid gas customer
- Technical suitability
- Gas accounts in good standing
- No financial encumbrances
- Suitable insurance
- Buildings properly maintained with no outstanding permit violations
- Easy access for service and data collection

Customers will need to have annual consumption above the minimum thresholds, which

[3] Stoner is a hydraulic modeling software package used by National Grid's Operations group to develop a model of the gas network. This model is based on theory and then verified using observed pressure data. Producing these models is part of National Grid's normal business practice. The models are updated annually.

are 4,000 DTh/yr for NYC customers and 6,000 DTh/yr for Long Island customers, and not be one of the excluded use types (*e.g. standby/backup equipment,* Compressed Natural Gas ("CNG") stations, distributed generation ("DG") facilities, Combined Heat and Power ("CHP" or "Cogen") systems).

1.12 Customer/Stakeholder Engagement and Communications

The Project is relatively small in terms of customers, twenty (20) in NYC and ten (10) in LI, so the communication will be tailored to the Project. The first choice for communication will be National Grid's Gas Demand Response Team working with the Strategic Sales group to leverage existing customer relationships. The Sales team was instructed to review the potential customer list to identify a few with whom they have strong relationships to engage in first round outreach. Additionally, the Companies will leverage relationships that the selected vendor possesses. DR vendors might have existing relationships with electric DR customers who, given their familiarity with DR, are likely to be more receptive to the idea of gas DR. National Grid will also support efforts to engage potential customers via community and government affairs representatives and through existing sales and marketing channels including:

- Targeted direct mail in collaboration with partners
- Outbound telemarketing
- National Grid sales and community representatives
- Social media

Large-scale marketing and advertising is not necessary or justified for the Project. Participants are expected to be tracked by the GridForce customer relationship management system.

Customer education and engagement will be a critical part of the Program. Gas DR for firm customers, as has been stated, is a relatively new concept for National Grid, which means it will also be new for the Companies' customers. For this reason, the Companies will endeavor to work primarily with customers who have a higher level of understanding of their equipment and a strong relationship with National Grid. The Project will function as a partnership so there is a need to ensure that there is a strong foundation. Initial customer meetings to explain the Project will involve National Grid's Sales team and the Gas Demand Response Team. These will leverage the marketing assets, included in the Appendices, which have been designed based on existing electric DR materials to educate customers about the nature of the Project. Following the initial customer visit, there will be several touch points for customers, including, but not limited to:

- Acknowledgement of receipt of Customer Application
- Site visit by enablement contractor and/or National Grid staff
- Return of bid form following bid evaluation
- Acceptance of final bids

- Site enablement
- Pre-dry run communications
- Site visits following dry run to rectify errors (if needed)

The Gas Demand Response Team will also work with National Grid's Marketing and Customer groups to develop a satisfaction survey that will be distributed to participating customers. This will garner insights from participating customers on the Project, DR activation events, and incentive payment that will inform future years.

1.13 Background on Gas Demand Management

Demand response is a concept that has been used by gas utilities as a tool for capital efficiency as early as the 1960's. It has been more recently used in a different manner by electric utilities and network operators as a means of prioritizing clean generation, impacting supply markets, and supporting overall reliability. It is possible that some of these benefits could be achieved by gas utilities through expanded demand response. Exploring this feasibility is the basis for the Project.[4]

National Grid has offered voluntary Interruptible and TC programs to customers for many years with about 3,900 TC customers in KEDNY. The importance of these programs was highlighted during the 2013/2014 heating season, often referred to as the "Polar Vortex" both in KEDNY's and KEDLI's operations and also regionally.[5] Despite the growing importance of interruptible and TC programs, there are necessary but punitive aspects to participation, such as the need to maintain a back-up system. This is viewed negatively by customers, is difficult to enforce, and generally skews the value of the service to customers.

Furthermore, customer demand for new natural gas service remains stable regardless of price but gas service requests clearly increase when the relative cost of heating oil increases. The addition of new customers benefits both new and existing customers but the variability in new demand for infrastructure can add a reactive element to system planning. The extent to which a gas DR program for large commercial customers could benefit or defer gas reinforcement costs will be investigated.

During the 2013/2014 heating season, portions of the Northeast also experienced spot gas price commodity instability which had more impact on electric generation prices than gas heating pricing. A similar situation occurred during California's energy crisis in 2000. While evaluation of potential commodity market impacts are beyond the scope of

[4] 15 Degrees of Separation: DR for Natural Gas is Closer Than You Think", ENRNOC, NARUC,7/23/12

[5] *Promise Delivered: Planning, Preparation and Performance During the 2013-14 Winter Heating Season*, American Gas Association, Arlington, VA, September 2014, *available at*: https://www.aga.org/sites/default/files/legacy-assets/Kc/winterheatingseason/Documents/Promise%20Delivered%20-%20Full%20Report.pdf

the Project, the scale of potential DR will be assessed and a recommendation made for further study.
The overall purpose of the Project is to assess the potential for a new market for large gas DR programs. The Project will combine the beneficial aspects of electric DR and gas interruptible programs into a new customer-centric program and determine:

1) Will it be attractive to customers?
2) What unit costs can be expected by market segment?
3) Could it be scalable?

The Project will focus on large, firm gas customers with process loads initially, followed by gas heating customers. DR will also be evaluated as an option for non-firm gas customers. The results will be compared to the results of other REV demonstration projects, such as mass market residential concepts (*e.g.*, Wi-Fi-enabled thermostats for heating in the Clifton Park, New York electric REV demonstration project)[6] and projects in National Grid's affiliate companies in New England.[7]

1.20 Test Statements

National Grid will test the validity of the hypotheses shown in Table 1, Test Statements, below. The results of hypothesis testing will be tracked and documented and then used to inform and modify subsequent offerings to large commercial gas customers in NYC and LI:

Table 1: Test Statements

Overarching Test Statement	If…	Then…
A gas distribution utility can engage large gas customers in a program to manage peak loads.	A. A sufficient positive financial incentive is offered to customers…	Large commercial gas customers will participate in peak gas load reduction.
	B. Customer adoption is sufficient to offset peak load growth…	The Companies will be able to better manage their gas reinforcement budgets and assess their ability to offer service to new customers.

[6] Case 14-M-0101, *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision* ("REV Proceeding"); National Grid Clifton Park Demand Reduction REV Demonstration Project – Implementation Plan (filed January 17, 2017).
[7] *See* https://www.nationalgridus.com/MA-Home/Energy-Saving-Programs/Connected Solutions

Test Statement	Hypothesis	
Customer Interest		
We believe…firm commercial customers will be interested in curtailing their demand during peak periods in exchange for an incentive payment.	**If…** customers have the ability to earn sufficient incentives without needing to install backup equipment,	**Then…** they will be willing to curtail their gas demand during peak periods.
Incentive Amount		
We believe… customers will participate at an incentive amount that maximizes their benefit.	**If…** payments to participating customers exceed those customers' revenue loss plus their perceived risk premium for that business,	**Then…** they will maximize their participation.
Utility Benefit		
We believe…that the gross potential for demand reduction is significant and that demand response can be a viable tool for system planning.	**If…** the Project results in a measurable operational impact that results in capital deferral exceeding project costs,	**Then…** a gas DR program will be beneficial for National Grid.
	If… the gross potential demand reduction projected from the Project results is similar in scale to the long-term annual growth rate of peak demand,	**Then…**it may be possible to add additional gas customers without capital investment.
	If… targeted customers in constrained areas of the gas distribution system participate and alleviate constraints,	**Then…** the need for distribution system reinforcement projects might be postponed.
SIC Code		
We believe… certain SIC codes will prove to be better candidates for participation in the Project.	**If…** the equipment at a customer's facility can be generally known based on SIC code,	**Then…** the viability of participation for a given SIC code can be assessed.
	If… A nominal 25% reduction in peak load in buildings in specific types (*i.e.*, by SIC code) does not result in discontinuance of operations,	**Then…**those SIC codes will have minimal financial hurdles to participate in the Project, which should maximize participation.

1.30 Test Population

The initial market size for the Project is large, primarily firm commercial customers.[8] Existing interruptible and TC customers will only be approached for participation in the Project if they have been approved by National Grid's Engineering group, meaning that their load is small enough not to impact a peak day, and if the potential customer base provided by firm customers does not yield enough subscription to meet the Project goals. As part of the Project, additional potential scenarios will be developed. While there are several parameters to be considered such as size, current load factor, subjective reduction potential, and market penetration rate, one conservative scenario of demand reduction potential from selected SIC codes is as follows:

	NYC						Long Island					
	No.	Therms/yr ea.	hrs/yr	DTH/Hr	Curtail	Amount	No.	Therms/yr ea.	hrs/yr	DTH/Hr	Curtail	Amount
Hospital	133	201,695	1,500	1,788	15%	268.3	98	258,585	1,500	1,689	15%	253.4
Nursing Homes	81	100,315	1,500	542	10%	54.2	116	56,564	1,500	437	10%	43.7
Residential Healthcare	26	85,277	1,500	148	10%	14.8	45	38,106	1,500	114	10%	11.4
Health & Psych	47	49,496	1,500	155	10%	15.5	67	29,473	1,500	132	10%	13.2
Multi-Family (20+)	3,894	5,827	1,000	2,269	10%	226.9	108	7,213	1,000	78	10%	7.8
University Buildings	206	41,828	1,000	862	25%	215.4	205	12,537	1,000	257	25%	64.3
Supermarkets	54	301,927	1,500	1,087	25%	271.7	112	235,817	1,500	1,761	25%	440.2
Food/Bakery	41	44,782	2,080	88	25%	22.1	38	14,902	2,080	27	25%	6.8
Dairy	6	74,243	2,080	21	25%	5.4	28	389,743	2,080	525	25%	131.2
Comm'l Laundry	426	7,504	2,080	154	25%	38.4	210	8,791	2,080	89	25%	22.2
Bottling	6	161,338	2,080	47	25%	11.6	-	-	-	-	-	-
Pharma	-	-	-	-	-	-	250	18,258	2,080	219	20%	43.9
Printing	-	-	-	-	-	-	45	31,527	2,080	68	20%	13.6
Food Prep	41	44,782	2,080	88	25%	22.1	-	-	-	-	-	-
Plastics	-	-	-	-	-	-	15	32,592	2,080	24	20%	4.7
Newspapers	15	19,984	2,080	14	25%	3.6	26	41,971	2,080	52	20%	10.5
Hotel/Motel	64	36,011	2,080	111	15%	16.6	93	20,999	2,080	94	15%	14.1
TOTAL	5,040					1,186.5	1,456					1,081.0
						DTH/hr						DTH/hr

Table (2)

For New York City, the amount of peak load reduction that could be achieved from the loads highlighted in this table is approximately 1.8% of the peak system load average from 2013-2015. This exceeds the average annual rates of growth in peak load forecasts, which are 1.7% in New York City and 1.8% on Long Island. However, the Project will be focused on a more modest scale. As mentioned in 1.00 above, the goal for demand reduction is 80 DTh/hr (160 units) for NYC and 60 DTh/hr (120 units) for Long Island. This is amount that the demand will be reduced for each DR activation event. NYC represents a greater total reduction in demand but a smaller reduction per customer. This is due to the fact that NYC tends to be populated by residential and multi-family buildings, which have lower usage when compared to production facilities.

[8] For NYC, large customer targets are initially assumed to have a 4,000 DTH annual usage each and for Long Island, a 6,000 DTH annual usage each and both with equipment typically operating for 1,000 full load hours annually.

1.40 Test Scenarios

Table 3: Test Scenarios

Scenario	Description
Unit Cost	
$ expanded per "Unit" of demand reduction	A convenient "Unit" of demand reduction will be established. Initially one "Unit" will represent ½ DTh/hr or 500,000 BTUH. Through an open solicitation or bid, where feasible, the necessary price of a "Unit" will be established by SIC code.
Demand Reduction per Customer	
Actual load reduction potential per customer for process and heating loads	National Grid will estimate the load reduction potential that each type of customer can be expected to offer by SIC code. While the priority target is customers with process loads, reduction in peak heating loads are also possible but are expected to be a lower proportion than process loads.
Market Penetration	
Predicted market penetration rate	National Grid will estimate the attainable market penetration rate in any customer segment that participates by SIC code. Preliminary market sizing is based on 15% for all SICs.
Gross Demand Reduction Potential	
Significance of demand reduction potential	National Grid uses the results to estimate the gross demand reduction potential and compare to total peak load measures and the long-term average growth rate of peak demand.
Potential for Capital Deferral	
Potential Impact on gas system planning	National Grid will use the results from the Project to perform a scenario analysis to estimate the potential gas system benefits if deployed at full scale where needed.
Customer Satisfaction	
Satisfaction with the prospective service compared to existing programs	National Grid will assess the customer satisfaction of the Project participants and compare with any existing data regarding the current interruptible and TC programs in New York City and on Long Island.

1.50 Milestones and Checkpoints

Table 4: Milestones

Action Items	Timing	Process Owner and Support
Work w/ Procurement group to develop RFP for vendors	6/30/17	Commercial Demand Response Team
Work with Long Term Planning and Operations Engineering to obtain heat maps	1/31/17	Commercial Demand Response Team
Automation Interface and Enhancement field for DR customers	11/30/17	Gridforce Champion
Market research to overlay heat maps with target customers to identify potential non-residential customers by usage	3/31/17	Market Research, Commercial Demand Response Team
Research and interview final qualified vendors	5/31/17	Commercial Demand Response Team
Legal to develop “Customer Agreement” and “Vendor “Agreement”	6/30/17	Legal, Regulatory, Business Development, Strategic Sales
Install necessary site equipment	11/30/17	Commercial Demand Response Team, CMS
Marketing to develop communications	6/30/17	Marketing
Strategic Sales and Gas Sales Support to sign-up customers for the Project	11/30/17	Commercial Demand Response Team, Strategic Sales
Develop internal pricing mechanism	3/31/17	Commercial Demand Response Team
Set up processes to issue payment with 90 days of the conclusion of the DR Season	11/30/17	Commercial Demand Response Team
Work with Advanced Data Analytics group on cost / benefit and payment	11/30/17	Advanced Data Analytics
Coordinate communication methods between Gas Control with winning vendor for the Project.	9/30/17	Commercial Demand Response Team
Train Sales Team and/or Call Center Reps on the Project.	7/31/17	Commercial Demand Response Team
Dry run test of DR system.	11/30/17	Commercial Demand Response Team

Determine methodology on how to claim carbon reduction benefits.	4/31/18	Commercial Demand Response Team
Go Live activation of signed agreements w/participating customers (***i.e***., curtailing usage)	3/31/18	Commercial Demand Response Team
Issue payments within 90 days of conclusion of DR Season	4/31/18	Commercial Demand Response Team
Begin to confirm and quantify financial and distribution system benefits (***e.g***., avoided infrastructure costs, customer savings). Quantify how many additional customers could be added to gas distribution system (in MCFH) and approximate New Distribution Revenue ("NDR") value to National Grid.	7/31/18	Commercial Demand Response Team
Take lesson learned and apply to 2018-2019 Project year.	3/31/19	Commercial Demand Response Team
2019 Project Year Go live activation of signed agreements with participating customers (i.e., curtailing usage).	3/31/19	Commercial Demand Response Team
2019 Project Year Issue payments within 90 days of conclusion of DR Season	4/31/19	Commercial Demand Response Team
2019 Project Year Confirm and quantify financial and distribution system benefits (*e.g*., avoided infrastructure costs, customer savings). Quantify how many additional customers could be added to gas distribution system (in MCFH) and approximate NDR value to National Grid.	7/31/19	Commercial Demand Response Team
2019 Project Year Quantify approximate annual carbon reduction benefits.	7/31/19	Commercial Demand Response Team
Progress on implementation and Project performance to be reviewed during National Grid Jurisdiction's monthly performance meetings. If any issues are identified, NY Jurisdiction will require a performance improvement plan.	Monthly	Commercial Demand Response Team

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

1.51 Checkpoints

Table 5: Checkpoints

Scenario	Description
Unit Cost	
$ expanded per "Unit" of demand reduction	Measure: Per unit present value ("PV") of costs and payments ($/DTH/hr) How and When: End of each heating season Resources: Project Manager Target: Cap below normal winter distribution charge for Project. Solution if off-target: Review and revise offering
Demand Reduction per Customer	
Actual load reduction potential per participating customer for process and heating loads	Measure: % reduction of customer's historical winter peak How and When: Beginning each heating season Resources: Project Manager Target: Average of 25% process and 10% heating loads. Solution if off-target: Review and revise offering
Market Penetration	
Predicted market penetration rate	Measure: Participant count How and When: End of each year of operation Resources: Data analytics Target: 15% of customers in each SIC code Solution if off-target: Review and revise offering
Gross Demand Reduction Potential	
Significance of demand reduction potential	Measure: Gross Potential in DTh/hr How and When: End of 2nd year of operation Resources: Gas System Operations Target: 80 DTh/hr in NYC and 60 DTh/hr on LI Solution: Review and revise offering
Potential for Capital Deferral	
Potential Impact on gas system planning	Measure: Per unit PV of costs and payments ($/DTH-hr.) How and When: End of 2nd year of operation Target: Comparable to per unit growth capital Resources: Gas Engineering Solution if off-target: Review and revise offering

Customer Satisfaction	
Satisfaction with the prospective service compared to existing programs	Measure: Percent of Participants "satisfied" or better. How and When: End of each heating season Resources: Survey Target: Exceed Interruptible and TC. Similar to electric. Solution if off-target: Review and revise offering

1.60 Conditions and Barriers

The following list includes key dependencies and potential barriers that are anticipated may need to be addressed during the progress of the Project:

- Support from Instrumentation Group
- Variability of communications options
- Metretek Installations Dedicated Customer Phone line needed
- AMI/ Itron Fixed Network (IT)
- Uncertainty as to proper amount to incentivize customers to participate
- Budget flexibility (Capital vs Ops Budget)

2.00 Project Structure and Governance

2.10 Project Team

All Gas REV demonstration projects are implemented by the Customer Solutions group in New Energy Solutions and include the following:

- Overall Gas REV Program Administration — Chris Cavanagh
- NES Procurement — John Spring

The Gas Demand Response Demonstration Project is implemented by the following team:

Table 6: Project Team

Tom	Amerige	Gas Control
Frank	Duggan	Customer Business Development
Brandon	Dyer	Program Strategy
Amanda	Santangelo	Engineering
Keith	Sperling	Sales & Program Ops
Fouad	Dagher	NES
Owen	Brady	NES Program Manager
Derek	Salisbury	Procurement
Jillian	Piccone	Legal
Christine	Kiviat	Marketing
Dave	Angelone	CMS
Jerry	Viola	CMS

2.20 Roles and Responsibilities

Table7: Project Roles

National Grid Role / Responsibility	**Description**
Support conceptual design and lead detailed program implementation	Provide necessary data, and expertise for the Project design work
Recruit customers	Conduct outreach campaign competitive solicitation for peak load reduction
Provide payment to customers	Process payment as pre-arranged
Operate systems and communications	Gas control center will notify participating customers and will isolate selected equipment remotely
Customer	**Description**
Participate in program as agreed.	Provide access to equipment and data.
Vendor	**Description**
Provide Equipment or Service	Provide, maintain and/or operate equipment control devices

2.30 Governance

The Gas Demand Response demonstration project is being managed through National Grid's NES team and is solely responsible for successful implementation. In accordance with the rate case, one incremental project manager has been hired specifically for the gas REV program which includes the demand response demonstration project. In addition, the Customer Solutions team in the Customer area is providing additional project management support. All projects in the gas REV Program are being included in an existing Performance Excellence (PEX) hub prior to any spending. The Project is supported by a dedicated procurement team in NES. In addition, there is substantial support required by several departments and groups and each is identified in the project timelines in Section 3.00.

In accordance with National Grid policies, the entire Gas REV demonstration program requires the approval of the Senior Executive Sanctioning Committee regardless of size. This approval covers all capital and first year expenses and the approval process will be repeated for years 2 and 3 of the Project.

Since the Gas REV demonstration funding was included in the KEDNY-KEDLI rate case order, implementation plans have been submitted to the Regulatory team, the major element of which are being tracked as regulatory obligations in the existing tracking system. In addition, all programs and progress are subject to regular scheduled reviews by the New York jurisdiction and other senior executives.

3.00 Work Plan

The work plan for the Project can be found in attached Appendix E.

3.10 Project Budget

The cost of the demonstration projects is divided into capital costs and first year operation and maintenance ("O&M") costs as presented in the rate filing for Cases 16-G-0058 and 16-G-0059. These costs only cover estimated incremental direct project costs. In the past, the approach taken by most utilities was to maximize the capital costs for a given project to increase the asset base on which a return could be collected. The Project, on the other hand, has been designed to minimize capital costs, which are limited to those required to enable each incremental customer. This not only makes it easy to bring new customers on to the program but limits the underutilized capital that has been installed at customer sites in the event of a year in which there are no activations. Also, given the possibility for turnover in the customer base, it makes sense to reduce costs so that customers can be replaced

without significant financial impact. Finally, reducing the cost of acquiring new customers ensures that there will not be a significant financial hurdle for third-party partners to assume ownership of the gas DR program following the conclusion of the Project. The majority of the cost is for incentive payments, which would still originate from National Grid.

Gas REV Demonstration Proposals
Customer (Products)- Sean P. Mongan Testimony

	KEDNY			KEDLI		
	FTE or Quantity	2017 Capital	O & M	FTE or Quantity	2017 Capital	O & M
Customer Options for Gas Constraints						
Commercial Gas Demand Response Demonstration Program						
Materials (Devices)	20	$56,000	$0	10	$28,000	$0
Installation Labor	20	$20,000	$0	10	$10,000	$0
Outreach		$0	$20,000		$0	$20,000
Comms	20	$0	$1,200	10	$0	$600
Maintenance/Repair (annual)	20	$0	$5,000	10	$0	$2,500
Total Annual "Units" purchased; Incentive = $400 per unit	800	$0	$320,000	600	$0	$240,000
(1 unit = 1/2 DTH/hr : Quant. = # cust X DTH/cust X #activations X 2)						
Annual Activations = 5						
NYC: 4 DTH/hr per customer avg. LI: 6 DTH/hr per customer avg.						
Subtotal		**$76,000**	**$346,200**		**$38,000**	**$263,100**

The structure of the Project ensures that the majority of the budget will never be at risk. Customers must submit an application and accept the bids offered by the Companies before any capital dollars are spent on enabling their site, which must be done before they can participate in DR Activations and become eligible for incentives. If no customers were to submit applications for the Project or if all of the bids were deemed unacceptable by National Grid, the Companies could discontinue the Project with minimal total cost or customer impact.

3.20 Reporting Structure

Reporting progress to the PSC shall, as a minimum, be in accordance with the requirements of the Commission's order[9] for Cases 16-G-0058, 16-G-0059 *et al*. Such order requires annual reports 45 days after the end of each rate year. Additional interim reporting is anticipated when major milestones are accomplished. In addition, progress is reported as regulatory obligations tracked by the Regulatory area. The Project will result in a final report detailing findings and recommendations.

The Project could result in scalable new products or services being made available to customers. If successful the Project will result in a deployment

Table (8)

[9] Cases 16-G-0058, 16-G-0059 *et al*., *supra* note 1, Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

plan derived from the Project findings and current market conditions. Since one of the core policy objectives of REV is "market animation," the deployment of product concepts that the Project indicates will be successful will most likely be deployed through the creation of new partnerships, potentially with some of the service providers included in the Project or with other new entrants. National Grid's gas utilities in NY have extensive experience in developing successful alliances. Previous examples include the following:

- Oil – Gas Heating Conversions (Value Plus Installer Program)[10]
- Natural Gas Vehicles and US DOE Clean Cities[11]
- Energy Efficiency Implementation
- Utility Energy Service Contracts ("UESC") for government customers

The NES team has a dedicated team focused on developing a wide variety of partnerships. Where these concepts require financing it is expected that a variety of sources will be sought individually or in combinations. National Grid has also supported its partners in a variety of ways including the following and expects to continue:

- Joint outreach and education programs
- Market sizing
- Environmental and socio-economic benefits analysis
- Facilitation of training of technicians and customers.
- Support for updated codes and standards to reflect new technologies.
- Additional project demonstrations
- Research Development and Demonstration for product improvements

Where possible, this Project will be designed to animate the market. This will most likely occur by creating a situation in which a third party would be responsible for achieving DR goals, similar to the setup for electric DR. National Grid expects that a scaled version of this offering would be of interest to an aggregator. The Companies are intentionally designing the Project so that National Grid plays a minimal part in it such that it could be easily transferred to a partner. This can be seen in the Project design choices such as utilizing a vendor solution for scalable data management and reducing the capital needed for each participating customer.

While National Grid anticipates partnerships that will mirror those in the electric DR world, it is possible that other partnerships could result from a scaled-up version of the Project. Such partnerships could include things such as: peak day gas sales, marketers shifting from daily to hourly sales, and the creation of new remote switching devices. Based on National Grid's research, it is clear that there is a dearth of technology options

[10] https://www.nationalgridus.com/NY-Home/Convert-to-Natural-Gas/Find-a-Contractor
[11] https://cleancities.energy.gov/coalitions/long-island

available for gas DR given that it has not been widely utilized by the industry. As utilities, including the Companies, seek to become operate their systems more efficiently, it is logical that the market would expand with solutions to support gas DR. Gas, historically, has not been as reliant on time-of-use rates due to the nature of the gas system, which offers a buffer against peaks due to line-pack and pipeline sizing. Because of this, utilities have avoided gas time-of-use rates to ensure that customers have a simple rate structure. The success of energy efficiency programs, such as those offered by National Grid, has made the difference between the base load and the peak load even larger by reducing the time frame during which gas heating equipment is required to closely mirror peak periods. This reduces system efficiency and can place additional strain on the gas system during peak events.

Other users of gas, such as power plants, have come in to make use of this latent capacity in the pipeline network. This has led to advantageous power prices and a reduction in emissions from that sector. It has also created a situation in which customers and the system need to be more responsive as they are mutually dependent on the same resources. To this end, the Companies anticipate that time-of-use billing and the need for a smarter gas grid will become much more popular over the next decade.

Appendix

- Appendix A: Customer Application Form
- Appendix B: Technical and Eligibility Requirements
- Appendix C: Marketing Flyer
- Appendix D: Data Flow Process Map
- Appendix E: Work Plan
- Appendix F: REV Alignment
- Appendix G: The Natural Gas Distribution Vision
- Appendix H: Alignment with New York State Energy Initiatives

Appendix A: Customer Application

Natural Gas Demand Response Program Application

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Directions

Please complete all sections of this application. When complete, sign this application and return it to us. If you have completed an application in previous years and have no changes to report, please indicate that below and return the signed application to National Grid.

☐ New Application ☐ Update to application submitted previously

Participant Eligibility

The National Grid natural gas account holder (the "Customer") identified in this Application must be a natural gas customer of National Grid. Program eligibility will be determined by National Grid as part of the Application review process. Applications may be completed by the Customer, or a third-party authorized to act on the Customer's behalf. The party completing the Application is the Applicant.

Program Requirements

Eligibility for the upcoming Demand Response Season will be determined by a bid evaluation process.
To be considered for the bid evaluation, complete Applications must be submitted by the following dates:

Application and Bid Evaluation	Deadline
A. Application Due Date	September 1, 2017
B. Announcement of Actual Incentives	September 15, 2017
*The date for the Announcement of Actual Incentives is subject to change.	

Program incentives will only be provided for demand response participants that adhere to all Program requirements, including the following:

1. Demand response participants must reduce a minimum of 500 CFH from the agreed baseline.
2. Demand response participants must have direct load control equipment installed and operational by the first day of the Demand Response Season (December 1-February 28) for the current calendar year. If the delay is the responsibility of National Grid or one of its vendors, the Customer will not be penalized.
3. All other Program requirements, including those contained in the Terms and Conditions section hereof and in the Technical Data Requirements for the Demand Response Program, must be satisfied.
4. **For questions regarding project eligibility, please contact Owen Brady or Frank Duggan**

1

Natural Gas Demand Response Program Application

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Customer and Facilities Information *(Required, Please Type or Print)*

Account Name (as shown on your National Grid bill)		
National Grid Account Number		
Contact Name		
Title		
Day Phone	Cell Phone	Email
Address 1		
Address 2		
City	State	Zip
Square Footage	Number of Floors	Annual Hours of Operation
Year Built	Building Type (e.g. Office, Hospital, etc.)	
Multifamily # of Units	Name of National Grid contact person (if applicable)	

Applicant Information

An applicant may be a Customer or a third-party authorized to apply for the Program on behalf of the Customer. If the Applicant is an authorized third-party, your information is required below.

Applicant/Company Name		
Contact Name		
Title		
Day Phone	Cell Phone	Email
Address 1		
Address 2		
City	State	Zip
Federal Tax ID		

Check Appropriate Box:

- ☐ Individual/Sole Proprietor
- ☐ Limited Liability Company
- ☐ Partnership
- ☐ Corporation
- ☐ Other
- ☐ Exempt Payee (W-9)

Enter the tax classification _____

D = entity, C = corporation, P = partnership

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Site Contact Information

A site contact is an individual at the facility who will be the designated person for National Grid to notify of Demand Response Event scheduling and who can coordinate and schedule site visits.

When you provide your phone numbers and email address, you consent to being contacted at these numbers about the specified National Grid commercial account.

Your consent allows us to use email, text messaging, artificial or pre-recorded voice messages and automatic dialing technology for informational regarding both Demand Response Events and account service calls.

☐ Same as Customer/Facilities information ☐ Same as Applicant Information

Contact Name		
Title		
Day Phone	Cell Phone	Email
Address 1		
Address 2		
City	State	Zip

Payee

An individual or entity to whom the incentive check should be mailed. If Customer seeks to assign its right to receive the incentive payment to Applicant, it must authorize the same via a separate signature on the last page of this Application.

Check to be made out to:		
Company Name (if different from above)		
Title		
Day Phone	Cell Phone	Email
Address 1		
Address 2		
City	State	Zip

Natural Gas Demand Response Program Application

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Natural Gas Fired Equipment

List all Gas-fired Equipment at the facility associated with the specified Natural Gas Account and a brief description of how the equipment is currently used:

Gas Fired Equipment	Quantity	BTUH Input Rating/CFH	Description of Current Use:
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
Total BTUH/CFH on Gas Account:		CFH	

List all gas-fired equipment on the Specified Natural Gas Account to be enrolled in the Natural Gas Demand Response Program, under Direct Load Control. (Must be completed in order to participate in the Natural Gas Demand Response Competitive Bid Process.)

Gas Fired Equipment	Quantity	BTUH Input Rating/CFH	Customer's Indicative Desired Incentive Amt. per Unit in $25 Increments ($/Unit where 1 Unit = 1/2 DTH/HR or 500,000 BTUH or 500 CFH)	National Grid's Final Offer ($/Unit)	Customer's Initials Accepting Final Offer
1)					
2)					
3)					
4)					
5)					
6)					
7)					
8)					
9)					
10)					
Total BTUH/CFH for Gas DR Program:		CFH			

Natural Gas Demand Response Program Application

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Terms and Conditions

The Customer agrees to participate in the Natural Gas Demand Response Pilot Program offered by The Brooklyn Union Gas Company d/b/a National Grid NY and Keyspan Gas East Corporation d/b/a National Grid (together "National Grid") pursuant to these terms and conditions ("Terms and Conditions"), set forth herein.

Definitions:

a. "Application" means the Winter 2017/2018 Gas Demand Response Application Form, which includes these Terms and Conditions.
b. Bid Evaluation Process" means the process by which National Grid will review all application submissions for indicative pricing based on a $/Unit basis per piece of gas-fired equipment. National Grid will determine the final incentive amount.
c. "Unit" shall be defined as ½ DTH per hour or 500MBtuh (500CFH).
d. "Customer" means the customer maintaining an account for service with National Grid who satisfies the Program requirements and participates in the Program. The specific customer for which these Terms and Conditions apply is set forth on Page two (2) of the Application.
e. "Data Collection" means the collection of data by National Grid from the installed DR System.
f. "Data Collection Equipment" means the National Grid owned equipment necessary for National Grid to monitor the performance of the DR System and perform the Data Collection.
g. "Demand Response Event" means a period of time in which National Grid first notifies the customer of an upcoming Activation, at least forty-eight (48) hours in advance, and then sends a signal to a control module that automatically curtails gas-fired equipment usage during the Demand Response Activation to the conclusion of the Demand Response Activation. A Demand Response Activation would occur between the hours of 6:00 AM and 9:00 AM anytime during the Demand Response Season.
h. "Demand Response Season" shall be defined as anytime between December 1st and February 28th.
i. "DR System" means the National Grid owned control module, equipment switching relays and metering equipment that both (1) curtails gas usage and (2) monitors gas flow.
j. "Financial Incentive" means a $/Unit financial incentive for reduced natural gas capacity to the Customer during a Demand Response Event based on the dollar value of a Unit determined through the Bid Evaluation Process.
k. "National Grid" means The Brooklyn Union Gas Company d/b/a National Grid NY and Keyspan Gas East Corporation d/b/a National Grid.
l. "Program" means the "National Grid Natural Gas Demand Response Pilot Program" offered by National Grid to Customer.
m. "Site" means the Customer's business location to which service is provided by National Grid where the DR System and Data Collection Equipment will be installed The specific Site for Customer is set forth on Page two (2) of the Application.
n. "Technical Data and Eligibility Requirements" means the technical data and eligibility requirements for Program participation distributed to Customers and incorporated by reference herein.
o. "Dry run" shall be defined as a Demand Response test of equipment during the month of November to ensure the DR System is operational and that the customer is able to participate. This is not a Financially Incented event.

Natural Gas Demand Response Pilot Program Conditions:

National Grid developed the Program to assess and test the potential for a new market for a larger Natural Gas Demand Response program for firm commercial rate Natural Gas customers. The equipment used for the DR System shall be identified and mutually agreed upon in advance between the Customer and National Grid. The DR System, which combines a control module, equipment switching relays and telemetry equipment, shall be activated by National Grid via direct load control, to curtail natural gas consumption to certain Customer owned, gas-fired equipment in order to reduce local and area-wide distribution system constraints.

Eligibility:

Incentives are available for reduction in natural gas via turning off equipment via direct load control for customers in good standing within the relevant National Grid service territories. Customers will be selected for the Program in accordance with the rules described in the Technical Data and Eligibility Requirements, which are incorporated by reference herein and form a part hereof. National Grid may modify the Technical Data and Eligibility Requirements from time to time in its reasonable discretion and participants will be notified of the changes via e-mail.

Obligations and Duties of Customer:

The Customer must,

a. Submit a completed Application, which includes (1) indicating the gas-fired equipment that Customer wishes to elect for participation in the Program, and (2) indicating for each piece of equipment, the bid amount on a $/Unit basis, for which Customer would allow National Grid to curtail natural gas usage during a Demand Response Event
b. Be (1) a customer of National Grid and (2) the owner of the Site or have the express authority to have the Equipment installed on the Site and comply with these Terms and Conditions.
c. Provide National Grid, National Grid and their authorized contractors access to the Site
    i. upon reasonable notice to perform an initial equipment assessment, the installation, the subsequent removal of the Data Collection Equipment, the Data Collection, and to service and monitor the DR System, and
    ii. without prior notice, at any time as National Grid reasonably determines to be necessary to address any emergency relating to the DR System.
d. Prepare the Site for work to be performed in connection with the Program. Be available for contact from National Grid via telephone, email and text for notifications of pending Demand Response Events.
e. If requested by National Grid, keep the DR System and Data Collection Equipment connected to Customer's WI-FI.
f. Not alter or modify, in any manner, the DR System or the Data Collection Equipment.
g. Be available, as requested from time to time by National Grid, to answer National Grid's or its authorized representative's questions regarding the performance of the DR System.
h. Maintain the Site to the extent necessary so as to cause no damage to the DR System or the Data Collection Equipment.
i. Provide, maintain and pay for, property and liability insurance coverage for the Site in amounts that are reasonable and prudent.
j. Immediately notify National Grid of any malfunction or suspected malfunction of the DR System or the Data Collection Equipment.
k. Not cause or permit the DR System or the Data Collection Equipment to specifically become subject to any mortgage, lien, security interest or other encumbrance.
l. Participate in Dry Run Demand Response Event before the Demand Response Season begins when notified by National Grid.
m. Participate in Demand Response Events when notified by National Grid.

Obligations and Duties of National Grid:

National Grid or its authorized contractors shall use reasonable efforts to,

a. Fabricate the DR System and install it at the Site.
b. Install the Data Collection Equipment and remove the Data Collection Equipment at the expiration of the Term.
c. Perform initial operation of the DR System to verify proper operation.
d. Service and Maintain the DR System to maintain proper operation.
e. Notify the Customer at least twenty-four (48) hours in advance of a Demand Response Event via phone call, text and/or email to the Customer's designated contact person as set forth by Customer on the Application Form.
f. Issue financial incentives to the Customer based on participation in the Program within ninety (90) days following the end of the Demand Response Season

Natural Gas Demand Response Program Application

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Terms and Conditions *(Continued)*

Demand Response Incentives:
Demand Response Incentive will be paid as follows:

a. Customers will be asked to both identify gas-fired equipment that would participate in the Program, as well as provide National Grid with an indicative incentive amount (on a $/Unit basis), that they would accept in order to allow National Grid to curtail equipment usage during a DR Event.
b. Through a bid evaluation process, National Grid will determine the "actual" $/Unit financial incentive and notify the Customer what that incentive amount is for reduced natural gas capacity to the Customer for a Demand Response Event. The Customer may then decide to participate in the Program at the actual incentive amount offered by National Grid or opt not to participate.
c. If the Customer over-rides the direct load control of the gas fired equipment identified for Demand Response during more than (1) Demand Response Events, or otherwise fails to participate in the Program when called upon, the Customer forfeits any Financial Incentive that would have been paid at the end of the Demand Response Season and can no longer participate in the Program.

Monitoring and Inspection:
The Customer agrees to allow National Grid or its contractor access to the Site to perform an initial site assessment, as well as verification of installed DR System or the Data Collection Equipment. During Customer's participation in the Program, National Grid may monitor the Customer's use of the DR System or the Data Collection Equipment and inspect the same in order to verify Customer's compliance with Program terms and to obtain certain information, including, without limitation, usage information, the actual demand reduction, and Customer's participation in Demand Response Events. Customer will cooperate in good faith with National Grid and its contractor and provide any reasonably requested information in connection with National Grid's monitoring and inspections. Customer understands and agrees that National Grid and its contractor shall not perform any kind of safety, code or other compliance review in connection with the Program.

Data Collection:
Customer understands and agrees that National Grid and/or National Grid's contractors will access and receive Customer's name, account number, energy usage data and energy savings information, including, without limitation the data as set forth on the "Schedule A" attached hereto which shall be solely owned by National Grid ("Customer Data"). National Grid may use such Customer Data in connection with National Grid's demand response programs and energy efficiency programs. To the extent permitted by applicable law, National Grid may disclose Customer Data to (a) National Grid's affiliates in connection with energy efficiency programs and demand response programs (b) National Grid's contractors for the services it provides to National Grid, and (c) any governmental or regulatory body having jurisdiction, upon request or demand. By its participation in the Program, Customer consents to the disclosure and use of its information as described herein. So that National Grid may improve and promote its service offerings, National Grid may aggregate Customer Data with other data, (and/or segregate portions of the Customer User Data) so that it is non-personally identifiable with respect to Customer. Such anonymous data is known as Aggregated Anonymous Data. Customer agrees that National Grid may create Aggregated Anonymous Data, and may use, execute, display and commercially exploit the Aggregated Anonymous Data. National Grid may disclose Aggregated Anonymous Data to third parties, and may transfer or sublicense its rights with respect to Aggregated Anonymous Data. During Customer's participation in the Program, Customer agrees that it will not enter into any agreement or relationship with any third party that would prevent or restrict National Grid from receiving or accessing Customer Data.

Publicity:
Customer shall not issue, cause to be issued, or permit to be issued any press release or other public statement of any kind relating to the Installation or operation of the DR System at the Site, or conduct or permit to be conducted any interview, news conference, or other public relations event in which the Installation or operation of the DR System at the Site is referred to or discussed. National Grid may issue any press release or public statement of any kind, or conduct any interview, news conference, or other public relations event relating to the Installation or operation of the DR System provided that National Grid will not, without Customer's prior consent, reveal Customer's identity or the specific Site location. Customer hereby authorizes National Grid and its authorized representatives to photograph and/or make video recordings of the DR System and the Site and to use such images on a royalty-free basis for all purposes related to the development, marketing or promotion of the Program and National Grid's business.

DR Season and Term:
The DR Season shall begin November 1 of each year. A dry run event will occur during November to check both Customers' response to a Demand Response Event and DR System readiness. Once the initial dry run event is completed, the DR System shall become fully operational effective on or about December 1 and will remain operational through February 28 (the "DR Season"). The Term shall begin on the last signature date set forth below ("Effective Date") and shall expire on March 1, 2020 unless extended by mutual agreement of the parties. For the avoidance of doubt, these Terms and Conditions shall apply for the entirety of Customer's participation in the Program.

Program Changes:
National Grid reserves the right to change, or terminate the Program at any time and for any reason without any liability to Customer except as expressly stated herein. Any changes to the Program, including those effectuated through changes to the Technical Data and Eligibility Requirements, will be binding upon Customer as of the date of their adoption.

Termination:

a. National Grid retains the right, in its sole discretion, to limit participation by any Customer, and to disallow participation or terminate, at any time after admission, participation by any Customer.
b. National Grid may, in its sole discretion, at any time and without notice, terminate (for convenience or cause) the Program, these Terms and Conditions and/or the Customer's participation in the Program or modify the Program or these Terms and Conditions, Program expenditures, requirements and eligibility. Upon such termination, neither party will have any further rights or obligations under these Terms and Conditions.
c. National Grid may terminate Customer's participation in the Program if the Customer over-rides the direct load control of the gas fired equipment identified for Demand Response during more than (1) Demand Response Events, or otherwise fails to participate in the Program when called upon.
d. Customer may terminate its participation in the Program upon thirty (30) days prior written notice to National Grid if National Grid fails to perform any of its obligations required hereunder and National Grid does not cure such failure during such thirty (30) day period.
e. Customer may terminate its participation in the Program by written notice prior to commencement of a DR Season in the event that the DR Season has not commenced within a one hundred eighty (180) day period following the Effective Date.
f. Customer may terminate its participation in the Program after participating in the Bid Evaluation Process for any given Demand Response Season via written request delivered by October 1st of any given Program Year .
g. Upon termination of Customer's participation in the Program, prior to the expiration of the DR Period Customer's participation in the Program, National Grid shall, at its option and expense, remove the Data Collection Equipment, including the associated meter and associated wiring.

Natural Gas Demand Response Program Application

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Terms and Conditions *(Continued)*

Assignment:
Subject to Sections (a) and (b) below, Customer may not assign or delegate any of its rights or obligations hereunder without first obtaining the written consent of the other National Grid.

a. If Customer proposes to transfer title to the Site to another person during the Program, Customer will provide National Grid with at least sixty (60) days advance written notice of such transfer. Such notice will include the name and address of the prospective transferee. During the sixty (60) day period following National Grid's receipt of such notice, National Grid shall, in its discretion, either (i) terminate Customer's participation in the Program and perform the actions specified in the Termination Section, or (ii) permit all of Customer's rights and obligations under this Agreement to be assigned to the prospective transferee, such assignment to be effective on the date title to the Site is conveyed to such transferee.
b. If at any time during the Term Customer proposes to terminate its occupancy of the Site, Customer will provide National Grid at least sixty (60) days prior written notice of such termination. If the Customer intends that other persons will become occupants of the Site, then such notice will include the name and address of such persons. Upon receipt of such notice, National Grid may either (i) terminate Customer's participation in the Program and perform the actions specified in the Termination Section or (ii) continue Customer's participation in the Program subject to the condition that the new occupants execute a writing satisfactory to National Grid and Customer in which such occupants agree to the applicable terms and conditions contained herein.

Indemnification:
The Customer shall indemnify, defend and hold harmless National Grid, its affiliates and their respective contractors, officers, directors, employees, agents, representatives ("Indemnified Parties") from and against any and all claims, damages, losses and expenses (including reasonable attorneys' fees and costs incurred to enforce this indemnity) arising out of, resulting from, or related to the Program or the performance of any services or work in connection with the Program except to the extent such results from the negligence or willful misconduct of the National Grid. The provisions of this section shall survive the termination, cancellation or completion of the Customer's participation in the Program.

Representations, Warranties and Covenants:
If Customer performs its own installation, the Customer assumes full responsibility for all installation work, and acknowledges that all work must be performed in full compliance with all applicable law, rules and regulations. Customer's submission of this Application and, if applicable, participation in the Program are completely voluntary. Neither National Grid nor its affiliated entities nor their respective trustees, directors, officers, shareholders, employees, contractors, representatives or agents shall be liable to the Customer or any other person or entity in respect of any claim, charge, complaint, cause of action, damage, loss or liability of any kind or nature whatsoever, whether known or unknown and whether at law or in equity, arising out of or related to (a) any qualifying project undertaken or attempted to be undertaken by the Customer, including, without limitation, the removal, installation or use of any equipment or Demand Response System installed in connection with the Program, (b) the review, rejection or approval of this Application by National Grid or its contractors, or (c) the determination of the total incentive amounts due to the Customer.

a. Customer represents warrants and agrees that: (i) it is the record Customer and principal occupant of the Site; (ii) the information it submitted on its application for the Program participation is complete and accurate; and (iii) if the DR System, Data Collection Equipment, and/or individual components thereof are, prior to the expiration of the Term, stolen or damaged due to Customer's negligence or misconduct, while located at the Site through no fault of National Grid or National Grid's authorized contractors, Customer shall reimburse National Grid for the full market value thereof (as determined by National Grid, but not to exceed $5,000.00).
b. National Grid represents, warrants and agrees that if the components of the DR System are damaged prior to the expiration of the Term and through no fault of the Customer, it shall repair or replace the DR System components on a timely basis.
c. DISCLAIMER OF WARRANTIES: EXCEPT AS EXPRESSLY STATED HEREIN, THE INDEMNIFIED PARTIES DO NOT MAKE ANY REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WHETHER ARISING BY IMPLICATION OR BY OPERATION OF LAW OR OTHERWISE, WITH RESPECT TO THE PROGRAM, ANY PROJECT, THE ADEQUACY OF ANY PROJECT DESIGN, PLAN, ENERGY EFFICIENCY OR DEMAND RESPONSE EQUIPMENT, CONSTRUCTION OR INSTALLATION OR THE AMOUNT OF INCENTIVES TO BE PAID, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OR REPRESENTATIONS AS TO MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. THIS PROVISION SHALL SURVIVE THE TERMINATION OR CANCELLATION OF THE PROGRAM AND ANY PARTICIPATION THEREIN BY THE APPLICANT AND/OR CUSTOMER.
d. LIMITATION OF LIABILITY: IN NO EVENT SHALL THE INDEMNIFIED PARTIES BE LIABLE TO THE CUSTOMER FOR ANY SPECIAL, INDIRECT, INCIDENTAL, PENAL, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY NATURE IN CONNECTION WITH ANY EQUIPMENT OR THE PROGRAM. THE INDEMNIFIED PARTIES' LIABILITY TO THE CUSTOMER FOR ANY AND ALL CLAIMS, LOSSES, EXPENSES, INJURIES, OR DAMAGES ARISING OUT OF OR ANY WAY RELATED TO THE PROGRAM TO THESE TERMS AND CONDITIONS BY REASON OR ANY ACT OR OMISSION, INCLUDING BREACH OF CONTRACT OR NEGLIGENCE NOT AMOUNTING TO A WILLFUL OR INTENTIONAL WRONG, SHALL NOT EXCEED THE TOTAL AMOUNT OF $500.00

Choice of Law; Venue:
This Application shall be deemed to be executed in the State of New York and shall be interpreted and enforced according to the Laws of the State of New York without regard to its conflicts of law principles. Only the courts of New York shall have jurisdiction over the Agreement and any controversies arising out of the Agreement; any controversies arising out of the Agreement shall be submitted only to the courts of New York; the Customer hereby submits to the courts of New York for the purposes of interpretation and enforcement of this Application and its Terms and Conditions.

Miscellaneous:
These Terms and Conditions do not grant any rights to any third parties. In the event of any conflict or inconsistency between these Terms and Conditions and any program materials, these Terms and Conditions shall be controlling. There shall be no amendment to the Application or these Terms and Conditions unless such is made or agreed to by National Grid.

All notices, requests, approvals and other communications which may or are required to be given by either party to the other under this Agreement shall be deemed to have been sufficiently given for all purposes hereunder when delivered personally or mailed by registered or certified mail (i) if to National Grid at One MetroTech Center Brooklyn, NY 11201, Attention: Owen Brady and (ii) if to the Customer, at the address of the Site as set forth in the Application.

This Application is a legal document. Customer acknowledges that it has been advised by counsel, or had the opportunity to be advised by counsel, in the execution and delivery of this Application and any of its attachments.

Customer (a) accepts and agrees with these Terms and Conditions, and (b) warrants Customer is of legal age and has the authority (and if applicable, all necessary consents) to execute these Terms and Conditions and participate in the Program.

SCHEDULE "A"
Customer Data:
Customer Data shall mean all data collected by National Grid via the Internet or Cellular Connection with the DR System, for the Gas Demand Response Pilot Program and with the communicating natural gas meter for the purposes including but not limited to the following:

- Determining appropriate $/Unit Cost for Demand Reduction (DTH/hr) by Equipment type and SIC code
- Determining Gross Therm Reduction by equipment type and by SIC code
- Determining Capital deferral potential
- Determining Customer Satisfaction overall with a Demand Response Program.

Natural Gas Demand Response Program Application

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Application Requirements

- ☐ Yes, I have provided a list of all existing gas-fired equipment at the facility as stipulated in the Technical Data and Eligibility Requirements
- ☐ Yes, I have provided a list of gas-fired equipment to be evaluated for participation in the DR Program as stipulated in the Technical Data and Eligibility Requirements
- ☐ Yes, I have entered in Indicative Desired Bid Amounts for all equipment that I wish to be considered for participation in the DR Program for the upcoming DR Season
- ☐ Yes, I have signed the Program Application.

To ensure the timely processing of your Application package, please make sure that you submit all of the documentation below:

1. Completed Program Application
2. W-9 form, if applicable (May be submitted at a later date)

Are any of the proposed equipment designed for the DR Program expected to participate in any other Program (e.g. National Grid Energy Efficiency Programs)? If yes, additional eligibility requirements may apply.

☐ Yes: Program Name _____

Customer Assignment of Rights to Incentive to Applicant:

Application Submission

I hereby assign any right, title, or interest that I may have in the incentive payment to the Applicant.
Note: This section is only required to be completed if the Customer is authorizing National Grid to issue this incentive payment to the Applicant.

Customer Name (please print)	Customer Signature	Date

Customer Signature:

Customer Name (please print)	Customer Signature	Date

Final Incentive Offer Acknowledgment:

To be signed upon acceptance of National Grid's notification of Final Incentive Offer and Acceptance by Customer.

Customer Name (please print)	Customer Signature	Date

Appendix B: Technical and Eligibility Requirements

Technical Data and Eligibility Requirements

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General Requirements

- Must be a firm commercial natural gas customer in good standing in National Grid's New York City or Long Island Service Territories.
- Must submit a Natural Gas Demand Response Application Form (the "Application") before September 1st of any given year to participate in that year's Demand Response Program ("Program").
- National Grid reserves the right to accept applications after September 1st.
- If your business signs up for the Winter 2017/2018 Demand Response ("DR") Season, it will be required to resubmit a bid for the 2018/2019 DR Season, and any subsequent DR Seasons if you are enrolled in the year prior. You will be able to terminate your participation in the Program via written request if you are not satisfied with National Grid's offered incentive.
- Incentives are available for reduction in natural gas consumption by Direct Load Control, turning off pre-identified natural gas equipment.
- Customers will be selected for the Program to receive financial incentives to reduce natural gas use in accordance with the eligibility requirements described herein and the Application Terms and Conditions.
- Customers that currently use a third-party marketer for commodity should be aware of implications to their commodity contract if complying with the Natural Gas Demand Response Program puts them out of swing tolerance in their commodity contract. However, because the Natural Gas Demand Response Program is not eliminating consumption, but ideally shifting the timeframe in which consumption occurs, this should minimize this concern. There should not be any issues for customers with "full requirements" commodity contracts.
- Customers who wish to integrate the Gas DR System with their Building Automation System (BMS) should be aware that they would need to coordinate with their BMS contractor. Additionally, the cost to integrate and program the BMS System with the Gas DR System would be borne by the customer.

Demand Response Type Requirements

- Must be able to curtail a minimum of 500 CFH (500,000 BTUH equipment input rating) of winter or process gas loads per event. Customers will be evaluated and selected for the Program based on their ability to reduce the most peak load and be within the $/Unit tolerance determined during the bid evaluation process.
- Customers can commit part of a unit (<500,000 BTUH) once they have surpassed the initial requirement. (i.e. 600,000 BTUH submitted would be 1.2 Units).
- Curtailment of standby equipment, emergency generators, NGV or CHP is not eligible.

About Demand Response Events

- DR Events will only be called during the DR Season, which lasts from December 1st to March 1st.
- DR events will be called forty-eight (48) hours before curtailment is needed.
- The DR Season is the months of December, January and February.
- All DR events will start at 6am and will finish at 9am.
- Maximum of 6 DR events per DR Season.
- Customers cannot opt out of a DR event.

About the Incentive

- Incentive $/Unit of load curtailed, will be determined via a bid evaluation process conducted by National Grid. Customers must complete the Application listing all natural gas equipment connected behind the customer's specified natural gas account, and indicating the corresponding connected load (in CFH) for each piece of equipment.
- On or about September 15th of each year, customers will be notified of the pieces of equipment that have been selected for participation in the Program based on their bids and the final incentive offers for these pieces of equipment. Customers may then accept the actual incentive offer by initialing the Application next to the qualifying equipment and signing the "accepted final offer" block within the Application.
- Incentives will be paid out within 90 days of the conclusion of the DR Season each year.

Details about the Demand Response Incentive Program

- This program is part of a 3-year demonstration project for demand response. National Grid cannot guarantee that incentives will be available after the winter of 2019. Customers not selected for participation in the Winter 2017/2018 Gas DR Season will have the opportunity to apply for participation in the 2018/2019 Winter DR Season program.
- Incentives and participant openings to this program are limited based on the quantity of demand response assets to register.

Learn more about Demand Response at ngrid.com/GDR

Appendix C: Marketing Flyer

Let's work together to lower peak energy demand.

There are times throughout the winter, between 6am and 9am, when natural gas use in our community reaches its highest levels. That's because homes and businesses are turning up the thermostat and production is starting for the day. By reducing overall energy demand during these periods, we can decrease our need for costly infrastructure upgrades.

Participate in the Natural Gas Demand Response Pilot Program and earn generous incentives

By shifting some of your business's natural gas use until after 9am in the winter, you will not only help us manage peak demand, but also earn money.

- **Earn an incentive each time a demand event is called between 6am and 9am (December through February).**
- **Increase your participation in the program and you'll increase your incentive.**

National Grid is launching this pilot program to help make reducing demand during peak times rewarding for everyone.

Example: We estimate that the average price of one Unit of natural gas for a Demand Response event will be approximately $200. This program will be based on Units where one unit of connected load is equal to 500 CFH, which is equal to 500,000 BTUH equipment input rating.

If you curtailed 1500 CFH (3 Units) of natural gas over a winter that had six Demand Response events, the incentive from National Grid would be:

$200* x 3 Units of Demand Response x 6 Demand Response events = $3,600

**estimated value of 500 CFH which is one unit*

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The Natural Gas Demand Response Pilot Program is designed to work for you.

1. This program is strictly voluntary.
2. This is NOT interruptible or temperature controlled (TC) service. You don't need a backup system to participate in this program and the Demand Events will only last for a pre-determined period of time.
3. Your rate won't change, which means no changes to your bills, billing cycle or anything else.
4. Similar to electric Demand Response, a Competitive Bid Process will determine which bids are selected to receive a final offer and what the price per unit will be.
5. We will arrange the installation of simple devices that will allow us to control equipment during demand response events, so you don't have to worry about turning off equipment at the appropriate time.
6. No long-term obligation: if you try this for a year and it doesn't work for your business, you can opt out.
7. You'll get a lump sum payment within 90 days of the end of the Demand Response Season – it's an easy way to get some additional capital as you head into the summer.

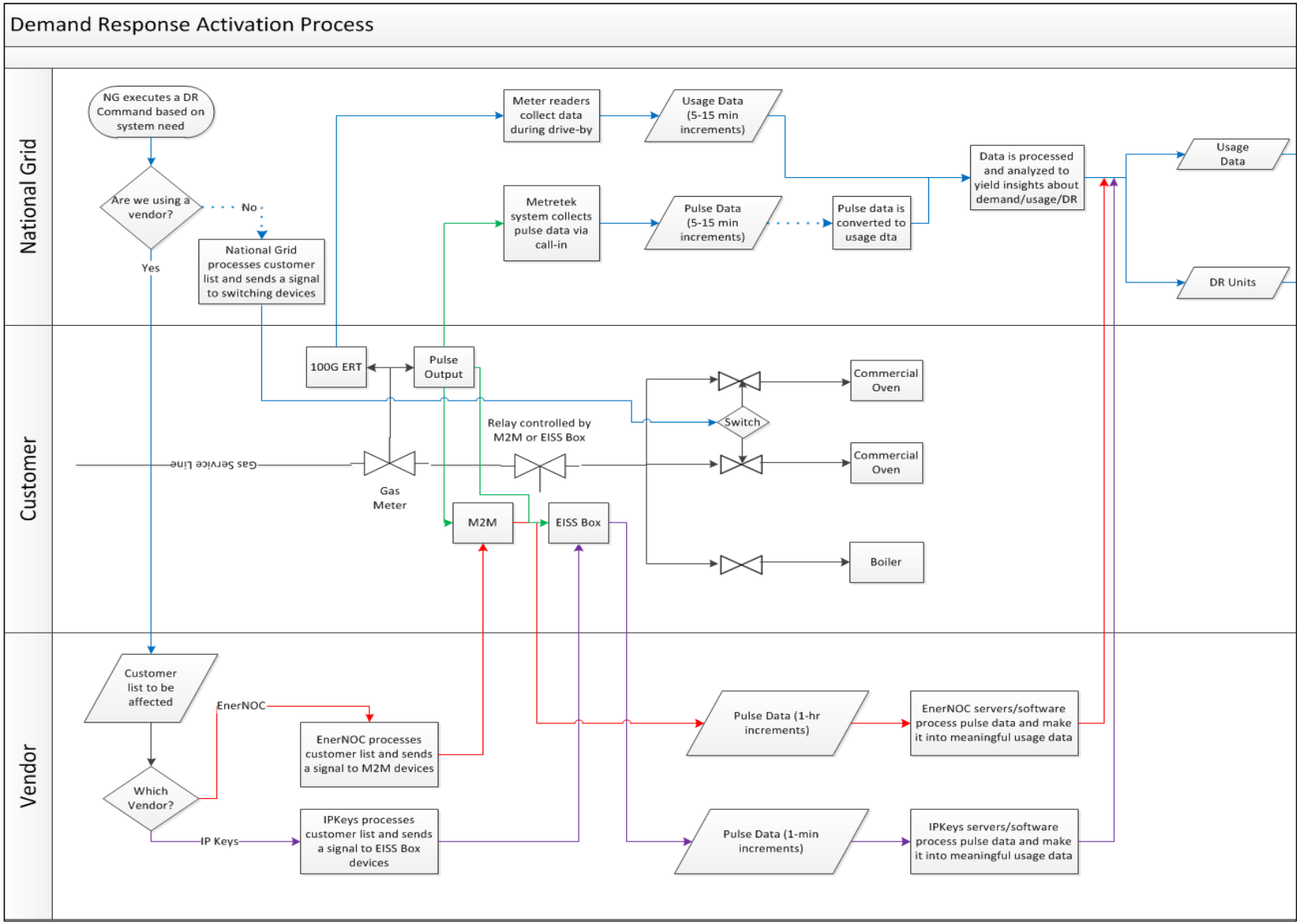
GET STARTED TODAY!

Frank Duggan
Lead Business Development Manager
781-907-2204
francis.duggan@nationalgrid.com

Owen Brady
Program Manager
929-324-5077
owen.brady@nationalgrid.com

Learn more about Demand Response at ngrid.com/GDR

Appendix D: Data Flow Process Map



Appendix E: Work Plan

Gas Demand Response Implementation Plan

Participating Group — Timeline: Dec-2016; CY 2017 (Jan-17 – Dec-17); CY 2018 (Jan-18 – Dec-18); CY' 2019 (Jan-19 – Dec-19)

No.	Task	BD Director, VP S&PO	Procurement	IS/IT Data Security	NES Project Manager	Instr. Group, Gas Control, Meter Data Services	Advanced Data Analytics	Long Term Planning / Operations Eng	Marketing / Public Awareness	Call Center	Jurisdiction	NES	Business Develop	CMS	Gas Control	Legal	Regulatory / Pricing	Billing & Accouning	Environmental & Sustainability Policy	Gridforce Team	Market Research	Evaulation Group	Strategic Sales / Complex Sales	Selected Vendor
0.00	**Governance**																							
0.10	Prepare Delegation of Authority $114,000 CapX $609,300 OpX (Monies may need to be reallocated between CapX and OpX)						X					X	X				X							
0.20	Submit for approvals	X					X						X		X		X							
0.30	Document Approvals and Retain Records	X			X		X						X		X		X							
1.00	**Work with Procurement to Develop RFP**																							
1.10	Solicit Vendors		X			X							X		X									X
1.20	Review Installer Specifications to match goals of program		X	X		X							X	X	X									
1.30	Select best equipment for the project		X			X							X	X	X									
1.40	Issue RFP		X																					X
1.50	Deteremine Communications Plan		X						X															
1.60	Review Quotes and Proposals		X		X	X							X	X	X		X							X
1.70	Award Contract to Vendor		X																					X
2.00	**Long Term Planning to obtain Heat Maps**																							
2.10	Solicit Long Term Planning engagement for necessary info							X				X	X											
2.20	Review to make sure info is adequate				X			X				X	X		X						X			
2.30	Send info to Market Research / ADA for Overlay				X		X						X								X			
3.00	**ADA / Market Research to overlay Heat Maps with target customers to identify potential non resi customers by usage**																							
3.10	Develop Participant Criteria						X	X			X		X		X			X			X			
3.20	Validate existing Load Profiles of Targeted Customers						X						X		X						X			
3.30	Develop Customer Agreement				X			X	X				X		X	X	X						X	
3.40	Develop Outreach Plan Materials								X		X		X			X					X		X	X
3.50	Finalize Initial Recruitment & Targeting List of Customers										X	X	X		X						X		X	X
4.00	**Determine best platform (Itron AMI Network or Metretek)**																							
4.10	Instrumentation / CMS Review			X	X	X								X	X									
4.11	Intron AMI Specs and applicability			X	X	X								X	X									X
4.12	Metretek Specs and applicability			X	X																			
4.13	Select Metering System			X	X							X	X	X	X									X
5.00	**Research and interview qualified Vendors (Enernoc or others)**																							
5.10	Enernoc		x									X	X				X						x	X
5.20	Vendor # 2																							x
5.30	Vendor # 3																							x
6.00	**Legal to develop "Customer Agreement" and Vendor "Agreement"**																							
6.10	Obtain Copt of Existing TC Contract KEDNY for Template of Proposed DR Agreement												X			X	X						X	
6.20	Draft DR Agreement submit to Legal												X				X							
6.30	Legal Review and edits														X	X	X							
6.40	Review Final Draft with Marketing, Sales and Engineering				X			X	X			X	X			X	X							X
6.50	Publish Agreement for Sales Dept use								X	X	X	X	X	X		X	X		X		X		X	X
7.00	**Install Equipment (Direct Load Control Relays & Servos / Meters**																							
7.10	Coordinate with Customer, Vendor, CMS and Gas Control			X	X	X							X	X	X								X	X
8.00	**Award Contract to Vendor**		X					X		X	X	X	X	X			X	X			X	X	X	X
8.10	Provide Coordination Contacts briefing CMS, Gas Control									X			X	X	X								X	X
9.00	**Marketing to Develop Communications**																							
9.10	Compile Agreement, Program Objectives Results							X	X								X				X			
9.20	Develop Outreach Plan Materials								X								X				X			X
9.30	Distribute to Sales							X	X		X		X	X			X				X		X	X
10.00	**Work with Strategic Sales and Gas Sales Support Reps to Sign up Customers for program**																							
10.10	Review program objectives				X					X	X	X	X							x			X	X
10.20	Review Cost Benefit/ Participation				X					X	X	X	X										X	X
10.30	Review investment modeler				X						X	X	X										X	X
10.40	Role Play Expected Q&A				X					X	X	X	X										X	X
10.50	Review Agreement and process in Gridforce to complete				X					X	X	X	X							x			X	X
10.60	Obtain Sign Agreements from Customer and Process				X						X	X	X										X	X
10.70	Identify process from Sale to Implementation (Notifications to CMS, Gas Control, Engineering)				X					X	X	x	X	x	x					x			X	X
11.00	**Regulatory and Pricing for input on pricing mechanism based on TC Customers Collaborative/ Auction within "Customer Agreement"**																							
11.10	Regulatory Legal											X	X			X	X							
11.20	Pricing											X	X			X	X							
11.30	Reccomendations for Next Steps											X	X											
12.00	**Billing and Accounting on CRSS set up for Crediting of Gas Account for program participation**																							
12.10	Determine if Vendor to deal directly with customer											X	X					X						
12.20	Vendor and Billing, flush out											X	X					X						
12.30																		X						
13.00	**ADA on cost / benefit proforma and Incentive**																							
13.10	Compile Typical inputs						X					X	X										X	
13.20	acceptable financials						X					X	X										X	
13.30	Finalize investment modeler						X					X	X										X	
14.00	**Coordinate Communication methods between Gas Control with Winning Vendor for Demand Response Program**																							
14.10	Coordinate Vendor Meeting with Gas Control, CMS and Billing				X	X							X	X	X									X
14.20	Q&A				X	X							X	X	X									X
15.00	**Train Call Center Reps on DR Program**																							
15.10	Review program objectives				X	X				X	X		X										X	
15.20	Review Cost Benefit/ Participation									X	X		X										X	
15.30	Review notifications (Sales, Gas Control, I&R /MDS etc)				X	X				X	X		X	X	X								X	X
16.00	**Dry run Test of DR System**																							
16.10	Compile Results of test				X	X				X			X	X	X									X
16.20	Final Report				X	X				X			X	X	X									X
16.30	Reccomendations for Go Live Next Steps				X	X		X		X			X	X	X									X
17.00	**Determine methodology on how to claim Carbon Reduction benefits /Environmental & Sustainability Policy As Well as Capital Deferral Benefits from Load Reduction**																							
17.10					X	X	X	X				X	X		X				X		X	X		
17.20					X	X	X	X				X	X		X				X		X	X		
17.30	Reccomendations for Next Steps				X	X	X	X				X	X		X				X		X	X		
18.00	**Gridforce Tracking Mechanism**																							
18.10	GF Team Notification												X							X			X	
18.20	Recommendations for GF Tracking												X							X			X	
18.30	Implement changes in GF												X							X			X	
19.00	**Go Live Activation of Signed Agreements w/ Customers (Curtailing usage)**																							
19.10	Compile Results				X	X	X	X					X		X								X	X
20.00	**Billing or Vendor to issue credits on bill upon next Cycle Read or Daily Read OR Vendor Issues Check Directly to Customer via Open PO between NGrid and Vendor**																							
20.10	Monitor for accuracy billing results				X	X							X		X			X					X	X
20.20	Reccomendations or corrections for following month				X	X							X		X			X					X	X
21.00	**Measurement & Verification**																							
21.10	Confirm and Quantify Financial and Distribution System benefits (Avoided Infrastructure costs, and customer savings).				X		X	X				X	X								X	X		
21.20	Quantify how many additional customers could be added to distribution system (MCFH) and approximate NDR value to National Grid				X	X	X	X				X	X								X	X		
21.30	Reccomendations for Next Steps				X		X	X				X	X		X						X	X		
21.40	Summarize results/ Final Report 2017- 2018				X		X	X				X	X								X	X		
21.50	Take learnings and correct mistakes and apply to 2018-2019 Program year				X	X	X	X				X	X		X						X	X	X	X
22.00	**Go Live Activation of Signed Agreements w/ Customers (Curtailing usage 2018-19)**																							
22.10	Compile Results				X								X										X	X
23.00	**Billing or Vendor to issue credits on bill upon next Cycle Read or Daily Read**																							
23.10	Monitor for accuracy billing results				X								X	X	X									
23.20	Reccomendations or corrections for following month				X																			
24.00	**Measurement & Verification**																							
24.10	Confirm and Quantify Financial and Distribution System benefits (Avoided Infrastructure costs, and customer savings).				X		X	X				X	X								X	X		
24.20	Quantify how many additional customers could be added to distribution system (MCFH) and approximate NDR value to National Grid				X		X	X				X	X								X	X		
24.30	Reccomendations for Next Steps				X		X	X				X	X								X	X		
24.40	Summarize results/ Final Report 2018-2019				X		X	X				X	X								X	X		
25.00	**Final Report**																							
25.10	Compile Results				X	X	X	X				X	X		X				X		X	X	X	X
25.20	Carbon Reduction results				X		X					X	X						X		X	X		
25.30	Added Revenue Potential NDR				X		X					X	X								X	X		
25.40	Avoided Capital and Customer CIAC				X		X					X	X		X						X	X		
25.50	Final Report				X		X					X	X						X		X	X		
25.60	Reccomendations for Next Steps				X		X				X	X	X						X		X	X		

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses.
Modifications will be captured in quarterly reports and meetings with Staff.

Appendix F: REV Alignment

NY's REV initiative has developed a series of Core Policy Objectives. In addition, for the natural gas products and services and services it is self-evident that safety is an additional outcome resulting in the following set of generic objectives for Gas REV.

After a review of these objectives the next step is translate them into specific initial objectives and metrics for gas service overall and each demonstration project as described in their respective implementation plans The figure below identifies one view of a series of utility services and also a set of gas service objectives and identifies pilot program focus and broad metrics that would be aligned with this service and objectives. This is the basis for the selection of Gas REV Projects.

Focus of Proposed Pilots	Aligned Services							
		Detect Leaks	Locate & Reduce Leaks	Flood Detection	Reduce Gas System Constraints (Automation)	Promote High Efficiency and Smart Appliances	Manage Gas Electric Interdependency	New Sources of Supply and Renewable Gas
	Safety Improvement	✓	✓	✓		✓		
	Modeling the Network for Growth	✓	✓		✓	✓	✓	✓
	Generation And Environment	✓	✓	✓	✓	✓	✓	✓

Focus of Proposed Pilots	Aligned Gas Objectives							
		Maximize Safety	Minimize Environmental Impact	Maximize Energy System Reliability	Improve Customer Affordability	Improve Operational Efficiency	Improve Access to Gas Service	Value Added/Choice Services for Customers
	Safety Improvement	✓	✓	✓				✓
	Modeling the Network for Growth	✓	✓			✓	✓	✓
	Generation And Environment	✓		✓	✓	✓	✓	✓
METRICS		Incident Frequency	GHG Reduction (CO_2e)	Forced Outages	Total Customer Energy Bills [$]	O&M[$] per Unit of Sendout	Capital Efficicncy [$/cust](Financial)	Adoption/New Revenue[$]

The alignment with REV principles for the Gas Demand Response demonstration project is described as follows

REV Objective	Demonstration Alignment
Enhance customer knowledge and tools that will support effective management of the total energy bill	The Project will create awareness of the significance of peak gas demand among large gas customers and their potential roles in its management.
	The Project will establish the concept that peak gas demand has a financial value for the utility and that it can potentially be monetized by customers.
Market animation; leverage customer contributions	The Project creates and animates a market for peak gas load among large firm gas customers.
	The Project extends a market or services and technologies that can manage peak gas demand.
System-wide efficiency	The implementation of a new gas demand response program could support the effective deployment of capital resources.
System reliability and resiliency	The Project will defer future constraints on the gas distribution system or potentially relive existing constraints.
Reduction of carbon emissions	The Project could support additional oil-to-gas conversions thus lowering carbon emissions by 25%.
Partnerships with third-party service providers	The Project has market-animating partnerships with building management technology, and platform providers.

Appendix G: Alignment with New York State Energy Initiatives

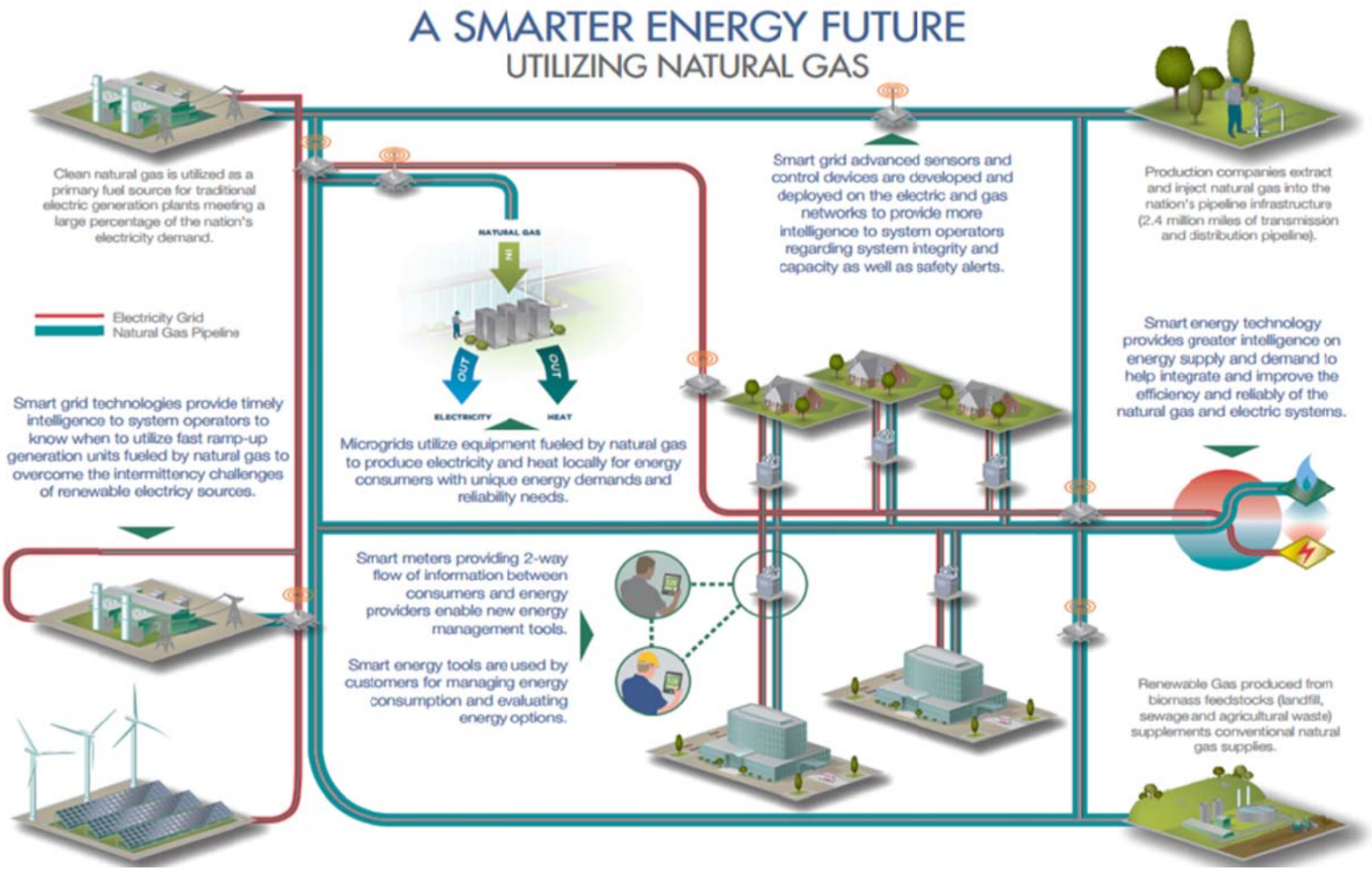
New York State has been supportive of the cost-effective and environmentally responsible expansion of the natural gas service. "[E]xpansion of the natural gas system complements the economic development efforts encompassed by Governor Cuomo's recently released New York Energy Highway "Blueprint"[12]…that "accelerating utility capital and operation and maintenance spending on the State's…natural gas infrastructure will result in enhanced reliability and safety for utility customers while generating substantial economic development benefits for the State's overall economy." [13]

In addition several initiatives in the 2015 New York State Energy Plan support the advanced development of the natural gas infrastructure and services including initiatives 7, 12, 13, 15, 28, and 29.

[12] Case 12-G-0297, *Proceeding on Motion of the Commission to Examine Policies Regarding the Expansion of Natural Gas Service*, Order Instituting Proceeding and Establishing Further Procedures (issued November 30, 2012), p. 5, n. 8.
[13] *Id.*, n. 9.

Appendix H: The Natural Gas Distribution Vision

The US natural gas distribution industry has also developed a future vision on smart energy. This vision has been developed by the American Gas Association and the Gas Technology Institute. It is summarized as follows:[14]



This vision is remarkably similar to the core REV principles in terms of using information to animate markets for energy efficiency and renewable energy but it also includes the benefits of greater interaction between the natural gas and electricity markets. What it does not include is the need for a new emphasis on safety. The gas industry's vision lists the following advantages. "A smart energy future in which natural gas is effectively integrated has the potential to deliver several important advantages:

- Improved safety, energy security, and environmental performance;
- A more efficient infrastructure, with the ability to provide demand response, accommodate emerging technologies, and new sources of supply;

[14] *See* https://www.aga.org/sites/default/files/natural_gas_in_a_smart_energy_future_2014.pdf

- Improved demand response for electric distribution through switching heating and cooling loads to natural gas and through the use of distributed generation;
- Greater consumer choice resulting in maximum energy value; and
- More optimized energy value from renewable wind and solar through the use of fast ramping dispatchable generation."[15]

"Natural gas infrastructure continues to grow in the U.S., and this growth provides opportunities to support aggressive goals for energy productivity while improving service and options for customers through the use of interactive smart electric and natural gas energy grids."[16] National Grid's Gas REV proposals are intended to merge the concepts of REV and this industry vision as it applies to New York State with a new focus on safety and resiliency on both sides of the customer's meter.

[15] *Natural Gas in a Smart Energy Future: A strategic resource for electricity and a smart resource for homes and businesses*, Gas Technology Institute ("GTI") and Navigant Consulting, January 2011, GTI-11/0001, p. 1; *available at*: http://www.gastechnology.org/Expertise/Documents/Natural_Gas_in_a_Smart_Energy_Future_02-22-2011_FINAL.pdf

[16] *Natural Gas Infrastructure: Enabling Energy Productivity, Alliance Commission on National Energy Efficiency Policy*, Washington DC, January 2013, p. 13, *available at*: https://www.ase.org/sites/ase.org/files/natural_gas_report_2-5-13.pdf

Implementation Plans for Gas REV Demonstration Projects Flood Zone Packages in New York City and on Long Island

nationalgrid

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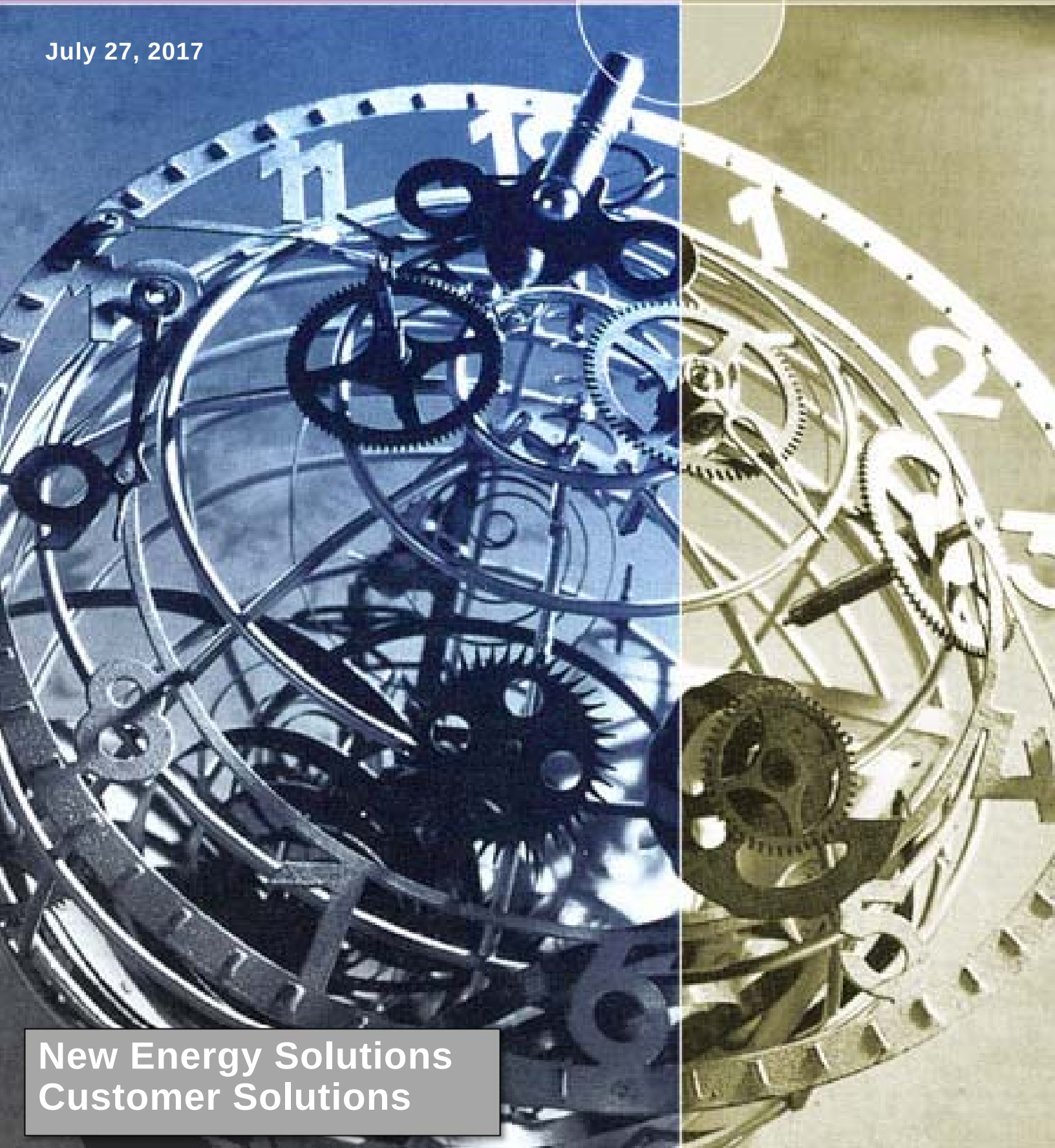
July 27, 2017



New Energy Solutions
Customer Solutions

Flood Zone Packages
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Executive Summary

KeySpan Gas East Corporation d/b/a National Grid ("KEDLI") and The Brooklyn Union Gas Company d/b/a National Grid NY ("KEDNY") (collectively "National Grid" or the "Companies") are implementing a new gas demonstration project to assess the benefits and value streams of a package of technologies and services which may offer increased safety and resiliency for gas customers by detecting gas leaks or flooding and providing localized operational data to assist gas utility operations (the "Flood Zone Packages" or the "Project" or the "Flood Zone Project"). The Project will also provide data that will enable customers to make energy choices and the utility to improve system management. The Flood Zone Packages will be demonstrated in areas where the Companies' gas systems were impacted by Hurricane Sandy in October 2012. The Flood Zone Packages will be deployed at 500 customer buildings in each of the Companies' service territories and will include the following:

- Connected Methane Detector
- Flood Sensors
- Automatic and Remote Gas Shutoff Valves
- On-grid Sensors (pressure)
- Analysis of Fine Meter Data

The Project is a test-and-learn demonstration and was designed in accordance with the principles of the New York State Public Service Commission's ("Commission" or "PSC") Reforming the Energy Vision ("REV") Proceeding.[1] A major goal of the Project is to assess the potential to engage customers in improving the safety and resiliency of gas service and gas appliances. The Project was approved through the 2016 KEDLI and KEDNY rate proceedings.[2] The purpose of this implementation plan is to describe National Grid's detailed execution plans for the Project.

The Project was designed to align within REV policy outcomes in several ways, including the potential to provide actionable information in order to "animate markets" for safety devices and energy efficiency improvements. National Grid believes that it is possible to create more mutually beneficial relationships with customers by leveraging critical infrastructure, customer outreach and engagement, energy insights, and actionable information. Toward that end, the following attributes of a successful suite of features will be measured or estimated from the Project results:

- Rate of customer adoption
- Number of participating customers that use the data
- Customer satisfaction
- Cost for perceived value

[1] Case 14-M-0101, *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision* ("REV Proceeding").

[2] Case 16-G-0058, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service*; Case 16-G-0059, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service et al*., Joint Proposal (filed September 7, 2016), Sections 9.9 & 13; and Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

The results of the Project will be reported to the PSC and recommendations will be made for either a full-scale program or further study based on the results of the Project and the projected benefits and opportunities at that time for a larger program.

1.0 Demonstration Project Design

The purpose of the Project is to test the benefits of a package of technologies and services and the potential to use these technologies to engage customers in improving safety, resiliency, and energy efficiency. The Flood Zone Packages will effectively provide for limited gas smart home trials focused on safety and resiliency with other potential benefits. There are a number of varied services that could result both through utility partnerships, third parties, or direct utility services. All would be developed in accordance with REV principles with the proposed addition of continuous safety improvement as a new REV objective. There are a number of potential value streams that could result that will be evaluated and include both qualitative and quantitative determination of the following attributes of those value streams for customers and utility operations:

- Technical Attributes
  - Cost to implement
  - Cost to maintain
  - Gas system benefits identified
    - Flood risk to system
    - Benefits of methane detection (*e.g.*, service line inspections)
    - Value of data
      - Flooding locations
      - System status (*e.g.*, pressure)
      - Customer load profiles
- Customer Attributes
  - Satisfaction and perceived value of safety improvements
    - Detection
    - Notification
  - Use of meter data
    - Energy efficiency (customer and service providers)

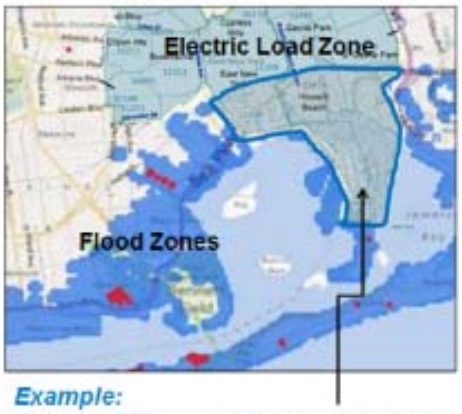
Installing remote gas shut-off valves with flood sensors to automatically shut down the gas supply to premises that experience flooding and provide an accurate count of gas services impacted by the flooding will enable improved emergency response during such events. This will be achieved by disconnecting only the services affected by flooding as opposed to the larger gas service district, sending alerts to the customers impacted, isolating the gas system, and alerting the Companies of the loss of gas service to respective customers in real time. This will enable improved management of emergencies with a specific focus on the affected customers. During Hurricane Sandy, National Grid had to shut down much larger gas service districts because of the lack of remotely operated service shut-off valves which resulted in the loss of gas service to many of our

customers for a significant period of time. The Project will also facilitate swift decision making during restoration allowing for a focus on affected regions, thus allowing improved customer satisfaction while further ensuring the safety and reliability of the gas system. Safety and compliance initiatives being tested in the Project could potentially provide an alternative to the frequency for inside gas service line leak surveys and inside inspections. Safety will also be enhanced through the analysis of fine meter data to identify hazardous conditions such as distressed heating[3] or gas theft. The same data may be used to remotely identify energy savings opportunities such as a lack of set-back thermostats. The concept of remote energy efficiency audits is being studied by the New York State Energy Research and Development Authority ("NYSERDA") and others.[4] An outside data analytics provider will be selected for this task.[5]

1.10 Project Component Details

The full Flood Zone Package will include the following features:

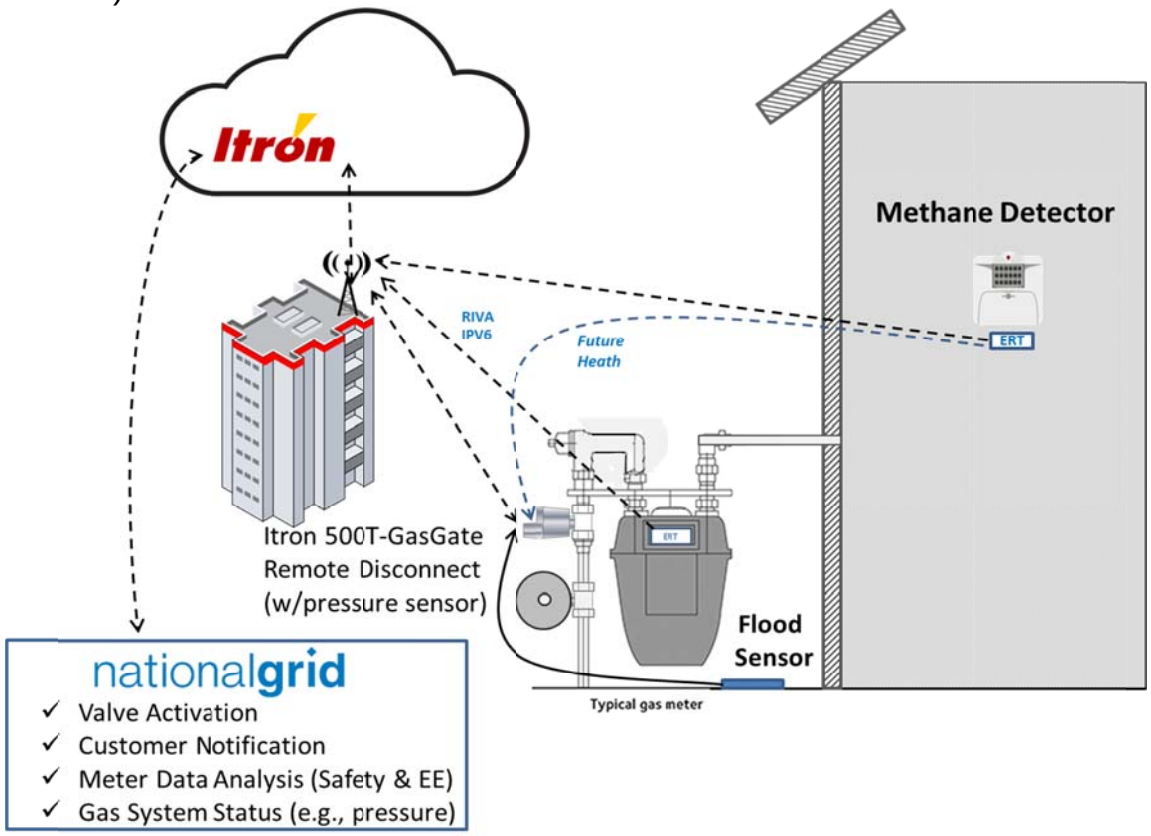
- Connected Methane Detector
- Flood Sensor
- Remote Shut-off Valve
- Connected by Advanced Metering Infrastructure ("AMI")
- Additional On-Grid Sensors at Customer Buildings at Strategic Locations
- Date Analytics for Safety and Efficiency (*e.g.*, remote audits)



Flood Zone Packages will be installed in 1,000 residential or light commercial buildings to be selected from those customers who volunteer to participate in the Project. One of the primary targets in New York City will be those neighborhoods that are both flood zones as well as served by a constrained electric or gas system, since the data developed may also offer insights into the usage patterns to potentially address electric and gas reliability. Some gas utilization equipment is also significant users of electricity, especially heating systems. Customers and National Grid will receive notifications of methane detection or flood alerts. Granular gas meter data will be used to categorize equipment operating modes to assess safety through profiling of gas flow rates and identification of abnormal flows. Energy efficiency (EE) opportunities will also be assessed by analysis of energy use patterns. The results will be communicated to customers at least once during the two years of operations. On-grid

[3] Distressed heating refers to use the improper use of equipment for heating during the breakdown of a heating system.
[4] M. Zeifman *et al*., *Residential remote energy performance assessment: estimation of building thermal parameters using interval energy consumption data*, ACEEE Summer Study on Energy Efficiency in Buildings (2016).
[5] *See* revised proposal to develop data analysis algorithms received from Research Foundation of SUNY (dated April 5, 2017).

sensors, Pressure and/or gas composition via on-grid sensors will be will be available and used to assess value to system design and operations. The potential to collaborate with the electric utilities in the Companies' service territories and local governments will be assessed in terms of notification and meter data utilization for their purposes. The flood zones chosen will be based on the Federal Emergency Management Agency's ("FEMA") latest maps and will be those areas affected by Hurricane Sandy (see attached Appendices).



Connected Methane Detector

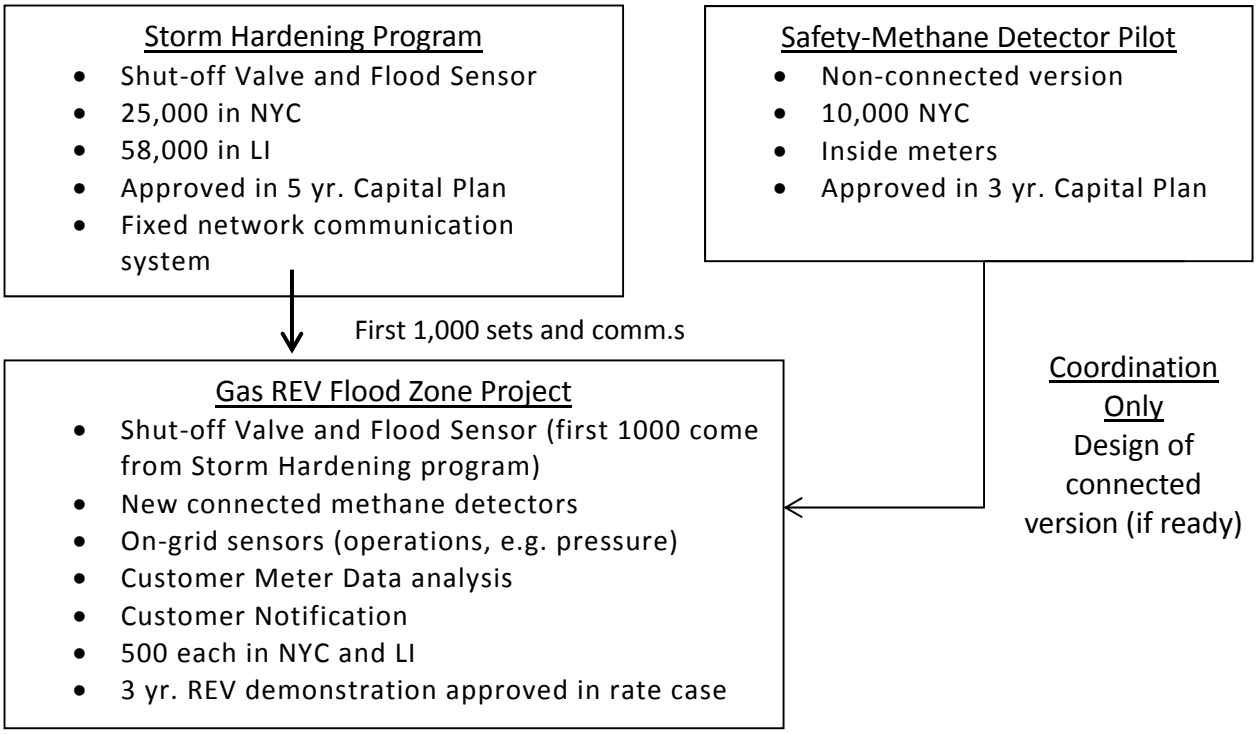
The primary safety initiative in this Project is the deployment of additional methane detectors incremental to those already planned by National Grid. The purpose of this expanded deployment is to test customer acceptance of the devices, which in the case of this Project will be connected to the Companies' communication systems, and will, if technically possible, provide notification of an alarm to both National Grid and the customer while concurrently activating the automatic shutoff valve. The selection of the device will be based on the results of ongoing research at NYSEARCH, the Gas Technology Institute, and several manufacturers.[6] The automatic electronic shut-off valve will be the same valve used in the National Grid Storm Hardening programs, most likely that developed by Itron. See shutoff valve information in attached Appendices.

Itron Remote Disconnect

[6] *See, e.g.*, P. Armstrong, *Residential Methane Detectors and Asset Lifecycle Tracking & Traceability*, Northeast Gas Association's Executive Conference (September 9, 2014); available at: http://www.northeastgas.org/pdf/p_armstrong_res_methane.pdf15

A review of the fixed network communications system chosen for the Companies' storm hardening programs indicates there is no ability to share network assets or services at this at this point in time or during the duration of this Project with the overlapping electric utilities. The Project will utilize an Itron network to make use of Itron devices. Consolidated Edson Company of New York, Inc.'s ("Con Edison") AMI networks are Silver Spring and PSEG-Long Island utilizes Landis and Gyr and the communications systems they will employ are not compatible with the devices planned for this project. As such, in order to use such systems, modifications and additional communications system design for National Grid's systems would be required that is beyond the scope of the Project. However, such integration is possible at a future date and will be considered should the services tested in the Project be brought to scale.

The implementation of the Project is related to two other larger capital projects approved simultaneously. These include the Storm Hardening program in the KEDNY and KEDLI service territories and the Safety-Methane Detector pilot in the KEDNY service territory. The Storm Hardening program is in response to Hurricane Sandy. The purpose of the Storm Hardening program is to protect gas customers from over pressurizing as a result of low pressure gas lines blocked by water from flooding by disconnecting the customer gas supply as soon flooding is detected and will limit the extent to which the gas system will be taken out of service by flooding. This program will also provide an accurate count of impacted customers for appropriate communications, responses, and repairs. They are separate projects but the Storm Hardening program provides key components of the Flood Zone Project at no cost. The interrelationship of these projects is shown as follows:



1.11 Storm Hardening Program

The primary elements of the Storm Hardening program are based on the need for the development of potential new services utilizing new systems and technologies in collaboration with Itron and will be included in the Flood Zone Project. As part of the Storm Hardening program, Itron will be providing 1) the gas remote disconnects with integrated flood sensor as shown here and 2) cloud-based, two-way data services that link the customer sites to the Companies' operations. The Itron disconnect device may also include pressure monitoring in a later version in the future, Thus, pressure monitoring in the Flood Zone Project is not part of the Storm Hardening program and is funded only in the Flood Zone Project. A prerequisite of the Storm Hardening program is the development of a fixed network communications system. There are limitations unique to gas utilities in that gas utilities generally may not have access to power for devices and must rely on batteries. National Grid's IS and Smart Grid teams with experience in fixed network communications for electric utility programs are supporting the Storm Hardening program which also supports the Flood Zone Project.

1.12 Methane Detector Pilot

The Methane Detector pilot, which will not provide materials for the Flood Zone Project, is focused only on NYC customers prioritizing those with gas meters sets located inside the premises and the evaluation of polices regarding service line inspections, unrelated to the objectives of the Flood Zone Project. While there are a number of UL listed products commercially available, few have the ability to send a signal of activation out.[7] As such, for this Project, a methane detector may be supplemented with a separate Encoded Receiver Transmitter ("ERT") that will, if possible, communicate with the Itron fixed network communications provided. Future versions of the Itron gas shutoff valve will be compatible. In addition, unrelated to the Methane Detector pilot or this Project, a new methane detector is being developed collaboratively with funding and technical support from the New York gas utilities R&D programs by Heath with a lower triggering level and is under the review of Department of Public Service Staff ("Staff"). For the Project, there will be a strong preference to wait for a connected version of the Heath product to the extent that the overall project timeline isn't significantly impacted.

1.13 Participant Eligibility

This project involves the recruitment of participants. The Project will be documented through a brief site agreement with the participating Customer describing the benefits, rights, and responsibilities for customers who are provided the full package. Participating customers that are provided with a methane detector and data services under the Project will be required to enter into such an agreement with National Grid that sets out the benefits, rights, and responsibilities of each party. The following general requirements will

[7] Two UL listed connected residential methane detectors are the Macurco GD-2B and the Roost RSA-400 Smart Alarm.

apply in order for a customer to be deemed eligible to participate in the Project:

- National Grid gas customer
- Technical suitability (only appliances with electronic starts; no standing pilots)
- Gas Utility account in good standing
- Proof of Property insurance
- Buildings properly maintained with no outstanding permit violations
- Internet access
- Easy access for service and data collection

1.14 Customer/Stakeholder Engagement and Communications

The participants in the Project will be recruited from those customers whose gas service is included in the Storm Hardening program. Participation in the Storm Hardening Program will not require customer recruitment as that program requires no direct customer engagement or involvement. However, experience with electric smart grid projects has demonstrated the need for early and continuous community outreach regarding public concerns related to the installation and use of the wireless fixed data network that will be built for the Storm Hardening program and thus support the Flood Zone Project.

The Flood Zone is relatively small in terms of numbers of participating customers and is completely voluntary. As such, customer engagement will be customized to each Flood Zone Package. Initial communications to customers will be implemented as part of the Companies' Storm Hardening programs. In addition, outreach through local agencies, such as local government or community agencies, will also be included in an effort to engage customers in the Project. National Grid will also support such efforts through community and government affairs representatives and through existing sales and marketing channels including:

- Targeted direct mail
- Outbound telemarketing
- National Grid sales and community representatives
- Social media

Large-scale marketing and advertising is not necessary or justified for the Project. Potential participants are expected to be tracked manually or by National Grid's GridForce customer relationship management system.

1.20 Test Statements

National Grid will test the validity of the hypotheses shown in Table 1, Test Statements, below. The results of hypothesis testing will be tracked and documented and then used to inform and modify subsequent offerings to residential or mixed-use small commercial gas customers in New York City and on Long Island:

Table 1: Test Statements

Overarching Test Statement	If…	Then…
A gas distribution utility can engage residential or small commercial customers with new technologies and services to improve safety, resiliency and efficiency.	New technologies and services offer customers insight and actionable information regarding gas safety, resiliency, and gas utilization.	Customers will be more active in preventing gas incidents; thereby improving overall system resiliency and energy utilization efficiency.
	B. Direct data and remote control of gas service are viable tools for gas system operations to improve safety and reduce restoration time in case of flooding.	Utility capital efficiency will improve and customer satisfaction with gas service will increase, both leading to sustained system growth.

Supporting Test Statements	If…?	Then…
1. Customers will accept and value automatic or remote shutoff for use when certain hazardous or damaging conditions are present.	A. Customers perceive that automatic or remote shutoff of gas service and notification enhances their safety when methane is detected.	Customers can be engaged to directly enhance premises safety and will accept these functionalities in order to achieve ongoing improvements to health and safety.
	B. Customers welcome automatic shutoff and the potential for false activation and notification to protect the gas system and their own buildings from damage in times of flooding regardless of the cause	Customers can be engaged to directly enhance the resiliency of the gas system serving their premises and those nearby and will perceive a greater value to gas utility service.

2. Interval meter data can be used to identify safety concerns such as leaks or gas theft.	A. Meter interval data can be used to identify hazardous conditions, such as distressed heating or gas theft, through data analysis.	The gas utility can engage directly with customers to improve the safety of customer premises and prevent or minimize gas leaks or gas theft or misuse of some appliances.
3. Interval meter data can be used to identify energy efficiency opportunities such as lack of setback controls.	A. Interval meter data can be effectively analyzed to identify energy efficiency opportunities including setback controls or those resulting from energy profiling.	Service providers and/or customers can utilize this information to develop the costs and benefits of making specific energy efficiency improvements.
4. Localized gas system measurement, such as pressure or gas composition, may be a tool for improved gas system expansion planning.	A. The addition of local connected measurement devices, such as pressure or gas composition at end-user locations, provides actionable information to gas system designers and operators.	The operations and planning of gas operations and gas infrastructure can be enhanced for improved utilization of capital and operating efficiency in certain locations.

1.40 Test Population

The current market size for the features in the Project will at a minimum encompass the flood zones identified as part of the Storm Hardening programs approved in the Companies' Capital Plans. This translates into a minimum of 25,000 units in New York City and 58,000 customers in Long Island.[8] However, exterior flooding is not the only potential source of flooding in buildings. Flooding can also result from water main breaks, interior water line breaks, or catastrophic failure of gas appliances such as water heaters or tanks. In 2005, National Grid implemented an in-home demonstration and evaluation of home management systems in downstate NY. The systems were made by Honeywell and Shell at the time. Of forty (40) participants surveyed, 95 percent indicated that "detecting water leaks" and "heating alarms" were the most important features. Ultimately the entire residential heating and non-heating customer segments could benefit from the successful development of this suite of services as follows:

	Current Gas Customers*	Potential New Customers*
KEDNY	529,000	17,000
KEDLI	482,000	398,000

[8] *See* Cases16-G-0058 and 16-G-0059, Testimony and Exhibits of: Gas Infrastructure and Operations Panel Book 4 – KEDNY and KEDLI Book 4 (filed January 29, 2016).

** By structure count as of May 2015*

1.50 Test Scenarios

Table 2: Test Scenarios

Scenario	Description
Rate of customer adoption	
Portion of customers offered Project participation that actually participate.	The project manager will assess customers' pre-installation interest in this bundle of features against customers' rate of adoption.
Number of participants that use the data	
Portion of customers in the Project that use data for safety or energy efficiency.	The project manager will assess the value of the data analytics used by customers by determining the portion of those customers using data to identify energy efficiency measures, the corresponding magnitude of energy savings and take action where data indicates there is potentially an unsafe condition.
Cost for perceived value	
Customers' assessment of installed feature value compared to other market products or services.	The project manager will survey participating customers to assess the perceived value of the Flood Zone Packages' features, individually and in combination, compared to existing products or services in the marketplace such as security and hazard monitoring services.
Customer satisfaction	
Satisfaction with services and features of the Project.	National Grid will assess the satisfaction of the participating customers in the Project and compare against relevant existing data regarding gas utility service in general and compare to related service providers or similar unrelated services.

1.60 Milestones and Checkpoints

Table 3: Milestones

Actions	Timing	Process Owner	Process Support
1. Design packages, including final selection of methane detector, sensor package and installer specification.	December 2016 – July 30, 2017	Flood Zone ("FZ") Team	n/a
2. Component procurement - Methane Detectors - On grid sensors (e.g., pressure) - Services (install, comms.) - Data Hosting	July 30- 2017 – March 30, 2018	Flood Zone ("FZ") Team	NES Procurement Gas System Engineering Advanced Data Analytics RD&D Information Services
3. Participant Recruitment - Participant criteria - Outreach campaign - Agreements	July – November 30, 2017	Flood Zone ("FZ") Team	NES Marketing Legal
4. Installation (coordinate with Storm Hardening Program in capital plan and AMI availability expected 10/31/2017).	March 1, 2017 - June 30, 2018	Flood Zone ("FZ") Team	NES CMS Gas System Engineering
5. Control Center integration	February 2018 – June 30, 2018	Flood Zone ("FZ") Team	NES Gas Control
6. Call Center training	February 1, 2018 – June 30, 2018	Flood Zone ("FZ") Team	NES Call Center
7. Data Analysis planning	August 2017 – September 30, 2017	Flood Zone ("FZ") Team	NES Advanced Data Analytics System Engineering
8. Go Live	July 30, 2018	Flood Zone ("FZ") Team	n/a
9. Progress on implementation and program performance to be reviewed during the Jurisdiction's monthly performance meetings. If any issues are identified, the Jurisdiction will require a performance improvement plan.	Monthly	Flood Zone ("FZ") Team	n/a

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

Table 4: Checkpoints

Scenario	Description
Rate of customer adoption	
Portion of customers in the Storm Hardening programs and those additional customers electing to participate in the Project.	Measure: Count of participants How and When: End of each year Resources: Project Manager Target: 75% of those asked Solution if off-target: Review and revise messaging
Number of participants that use the data	
Actual load reduction potential per customer for process and heating loads.	Measure: Count of participants using data How and When: End of each year Resources: Project Manager Target: 75% of those participating Solution if off-target: Review and revise messaging
Cost for perceived value	
Cost of each feature individually and collectively.	Measure: Cost of features and services How and When: End of each year Resources: Project Manager Target: Equivalent to similar market services such as security monitoring Solution if off-target: Review and revise product design
Customer Satisfaction	
Satisfaction with the prospective service to date compared to existing gas service programs.	Measure: Percent of participants “satisfied” or better. How and When: End of each year Resources: Survey Target: Exceed satisfaction with gas utility service Solution if off-target: Review and revise procedures

1.70 Conditions and Barriers

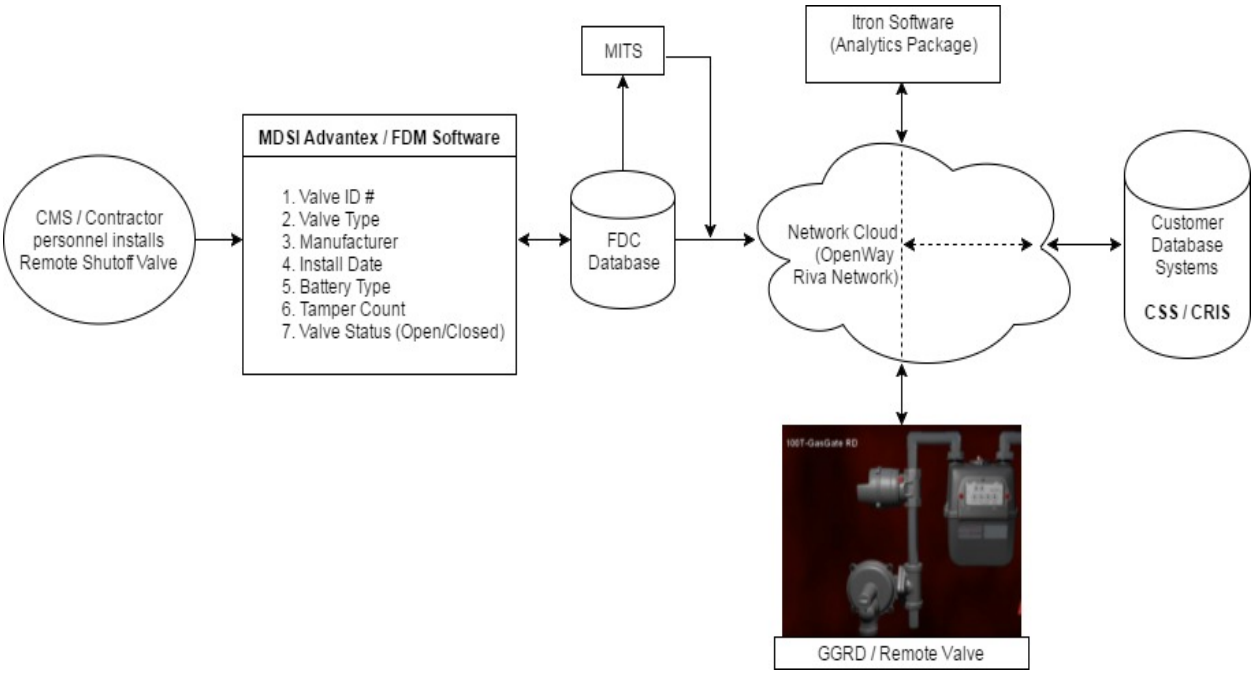
The following list includes anticipated key dependencies and potential barriers that may need to be addressed during the progress of the Project:

- Fixed network communications system and utility system interfaces are provided by the Storm Hardening programs and can be integrated by IS.
- Completion of Itron redesign of communicating gas shutoff valve
- Timely support from Itron for additional functionality for this pilot is required.
- Remotely operated shut-off valve is provided by the Storm Hardening

programs and produced in sufficient quantities

- Flood detector is provided by the Storm Hardening programs
- A commercially available Methane detector is provided through the Flood Zone Project but should be the same model as that expected to be provided through the Gas Safety-methane detector program or the improved product from the current R&D program.

The Storm Hardening Program and, by extension, the Flood Zone Project, requires integration with a number of corporate systems as follows:



FDC: Field Data Capture
CRIS/CSS: Customer billing and information systems
CMS: Customer Meter Services
MITS: Metering Inventory Tracking System

Preparation for integration with each of these systems for the Storm Hardening program has begun.

2.00 Project Structure and Governance

2.10 Project Team

All Gas REV Demonstration projects are implemented by the Customer Solutions group in New Energy Solutions and include the following:

- Overall Gas REV Program Administration — Chris Cavanagh
- NES Procurement — John Spring

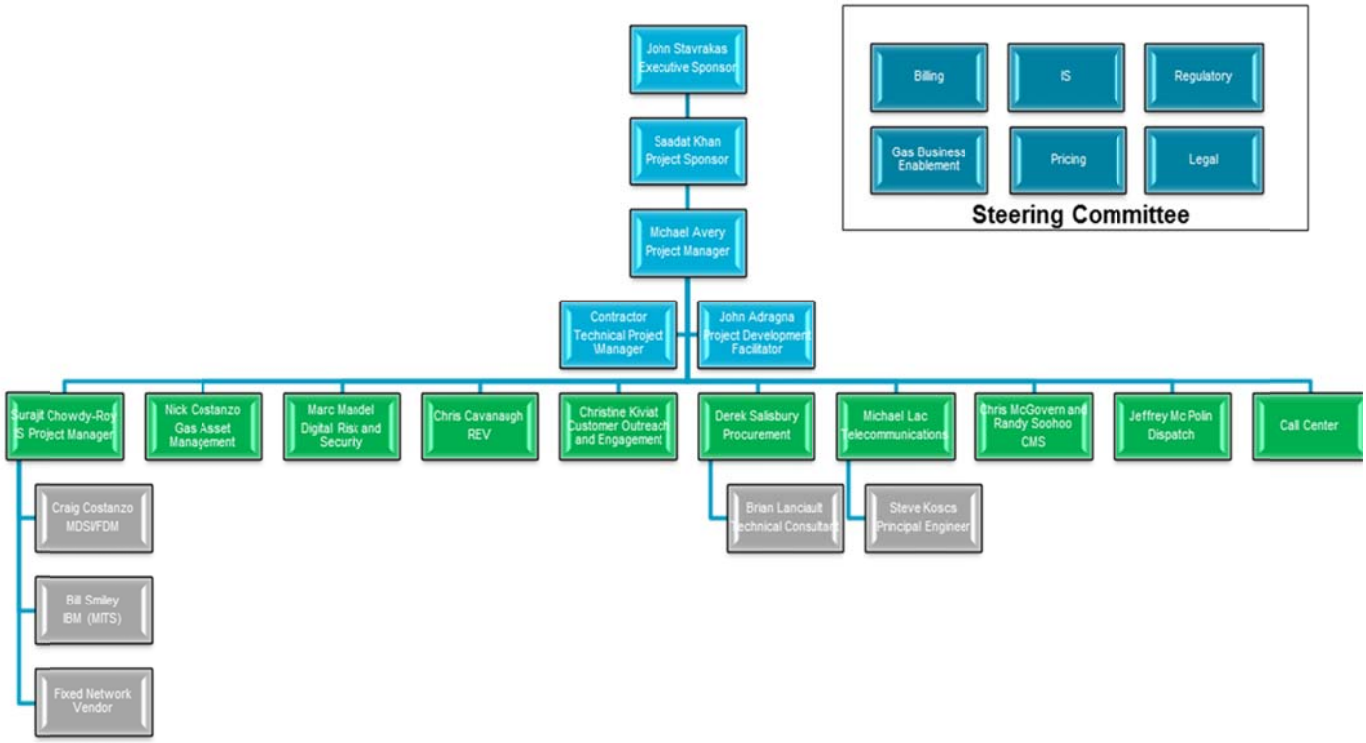
The Project is implemented by the following team:

Table 5: Project Team

Name		Department
Saadat	Kahn	Asset Engineering
Chris	Cavanagh*	NES
Eric	Aprigliano	Gas Engineering
Mary	Holzman	Engineering R&D
Stela	Mhinerva	Data Analytics

* Project Manager

In addition, the Project is supported by the project team developed for the Storm Hardening programs. The organizational structure for the Storm Hardening programs is shown in the following chart.



2.20 Roles and Responsibilities

Table 6: Project Roles

National Grid Role / Responsibility	Description
Support conceptual design and lead detailed Project implementation.	Provide necessary data and expertise for the Project design work.
Recruit customers.	Conduct outreach campaign to recruit customers already included in the Storm Hardening programs.
Operate systems and communications.	Remotely or automatically operate gas isolation valves and provide customer notice.
Customer	**Description**
Participate in the Project as agreed.	Provide access to equipment and data and utilize data to consider energy efficiency upgrades.
Data Analytics provider	**Description**
Perform data analysis.	Develop procedures and analytical process to analyze interval gas meter data.

2.30 Governance

The Project is being managed through National Grid's NES team who is responsible for the Project implementation. In accordance with the Companies' rate cases, one incremental project manager has been hired specifically for the gas REV demonstration program which includes the Flood Zone Packages. In addition, the Customer Solutions team in the Customer area is providing additional project management support. All projects in the gas REV demonstration program are being included in an existing Performance Excellence ("PEX") hub prior to incurring any spending. The PEX program is used to monitor projects and quickly identify obstacles to achieving major milestones. The Project is supported by a dedicated procurement team in NES. In addition, there is substantial support required by several departments and groups and each is identified in the Project timelines in Section 3.00 of this plan.

In accordance with National Grid policies, the entire gas REV demonstration program requires the approval of the Senior Executive Sanctioning Committee regardless of size. This approval covers all capital requirements and first year expenses and the approval process will be repeated for years 2 and 3 of the project. Since the gas REV demonstration program funding was included in the KEDLI/KEDNY rate case order, implementation plans have been submitted to the Regulatory team, the major elements of which are being tracked as regulatory obligations. In addition, all programs and progress are subject to regular scheduled reviews by the New York jurisdiction and other senior executives.

3.00 **Work Plan .....** *(Revised to reflect expected delivery of Itron Valves)*

Flood Zone Protection Package Implementation Plan

Propsed Adjustments

		Participating Group							CY 2017														CY 2018												CY' 2019											
		NES	RDD	Asset ENG	SYS ENG	CMS	EE	Other	Dec-2016	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
1.00	Design Packages																		AMI Available																										
1.10	Select Flood Valve	X		X																																								
1.20	Select Flood Sensor	X		X																																								
1.30	Select On-Grid Sensors	X		X																																								
1.40	Select Conncted Methane Detector	X	X																																									
1.50	Deteremine Communications Plan	X				X																																					
1.60	Installer Specifications																				VALVES																							
1.70	Specify Data Hosting	X				X		IT/ADA																																				
1.80	Finalize Data Analaysis Outputs	X	X	X	X	X	X																																					
2.00	Procurement																																											
2.10	Flood Valve	X						Proc.								Delivery																													
2.20	Flood Sensor	X						Proc.																Delivery																				
2.30	On-grid sensors	X						Proc.																																				
2.40	Conncted Methane Detector	X						Proc.																MAX ONLY IF NEEDED																				
2.50	Comminications Services	X						Proc./IT										storage																										
2.60	Installer Specifications	X						Proc.																																				
2.70	Data Hosting	X						Proc./IT																																				
2.80	Data Analyst (if required)	X						Proc. ADA																																				
3.00	Recruitment																																											
3.10	Develop Participant Criteria	X	X	X		X	X	Cust.																																				
3.20	Develop Customer Agreement	X						Cust./legal																																				
3.20	Develop Outreach Plan Materials	X						Cust.								NO IMPACT																												
3.30	Recruitment	X						Cust.																																				
4.00	Installation (via Storm Hardening Program)																																											
4.10	In Home Installation																																											
4.11	KEDNY (12 per day avg.)	X		X		X																																						
4.12	KEDLI (12 per day avg.)	X		X		X																																						
4.10	Control Center Integration (senors/data)																																											
4.11	KEDNY	X						Gas Ops																																				
4.12	KEDLI	X						Gas Ops													COMPRESS																							
4.20	Call Center Integration/Training	X		X	X			Call Cntr																																				
4.30	Testing																																											
4.31	KEDNY	X	X	X		X	X	Gas Ops																																				
4.32	KEDLI	X	X	X		X	X	Gas Ops																																				
4.40	Data Analysis Plan - Safety	X	X	X				ADA																																				
4.50	Data Analysis Plan - Efficiency	X				X	X	ADA													NO IMPACT																							
4.60	Data Analysis Plan - Gas System Ops	X	X	X		X		ADA																																				
5.00	Operation																																											
5.10	Go Live																																											
5.11	KEDNY	X	X	X	X	X	X																										GO LIVE											
5.12	KEDLI	X	X	X	X	X	X																																				
5.20	Maintenance/Repair	X						As needed																																				
5.30	Data Analysis - Safety	X	X	X				ADA																																				
5.40	Data Analysis - Efficiency	X				X	X	ADA																																				
5.50	Data Analysis - Gas System Ops	X	X	X	X	X		ADA																																				
5.60	Periodic Reporting	X	X	X	X	X	X																																				
6.00	Final Report																																											
6.10	Compile Results	X	X	X	X	X	X	ADA																																				
6.20	Final Report	X	X	X	X	X	X																																					
6.30	Reccomendations forp Next Steps	X	X	X	X	X	X																																					

NES: New Energy Solutions
RDD: Gas Research
SYS ENG: Gas Syst Eng
CMS: Cust. Meter Services
EE: Energy Efficiency (Customer)
ADA: Advanced data Analytics
Cust: Marketing Advertising

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

3.10 Project Budget

The cost of the gas demonstration projects is divided into capital costs and first year operating and maintenance ("O&M") costs as presented below from the Companies' rate filings in Cases 16-G-0058 and 16-G-0059. These costs only cover estimated incremental direct project costs.

Table 7: Budget

Gas REV Demonstration Proposals		KEDNY			KEDLI	
Customer (Products)- Sean P. Mongan Testimony	FTE or	2017		FTE or	2017	
	Quantity	Capital	O & M	Quantity	Capital	O & M
Resilient, Safer and Smarter Networks						
AMI & Storm Hardening (500 per region)						
Fixed Comm Network (in Capital program)	0.0	$0		0.0	$0	
Meters	500	$100,000		500	$100,000	
Methane Detectors	500	$35,000		500	$35,000	
Shutoff Valves (in Capital Program)	0	$0		0	$0	
Flood Detector (in Capital Program)	0	$0		0	$0	
Gas Composition Sensors	50	$5,000		50	$5,000	
Pressure Sensor	50	$5,000		50	$5,000	
Installation (1-man-day)	500	$171,500		500	$171,500	
Maintenance & Repair	500		$42,875	500		$42,875
Usage Analysis	500		$100,000	500		$100,000
Subtotal		$316,500	$142,875		$316,500	$142,875

3.20 Reporting Structure

Reporting progress to the PSC shall, as a minimum, be in accordance with the requirements of the Commission's order[9] in Cases 16-G-0058, 16-G-0059 *et al*. which requires annual reports 45 days after the end of each rate year. Additional interim reporting is anticipated when major milestones are accomplished. In addition, progress is reported as regulatory obligations tracked by the Regulatory area. The Project will result in a final report detailing findings and recommendations.

3.30 Partnership Development

The Project could result in scalable new products or services being made available to customers. If successful the Project will result in a deployment plan derived from the Project findings and current market conditions. Since one of the core policy objectives of REV is "market animation," there is likely to be deployment of product concepts that this demonstration indicates will be successful. Such deployment will most likely occur through the creation of new partnerships, potentially with some of the service providers supporting the Project or with other new entrants. National Grid's

[9] Cases 16-G-0058, 16-G-0059 *et al*., *supra* note 1, Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

gas utilities in New York have extensive experience in developing successful alliances. Previous examples relevant to gas service include the following:

- Oil – Gas Heating Conversions (Value Plus Installer Program)[10]
- Natural Gas Vehicles and US DOE Clean Cities[11]
- Energy Efficiency Program Implementation
- Utility Energy Service Contracts ("UESC") for government customers

The NES team has a dedicated team focused on developing a wide variety of partnerships. Where these concepts require financing it is expected that a variety of sources will be sought individually or in combination. National Grid has also supported certain efforts of its partners in a variety of ways including the following and expects to support the deployment of technologies or services that may be developed as a result of this project

- Joint outreach and education programs
- Market sizing
- Environmental and socio-economic benefits analysis
- Facilitation of training of technicians and customers
- Support for updated codes and standards to reflect new technologies
- Additional project demonstrations
- Research Development and Demonstration ("RD&D") for product improvements

There are two types of partnerships that may develop as a result of the Project: 1) the communications and control platform that enables the devices and services that would be provided by Itron; and 2) additional partnerships to be determined that could make use of the control functions, modifications, and primary partnership that may result from the Project. Potential partners that could develop in the future based on the perceived value of the services could include, but not be limited to:

- Residential Energy Service Companies
    - Commodity providers
    - Building service providers
- Alarm and security companies
- Utilities
    - Electric
    - Water
    - Communications
- Local government

[10] https://www.nationalgridus.com/NY-Home/Convert-to-Natural-Gas/Find-a-Contractor
[11] https://cleancities.energy.gov/coalitions/long-island

- Emergency Service
- Energy Initiatives (PACE Bonds, etc.)

Appendix

- REV Alignment
- The Natural Gas Distribution Vision
- Alignment with New York State Energy Initiatives
- Gas Service Impacted by Hurricane Sandy
- Itron Remote Shut-off Valve
- Sample Connected Methane Detector

REV Alignment

NY's REV initiative has developed a series of Core Policy Objectives. In addition, for the natural gas products and services and services it is self-evident that safety is an additional outcome resulting in the following set of generic objectives for Gas REV.

After a review of these objectives the next step is translate them into specific initial objectives and metrics for gas service overall and each demonstration project as described in their respective implementation plans The figure below identifies one view of a series of utility services and also a set of gas service objectives and identifies pilot program focus and broad metrics that would be aligned with this service and objectives. This is the basis for the selection of Gas REV Projects.

Focus of Proposed Pilots	Aligned Services							
		Detect Leaks	Locate & Reduce Leaks	Flood Detection	Reduce Gas System Constraints (Automation)	Promote High Efficiency and Smart Appliances	Manage Gas Electric Interdependency	New Sources of Supply and Renewable Gas
	Safety Improvement	✓	✓	✓		✓		
	Modeling the Network for Growth	✓	✓		✓	✓	✓	✓
	Generation And Environment	✓	✓	✓	✓	✓	✓	✓

Focus of Proposed Pilots	Aligned Gas Objectives							
		Maximize Safety	Minimize Environmental Impact	Maximize Energy System Reliability	Improve Customer Affordability	Improve Operational Efficiency	Improve Access to Gas Service	Value Added/Choice Services for Customers
	Safety Improvement	✓	✓	✓				✓
	Modeling the Network for Growth	✓	✓			✓	✓	✓
	Generation And Environment	✓		✓	✓	✓	✓	✓
METRICS		Incident Frequency	GHG Reduction (CO_2e)	Forced Outages	Total Customer Energy Bills [$]	O&M[$] per Unit of Sendout	Capital Efficicncy [$/cust](Financial)	Adoption/New Revenue[$]

The alignment with REV principles for the Flood Zone Package Project is described as follows

REV Objective	Demonstration Alignment
Enhance customer knowledge and tools that will support effective management of the total energy bill	The Project will use data to assess gas heating, water heating, and other gas appliances in order to evaluate their safe use and quantify opportunities for energy conservation opportunities.
	Increased access to local gas system operational data at targeted locations will provide gas system operations opportunities to improve system planning and support capital efficiency.
Market animation; leverage customer contributions	The Project will demonstrate the value of interval meters data for both enhancing safety and efficiency; thus potentially enabling markets new services to use that data and expand markets for energy service upgrades.
System-wide efficiency	Increased access to local gas system operational data at targeted locations will provide gas system operations opportunities to improve peak load management and overall system efficiency.
System reliability and resiliency	The Project will demonstrate one technique to prevent damage to the gas distribution system and customer appliances from external and/or internal flooding.
Reduction of carbon emissions	The Project could provide data to customer energy efficiency improvements and also support additional oil-to-gas conversions, thus lowering carbon emissions by 25%.
Partnerships with third-party service providers	The Project market-animating partnerships with building management technology, and platform providers.

Alignment with New York State Energy Initiatives

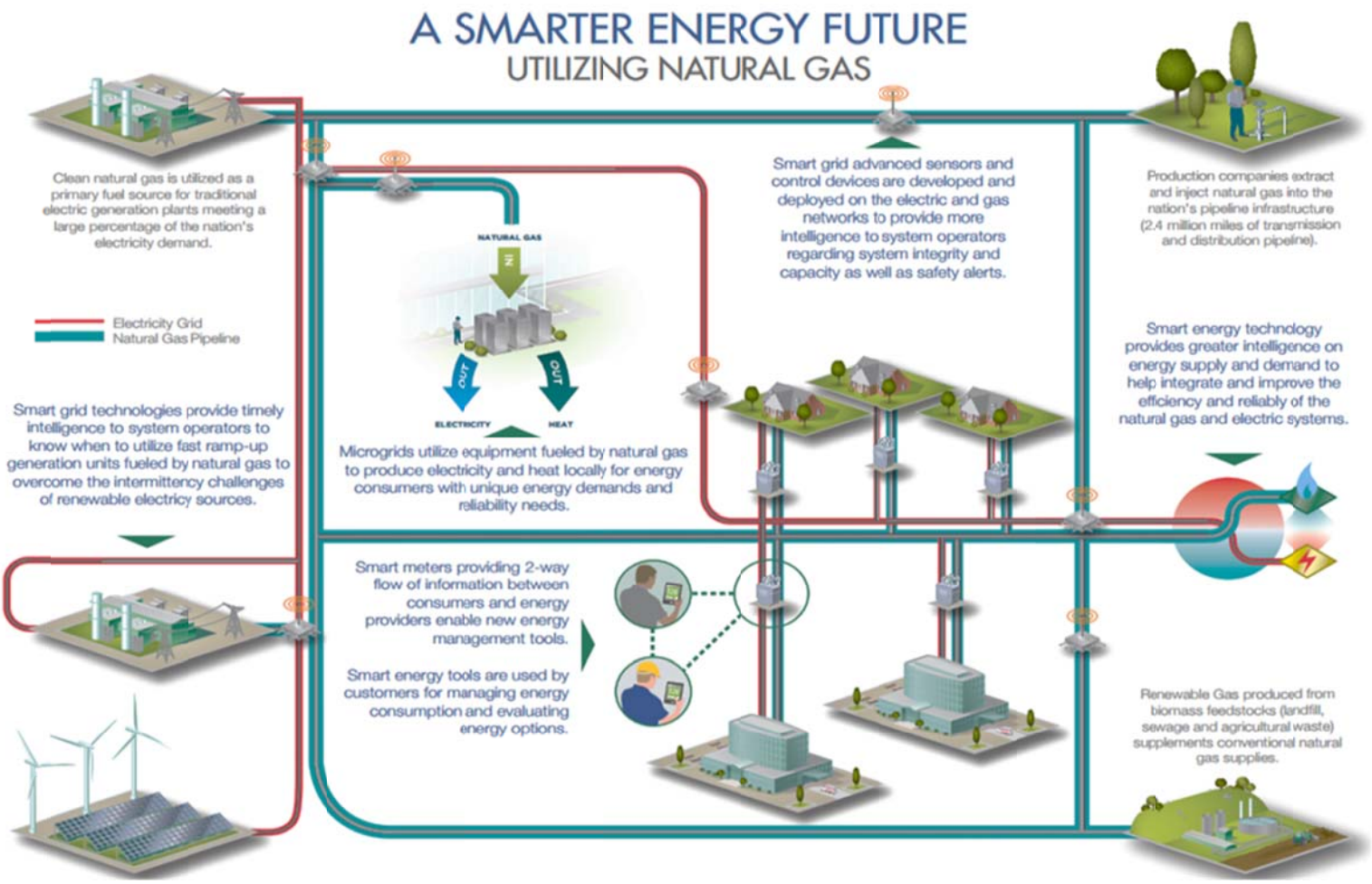
New York State has been supportive of the cost-effective and environmentally responsible expansion of the natural gas service. "[E]xpansion of the natural gas system complements the economic development efforts encompassed by Governor Cuomo's recently released New York Energy Highway "Blueprint"[12]…that "accelerating utility capital and operation and maintenance spending on the State's…natural gas infrastructure will result in enhanced reliability and safety for utility customers while generating substantial economic development benefits for the State's overall economy."[13]

In addition, several initiatives in the 2015 New York State Energy Plan support the advanced development of the natural gas infrastructure and services including initiatives7, 12, 13, 15, 28, and 29.

[12] Case 12-G-0297, *Proceeding on Motion of the Commission to Examine Policies Regarding the Expansion of Natural Gas Service*, Order Instituting Proceeding and Establishing Further Procedures (issued November 30, 2012), p. 5, n. 8.
[13] *Id.,* n. 9.

The Natural Gas Distribution Vision

The US natural gas distribution industry has also developed a future vision on smart energy. This vision has been developed by the American Gas Association and the Gas Technology Institute. It is summarized as follows:[14]



This vision is remarkably similar to the core REV principles in terms of using information to animate markets for energy efficiency and renewable energy but it also includes the benefits of greater interaction between the natural gas and electricity markets. What it does not include is the need for a new emphasis on safety. The gas industry's vision lists the following advantages. "A smart energy future in which natural gas is effectively integrated has the potential to deliver several important advantages:

[14] *See* https://www.aga.org/sites/default/files/natural_gas_in_a_smart_energy_future_2014.pdf

- Improved safety, energy security, and environmental performance;
- A more efficient infrastructure, with the ability to provide demand response, accommodate emerging technologies, and new sources of supply;
- Improved demand response for electric distribution through switching heating and cooling loads to natural gas and through the use of distributed generation;
- Greater consumer choice resulting in maximum energy value; and
- More optimized energy value from renewable wind and solar through the use of fast ramping dispatchable generation."[15]

"Natural gas infrastructure continues to grow in the U.S., and this growth provides opportunities to support aggressive goals for energy productivity while improving service and options for customers through the use of interactive smart electric and natural gas energy grids."[16] National Grid's Gas REV program proposals are intended to merge the concepts of REV and this industry vision as it applies to New York State with a new focus on safety and resiliency on both sides of the customer's meter.

[15] *Natural Gas in a Smart Energy Future: A strategic resource for electricity and a smart resource for homes and businesses*, Gas Technology Institute ("GTI") and Navigant Consulting, January 2011, GTI-11/0001, p. 1; *available at*: http://www.gastechnology.org/Expertise/Documents/Natural_Gas_in_a_Smart_Energy_Future_02-22-2011_FINAL.pdf

[16] *Natural Gas Infrastructure: Enabling Energy Productivity, Alliance Commission on National Energy Efficiency Policy*, Washington DC, January 2013, p. 13, *available at*: https://www.ase.org/sites/ase.org/files/natural_gas_report_2-5-13.pdf

O Flood Zone & Potentially Constrained HP or LP

nationalgrid

Itron

100T-GasGate Remote Disconnect™

Remote Service Shut-off | 100T-GGRD

Gas utilities are under pressure to reduce operational costs and increase customer service. Reducing truck rolls with the GasGate Remote Disconnect (RD) from Itron helps achieve these goals. By remotely stopping the flow of gas at the riser, the GasGate RD improves employee safety by eliminating the need to access the gas meter set for service shut-offs.

The GasGate RD is a standalone valve with an integrated communications module that offers service shut-off capabilities for enhanced operational and safety benefits. Now, a gas service provider can remotely shut-off gas flow during move-outs or for credit issues. The valve also increases safety for customers, emergency response crews and utility crews by shutting off gas flow to the premise in the event of a gas leak or fire. Typically installed between the regulator and meter, the GasGate RD communicates with Itron's fixed network, mobile and handheld systems, allowing for efficient service disconnects.

The GasGate RD leverages the field proven communications technology of the 100-series gas modules and utilizes Itron communication systems to enable service shut-off. Utilities gain the greatest benefit with the remote capabilities that the Itron Fixed Network offers; by being able to shut-off service without having to roll a truck. Our mobile collection systems communicate with the device and offer the safety of shutting off gas flow from a distance, without having to access the meter set. Itron handheld systems also communicate with the GasGate RD and are an integral part of restoring gas service with required on-site field crews.

The GasGate RD installs easily into an existing meter set or can be incorporated into a newly designed meter loop. Because the MAOP is 7 PSIG, the GasGate RD will be installed after the regulator for any system pressure above 7 PSIG. The valve is available in ¾" and 1" connection sizes for all meter loop configurations.

The GasGate RD is made in the USA at Itron's state of the art facilities in Waseca, Minnesota.

SPECIFICATIONS

nationalgrid

FEATURES

- Utilizes Itron enhanced security using Itron encryption and authentication protocols (Itron Security Manager is required for operation.)
- Security tamper seal on mechanical valve

Specifications

- UL Class I, Division 1, Group D
- Power source: 2 A-cell lithium battery pack
- Meets or exceeds ASME B16.33, Section 4.2 Gas Tightness
- Battery life: 20 years or 80 disconnects
- Radio programming parameters
  - Test station site ID (not available if factory programmed)
  - Utility ID
  - Enhanced security
- Programming Options
  - Fixed Network Mode with +27 dBm (500 milliwatts) output power and a daily bubble-up of the Network Daily Message, which is transmitted 10 times, unless acknowledged sooner by the Fixed Network. This mode also includes a 60-second bubble-up rate of the Mobile Bubble-up message at +10 dBm output power (10 milliwatts)
  - Mobile/Handheld Mode* with +10 dBm (10 milliwatts) output power and a 15-second bubble-up rate
  - Mobile High Power Mode* with +24 dBm (250 milliwatts) output power and a 60-second bubble-up rate
  - Hard-to-Read Mobile/Handheld Mode* with +24 dBm (250 milliwatts) output power and a 30-second bubble-up rate. (This mode reduces battery life to 14 years (not secure, not commissioned) & 12 years (secure mode & commissioned)
- All messages are AM modulated
- Frequency Range: Frequency-Hopping Spread Spectrum 903 to 926.85 MHz in the ISM band; program frequency, 908 MHz
- Tamper/Flag/Counter: tilt, cut cable, magnetic tamper sensor, valve tamper, electronics tamper, valve actuation record, battery monitoring, temperature monitoring, last command, status of last command, valve firmware and status of last 16 commands via export log
- Actuation temperature range: -20°F to +150°F (-29°C to +66°C)
- Seal maintenance temperature range: -40°F to +150°F (-40°C to +66°C)
- Product identification: Numeric and bar-coded serial number
- Message contents
- Network telemetry beacon
  - Utility ID
  - Endpoint type/subtype
  - Extended tamper/flag field
  - Event counter
  - Timestamp, in secure messages
- Mobile telemetry beacon
  - Message endpoint ID
  - Endpoint type/subtype
  - Extended tamper/flag field
  - Timestamp, in secure messages

Physical

Aluminum die cast valve body and polycarbonate with encapsulated electronics for protection against environmental hazards and tampering

- Dimensions: 8.25" x 5" x 5""
- Shipping: GasGates per box: 9
- Box dimensions: 15.75" x 15.75" x 9"
- Box weight: 26.11 lbs/ 11.84 kg
- GasGates per pallet*: 270
- Pallet dimensions: 40" x 48" x 48"H
- Pallet weight: 783 lbs/ 355 kg + pallet weight

* Modules are not stacked when shipped but can be stored two pallets high. Modules are to be stored indoors. If outdoor storage is necessary, modules must be sheltered from weather and damage.

ADDITIONAL INFORMATION

Programming Devices

- FC300SR with Field Deployment Manager (FDM) v3.4 or higher
- FC200SR with Field Deployment Manager (FDM) v3.4 or higher
- Belt Clip Radios

Software Kits

- SWK-0250-004 or newer

Documentation

- GasGate Remote Disconnect Installation Guide (TDC-1345)
- GasGate Remote Disconnect Customer Information
- Gas and Telemetry Module Ordering Guide (PUB-0117-001)
- 100 Series Gas and Telemetry Technology Guide (TDC-0825)
- Field Deployment Manager Endpoint Tools Mobile Application Guide (TDC-0934)
- Field Deployment Manager Endpoint Tools Configuration Guide (TDC-0935)
- Field Deployment Manager Endpoint Checklist (TDC-0942)

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To learn more visit **itron.com**

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Fax: 1.509.891.3355

Macurco™ Combustible Gas Detector

MACURCO GAS DETECTION

GD-2B

For use with alarm control panels

Methane and Propane Gas Detection

The GD-2B is a low voltage electronic detector of combustible, heating type gases. The GD-2B is designed for connection to Fire Alarm/Burglary Control Panels. The GD-2B is intended for installation in buildings in non-hazardous locations such as residences, retail stores, office buildings, and institutional buildings. This combustible gas detector has been designed to detect methane (natural gas) and propane (LP) gas. It is NOT designed to detect smoke, fire or carbon monoxide.

Features

- Designed to meet UL standard 2075 for the Standard For Safety for Gas and Vapor Detector and Sensors
- Sensitivity tested based on UL 1484 Standard for Residential Gas Detectors
- Surface mounts to a wall using the supplied enclosure rear housing
- Flush mounts in a 2 x 4 (1-3/4 inch deep minimum) single gang switch, or handy electrical box
- Small, low profile, attractive unit in a white plastic case
- Can be self-restoring or latching
- Test & Reset switch conducts internal tests and actuates alarm relay
- 10 year solid-state electronic sensor: no maintenance or recalibration
- N.O. or N.C. SPST Alarm Relay and N.C. SPST Trouble relay to connect to Alarm Control Panels
- Optional Buzzer: Produces repeating loud tone bursts during alarm, and chirps if sensor trouble is found

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Implementation Plans for Gas REV Demonstration Projects

Geothermal Demonstration On Long Island

nationalgrid

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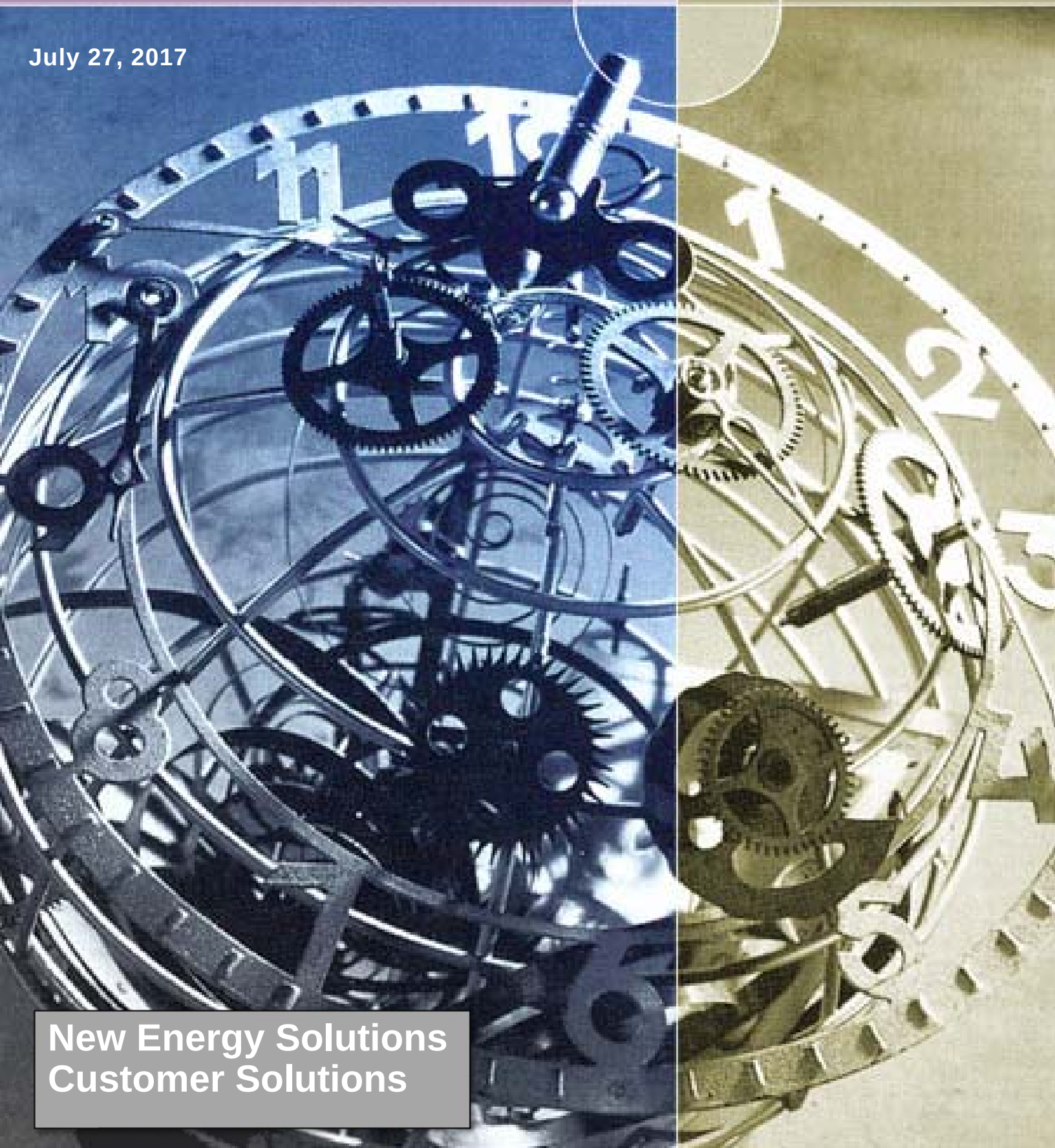
July 27, 2017



New Energy Solutions
Customer Solutions

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Executive Summary

KeySpan Gas East Corporation d/b/a National Grid ("KEDLI" or "National Grid" or the "Company") has been maintaining and investing in gas infrastructure projects to provide safe and reliable natural gas service to Long Island ("LI") customers for decades. Due to the geography of LI, a significant amount of new gas main would be required to serve many new customers outside the reach of the existing gas distribution system. This would result in a substantial cost to current natural gas customers. Installing geothermal (ground source) heat pump ("GHP") systems may offer an opportunity to economically provide new customers located outside the Company's current gas distribution system with clean, low-cost heat.

National Grid is implementing a gas demonstration project to determine if GHP systems are a technically and economically viable option for a gas utility to provide low-cost heating and cooling where natural gas service is not available due to excessive distance to a gas main or gas system constraints (the "Project"). The Project will install GHPs in large buildings or collections of small buildings (*i.e.*, commercial buildings and residential and multi-family dwellings) with no economic access to natural gas. This will provide the Company with experience relating to GHP systems, including data related to customer benefits, gas and electric utility benefits, and associated social and environmental impacts. National Grid is partnering with the New York State Energy Research and Development Authority ("NYSERDA") to validate customer savings and system performance, and evaluate various market strategies to increase adoption of GHPs.

The Project is a test-and-learn demonstration and was designed in accordance with the principles of the New York State Public Service Commission's ("Commission" or "PSC") Reforming the Energy Vision ("REV") Proceeding.[1] The Project was approved through the 2016 KEDLI rate proceeding.[2] The purpose of this implementation plan is to describe National Grid's detailed execution plans for the Project. The Company believes that it is possible to create more mutually beneficial relationships with customers by leveraging critical infrastructure, customer outreach and engagement, energy insights, and actionable information. Towards that end, the following metrics will be used to determine viability of the concept and the success of the Project:

- Carbon Reduction
- Energy Savings
- System Benefits
- Economic Growth
- Participant Satisfaction

The results of the Project will be reported to the PSC and recommendations will be made for a full-scale program or further study based on the projected benefits and needs at that time for a larger program.

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[1] Case 14-M-0101, *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision* ("REV Proceeding").

[2] Case 16-G-0058, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service*; Case 16-G-0059, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service et al.*, Joint Proposal (filed September 7, 2016), Sections 9.9 & 13; and Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

1.00 Demonstration Project Design

The Project will determine if GHP systems, including underground heat exchangers and the building are a technically and economically viable option for a gas utility to provide low-cost heating where gas service is not available due to excessive distance to a gas main or gas system constraints. The Project will also evaluate GHP systems are a viable option to mitigate growing peak demand and constrained areas for natural gas.

The Project will have two purposes; the first is to validate installation and operating costs as well as customer savings for GHPs, preferably with an underground heat exchanger shared between multiple customers or housing units. This approach is also known as a district loop piping system where individual residences would be connected to a common loop field. This objective also includes an analysis of the benefits to the gas utility, principally in terms of a potential gas demand growth management tool. The second objective is to use the collected data to analyze different financial and business models for the installation of GHPs.

1.10 Project Component Details

A demonstration of closed-loop GHP systems with a total capacity of approximately thirty (30) tons of cooling[3] will be constructed to serve large buildings (*i.e.*, commercial or multi-family residential) or a collection of approximately ten (10) residential dwellings or small multi-family residential buildings on LI, preferably in a low-to-moderate income ("LMI") area to the extent possible. The closed-loop system, as opposed to an open-loop system, was chosen as it is the system that has the broadest applicability downstate. An open loop system is less common since an ample source of ground water is required, such as a well or pond.

The data points of interest will include overall system performance measured on-site by various temperature sensors, flow meters, and refrigerant conditions. Electric consumption data will also be collected to support analysis of electric system benefits to the electric grid. Measurement and verification ("M&V") will include energy and performance data collected through thermal metering *(i.e.*, BTU[4] meters), and data collection systems to capture system usage data by individual participants. Data collected using BTU meters will not be used to bill participants in the Project. The data will be used to verify system performance and support analysis of potential revenue streams to inform future policy or rate design. The Project will analyze and document the following GHP attributes:

- System installed cost
- Operating and ongoing maintenance costs
- Changes in customer heating and cooling costs
- System performance of the GHPs and underground heat exchanger
- Energy transfers with the underground heat exchanger
- Greenhouse Gas ("GHG") emissions reductions
- Customer satisfaction with GHPs

[3] GHPs are heating, ventilation and air conditioning ("HVAC") systems with system capacity commonly rated in tons of cooling (*i.e.*, air conditioning).
[4] "BTU" refers to British Thermal Unit and is a traditional unit of heat, defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

The collected data will answer the following questions:

- What are the costs of actual GHP systems including the cost to install individual participant GHPs and the shared underground heat exchanger?
- What the cost efficiencies are achieved when multiple homes share a common underground heat exchanger?
- What are pricing points for both the traditional geothermal installations and a shared common loop concept? The cost of the Project installation can be compared to the cost of traditional single-facility geothermal installation.
- What the heating and cooling energy cost savings are achieved with the retrofit applications? What are estimated savings in new construction buildings?
- How does the system perform, in terms of heating and cooling, relative to the design specifications?
- How much energy (*i.e.*, BTUs) can the underground heat exchanger provide to meet the heating and cooling needs of individual homes?
- Will the BTU meter data captured be useful information in formulating a possible, future geothermal billing rate structure, , similar to the existing gas service provided by National Grid, in the event of a utility ownership model?
- What are the estimated carbon savings associated with the GHP installations?
- How is the level of comfort within the building impacted by the GHP system?

Participant Monthly Access Charge

All participants will become Residential customers of the Company during the project and will pay a fixed monthly access fee to use the ground loop for the duration of the Project. The primary purpose of the monthly access fee is to establish a customer relationship with participants with National Grid as the geothermal service provider. The monthly access fee shall be equivalent to the current minimum charge of a KEDLI residential heating customer (Rate Code 140). This nominal fee is not intended to recover the cost of the ground loop or any other part of the Project but will be applied as a credit to the Project's costs and reconciled at the Project closeout with any balance used on this project or returned to Customers. Because the Project is a demonstration, the Company is not proposing to implement a new tariff at this time. If National Grid continues to provide geothermal services to the participants after conclusion of the Project, the Company will make the appropriate tariff filing for rate and/or incentives justified by results of the project and the regulatory policies at that time and in consultation with Department of Public Service Staff ("Staff").

NYSERDA Partnership

The Company will partner with the New York State Energy Research and Development Authority ("NYSERDA") through Program Opportunity Notice ("PON") 3127 [5], Emerging Technology Demonstration Project – Residential HVAC.

[5] Applied Energy Groups was awarded a NYSERDA contract under PON 3127 to monitor forty (40) homes with new geothermal systems of which these ten (10) homes have been approved by NYSERDA to be included in the monitoring program at no additional cost.

NYSERDA seeks to accelerate the market adoption of commercially available, but underused, technologies, to address barriers to widespread adoption of GHPs by demonstrating and validating the energy savings, cost-effectiveness, and other performance indicators. Specifically, National Grid will partner with NYSERDA to conduct M&V and data collection at selected Project sites. These activities will focus on determining actual participant energy bill savings and performance of the GHP system. The Project will aim to address market barriers such as the high upfront costs of the underground heat exchanger. National Grid will work together with NYSERDA to use the data collected to propose and evaluate several potential market support strategies that could overcome current market barriers such as low-interest financing, direct rebate or buy-downs, targeted community aggregation programs, and on-bill financing. Financial modeling of each strategy proposed will be developed in order to compare their potential economic performance.

PSEG Long Island Collaboration

The Project will seek collaboration with PSEG Long Island ("PSEG LI") to evaluate potential electric utility system benefits. After receiving participant's consent for PSEG LI to release their energy use data for Project evaluation purposes, the electric consumption data will be used to calculate and evaluate peak electric load reductions and energy savings.

Industry Partners and Heat Pump Manufacturers

National Grid will be exploring partnership opportunities with various GHP manufacturers to determine potential cost savings due to volume discounts. The Project will invite GHP manufacturers to offer equipment pricing that is competitive to conventional systems. The objective is to obtain the unit cost of the GHPs if the technology reaches widespread market-scale adoption.

The Project is also being supported by The Geothermal National & International Initiative (GEO-NII) [6] and New York Geothermal Energy Organization (NY-GEO).[7] GEO-NII will be offering technical and advisory support to identify feasible candidate host sites for the GHP system. NY-GEO and GEO-NII will assist in identifying from within their network of approved geothermal contractors and providers, those who can best assist the Project.

Data Analysis to Evaluate Potential Future Business Models

The cost and performance data collected, as outlined above, will help National Grid determine if it is feasible to provide GHP systems as an alternative to extending gas service to communities that are beyond the reach of current infrastructure expansion policies. The feasibility of a geothermal offering will incorporate the actual system installation and maintenance costs, the change in customer energy costs, and customer satisfaction compared to gas service. Additionally, the Company will assess a variety of different business models to determine which approach would best maximize customer benefits and geothermal adoption while minimizing costs.

[6] *See* http://www.geo-nii.org/
[7] *See* https://ny-geo.org/

National Grid has identified, based on an initial assessment of the geothermal market, three possible business models that the Company could adopt if it were to incorporate geothermal offerings into its portfolio going forward. These three models are:

- Utility Ownership
- Financing
- Joint Marketing

Under a utility ownership model, National Grid would own and operate the geothermal systems installed at participants' premises. Specifically, the Company will analyze whether the cost savings provided by a shared loop system, which is facilitated by the ability of a utility to install in a public right-of-way, would expand the market interest in geothermal. In a utility financing model, the Company could establish low-interest financing for the installation of geothermal systems at geothermal customer buildings, either through a shared savings arrangement or traditional financing, but would not install, own, or operate the GHP systems. In a joint marketing model, the Company would encourage adoption of geothermal systems through expanded marketing efforts and industry partnerships but would not take a financial or operational role. Both the financing and joint marketing approaches are means to facilitate market development and could include the provision of incentives similar to that available today for the current Energy Efficiency programs.

Future rate design concepts for the gas utility will be proposed and seek to include customer energy savings, lifecycle cost of GHP systems to the utility, utility savings and comparison to existing gas tariffs to calculate the appropriate geothermal rate. The goals of the geothermal rate design would be ensuring customer savings, allowing gas company ratebase of geothermal assets consistent with provisions of the gas tariff, and evaluating different price levels for the services provided by GHP systems.

Asset Transfer Plan

During the Project period, the Company will own, operate, and maintain the underground heat exchangers. National Grid will also own the heat pump equipment installed in each home in order to provide maintenance during the project period. At the end of the Project ownership of the GHPs equipment will be transferred to the Project Participants at no cost. Also, at the end of the Project period, ongoing ownership of the ground loop and interconnecting piping may be decided based on negotiations with the landowner. If at the end of the Project, the Company has plans to offer geothermal services in any form, inclusion of this facility in that service will be considered. If no such plans are proposed or implemented, the property owner will take ownership of the underground heat exchanger and common piping at the end of the project at no cost to the property owner.

A final report to the PSC will document the results in terms of evaluated customer benefits, gas system management options, and forecasted social, environmental, and economic benefits. Social and economic benefits will be determined through a REMI[8] analysis based on several service models scenarios.

[8] REMI is the acronym for Regional Economic Models, Inc. For more information, *see* www.remi.com

1.11 Participant Eligibility and Termination

An optimal installation site will be determined based on several criteria such as existing heating and cooling distribution system, gas availability, and building characteristics. Participation in the Project will be voluntary and participant eligibility will be contingent upon an initial site assessment and ability to meet the following criteria:

- Building and premise must be in LI
- Buildings must not have access to natural gas under the 100 ft. allowance provision of the tariff
- Property owner must agree to easement requirements to grant National Grid authority to construct, own, operate, repair, and maintain the underground and/or grade level district geothermal heat exchanger and lateral geothermal loop distribution systems ("Geothermal Facilities"). Also, participants have to be willing to take over ownership of the Geothermal Facilities at the end of the Project, including the underground heat exchanger.
- Buildings meet technical suitability
- Electric utility *account must be in good standing*
- No financial encumbrances on the building that could impact the Project.
- Buildings properly maintained with no outstanding permit violations or liens
- Easy access for service and data collection.

The Project focuses on commercial, residential, and multi-family buildings located on LI where gas service is currently unavailable. All prospective participants meeting the above criteria must own the rights to install both the underground heat exchanger and above-ground heat pump. If the premise is leased or rented, both the Property owner and the tenant will be required to execute the participation agreement with National Grid. The building heating and cooling system must be able to accommodate the GHP unit. Additionally, the property characteristics must be able to accommodate the placement of the underground heat exchanger.

A participant may terminate his or her participation during the Project period. In the event that a participant wishes to discontinue participation, the Company will disconnect the GHP and restore the heating and cooling system to the same or similar conditions prior to the installation of the equipment.

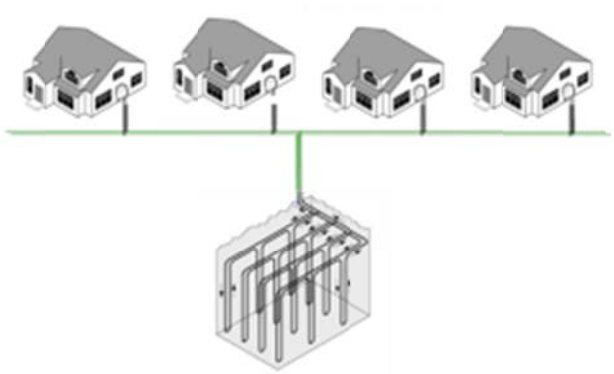
1.12 Customer/Stakeholder Engagement and Communications

The Project is relatively small in terms of number of participating customers. As such, customer engagement will follow a targeted approach. National Grid will coordinate with external stakeholders to conduct outreach to prospective Project participants. The first choice for communication will be partners such as local government or community agencies. National Grid will also support such efforts through community and government affairs representatives and through existing sales and marketing channels including:

- National Grid sales and community representatives
- Targeted collaboration with partners and community agencies

Large-scale marketing and advertising is not necessary or justified for the Project.

1.13 Background on Geothermal



A GHP system is a heating and cooling solution with benefits to the consumer, the gas and electric utilities, and the environment. Also known as ground-coupled, ground-source, and geo-exchange heat pumps, GHP equipment is highly efficient and has been commercially available for several years. The technology harnesses the near constant temperature of the subsurface ground to move heat from one space to another for space heating and space cooling. By extracting the heat from the ground, GHPs can effectively reach Coefficients of Performance (COP) of between 3 to 6 or efficiencies between 300%-600%. This is achieved by using one unit of electricity to drive the heat pump to extract three to five times the energy from the ground. GHP equipment uses less energy than conventional heating and cooling equipment, therefore providing consumers with lower lifecycle costs and greater energy savings.

At present, the cost of oil heating is at a premium to natural gas heating by up to 40% for heating equipment of the same age. The only other heating sources on LI are propane and electric heat (using either resistance or air-side heat pumps). None of these sources is comparable to natural gas service in terms of heating costs, carbon reduction, and convenience. However, GHPs can result in energy cost savings equivalent to or exceeding natural gas heating. Therefore, GHP systems may be a cost-effective alternative to communities without access to natural gas. While actual heating system performance varies, a simplified estimation of comparative heating costs was created assuming residential heating as follows for LI:[9]

[9] As calculated by National Grid.

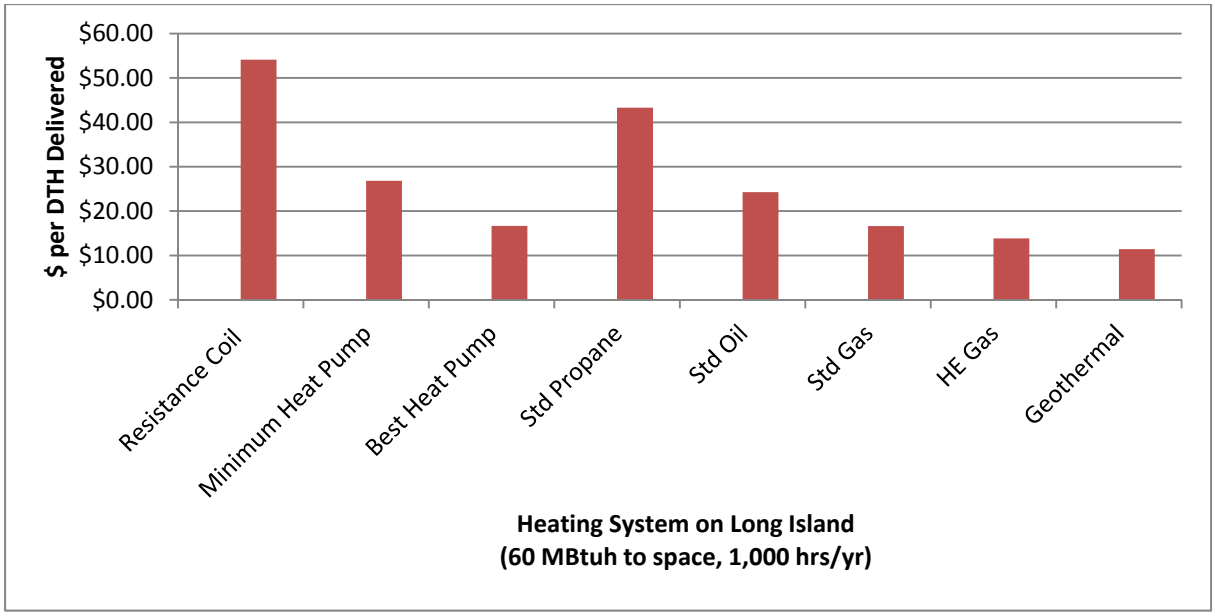


Figure (1). An estimated cost of different heating systems in $/MMBtu delivered for Long Island.

This estimate is based on the following assumptions:

- ✓ Calculated based on 2017 data
- ✓ Best efficiency closed-loop GHP (*e.g.*, Carrier® geothermal heat pumps,[10] COP_h=4.7)[11]
- ✓ Forced air hydronic systems have a lower COP_h. Geothermal systems have a higher COP_h.
- ✓ PSEG LI electric and National Grid gas residential costs f
- ✓ 1,000 full load hours heating assumed (not modeled) and heating system assumed to be properly sized

GHPs also provide benefits to the electric grid by reducing summer peak demand and having the potential to increase the base load during non-peak winter periods. In fact, a typical residential GHP shaves about 1-2 kW and 5-10 kW (versus electric heat) from the summer and winter peak loads, respectively.[12] GHPs systems can also be installed in communities where the natural gas grid is constrained. These are additional benefits to the consumer because lower energy consumption will reduce the need for new grid capacity and reduce utility bills. Lastly, GHP equipment does not burn any fuel to provide space heating, therefore conserving precious resources and reducing pollutants. With no fuel to burn and no carbon monoxide produced on-site, safety inside homes is increased when GHPs replace more conventional heating and cooling equipment.

A closed-loop GHP system consists of a heat pump connected to a series of underground pipes, located in either horizontal trenches or vertical boreholes, to heat or cool a space.

[10] *See* Appendix for a side-by-side comparison of Carrier® heat pump systems.
[11] COP_h = Coefficient of Performance for heating in accordance with Air-Conditioning, Heating and Refrigeration Institute ("AHRI") Standard 340/360, *2015 Standard for Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment*.
[12] Pratsch, Lew W. "Geothermal heat pumps. Emerging giant?." *Bulletin of the Geothermal Resources Council* 19.4 (1990): pp. 115-120.

In the winter, the GHP equipment can move heat from the ground by extracting the natural heat from the earth and transferring it to the home or building. Conversely, in the summer, the GHP will work in reverse to extract heat from a building and transfer it to the ground as a heat sink for cooling.

Generally, to estimate the heating load requirements when designing heating systems, one uses 25 BTUs requirements per square feet. For a 1,500 square feet house, the heating load requirement would be 37,500 BTUs or 3.125 tons (12,000 BTU equals 1 Ton). When estimating the cooling load requirements, one would use 400 square feet for every ton of cooling needs.[13] Therefore, for a 1,500 square feet house, the cooling load requirement will be 3.75 tons. Selecting GHP equipment that is sized properly to meet the heating and cooling needs is important and will depend on the equipment cooling and thermal output. Moreover, heating and cooling load calculations (*i.e.,* Manual J HVAC calculations[14]) would need to be performed to determine the heat loss and heat gain requirements for the house.

The pipes used in the ground loop are typically made of long-lasting polyethylene (similar to polyvinyl chloride ("PVC")), which is similar to the pipe material currently used in the natural gas industry. To exchange heat with the ground, the GHP system circulates a mixture of water and freeze protection solution (*i.e*., propylene glycol), a synthetic liquid that is classified by The Food and Drug Administration as "generally recognized as safe," and approved for use in flavoring, drugs, and as a direct food additive. In an unlikely event of a ground loop leak, propylene glycol can break down relatively quickly (within several days to a week in surface water and in soil.[15]

GHP system advantages and benefits include:[16]

- Low operating cost – Heating fuel eliminated and higher heating and cooling efficiencies.
- No required exposed outdoor equipment – Ground loops are buried below ground level and the heat pump is housed inside the building, away from seasonal weather elements.
- Level seasonal electric demand – GHPs can reduce seasonal peak demands and increase base electric loads.
- No on-site combustion – Conventional heating systems use combustion to create heat whereas GHPs concentrate naturally existing heat located near the surface of the earth.
- Long life expectancy – Conventional heating and cooling equipment typically has a life expectancy of 5 to 10 years, whereas GHPs are estimated at 25 years for the inside heat pumps and 50+ years for the ground loop.
- Simplicity – GHPs provide heating and cooling all in one unit.

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[13] *See* ASHRAE Journal July 2012, p. 44. Available at: https://www.ashrae.org/File%20Library/docLib/Journal%20Documents/2012January/040-047_bruning.pdf

[14] Manual J is the name for a specific protocol (often called "Heat Load Calculation" or "Cooling Load Calculation") used to determine how much heating/cooling a home needs to stay cool and dry in the summer and warm in the winter.

[15] Propylene Glycol. Access from CDC.gov

[16] Geothermal Heat Pumps. Access from https://energy.gov/energysaver/geothermal-heat-pumps

- No supplemental heat and cooling required – if properly designed, GHPs can meet 100% of heating and cooling requirements.

Although GHP technology is well established, it comes at a high upfront cost, more than three times that of conventional air-side heat pumps. This prohibitive first-cost makes GHPs economically disadvantageous compared to conventional heating and cooling systems. Furthermore, "the primary GHP market failure is the expectation that building owners [are responsible for] the 'GHP infrastructure,' or outside-the-building portion of the GHP system, such as the underground heat exchanger."[17]

The carbon benefits compared to heating oil and electric air conditioning with standard new equipment were also estimated. Based on the annual analysis, a typical LI residence, using the same sized GHP for heating and cooling, would generate approximately 62% less carbon emissions from heating and cooling combined.[18] GHPs may be a cost-effective alternative for area of LI without access to natural gas to provide LI residents with substantial energy savings while reducing environmental impacts.

Market studies have shown the attributes of natural gas service are cleanliness, convenience of delivery, and reliability of delivery.[19] Like natural gas, the GHP system will exhibit increased resiliency and convenience due to the reduced fuel cost volatility and lack of fuel deliveries by truck, as well as averting the potential environmental risks related to fuel storage and delivery. These attributes will be surveyed for GHPs as part of the Project.

1.20 Test Statements

National Grid will test the validity of the hypotheses shown in Table 1, Test Statements, below. The results of hypothesis testing will be tracked and documented and then used to inform and modify subsequent offerings to customers in LI:

Table 1: Test Statements

Overarching Test Statements	If…	Then…
GHP is a technically and economically viable alternative for a gas utility to provide low-cost heating and cooling.	A. National Grid installs a GHP system to provide heating and cooling needs to the participants.	Participants will accept the technology and be receptive to a GHP system installed at their property.

[17] Patrick J. Hughes, *Geothermal (Ground-Source) Heat Pumps: Market Status, Barriers to Adoption, and Actions to Overcome Barriers*, Oak Ridge National Laboratory, ORNL/TM-2008/232 (December 2008).
[18] Calculated for NYISO Zone K (Long Island) Marginal Emission rates for generation and a Seasonal Energy Efficiency Ratio ("SEER") = 32 for cooling and COP_h=4.7 for electric heat as compared to a new conventional 80% Annual Fuel Utilization Efficiency ("AFUE") oil-fired boiler and SEER=12 for cooling.
[19] *Assessment Natural Gas Conversion Inquiries*, Praxis Research Partners (May, 2008).

	B. Participants heat and cool their homes at a more competitive cost using GHPs than conventional heating (fuel oil, or electric heat) and cooling (central air or window air conditioning) methods.	Participants would want to use GHPs to heat and cool their homes.
	C. GHP systems can deliver heating and cooling at a competitive cost compared to bringing natural gas service to individuals or grouped buildings where natural gas is currently not available.	National Grid will evaluate offering GHPs to homes and buildings with no access to natural gas.
Supporting Test Statements	**If…**	**Then…**
1. A GHP system produces a lower carbon footprint than conventional heating (fuel oil, or electric heat) and cooling (central air or window air conditioners) methods.	A. The operation of the GHP system produces less carbon emissions on a full-cycle basis than conventional heating and cooling equipment	GHP systems will support the State's climate change targets.
2. A GHP system yields higher life-cycle energy savings to the participants.	A. Participants experience energy savings of 30% or greater.	A GHP system is a cost-effective option for consumers to reduce heating and cooling costs and improve energy affordability.
3. GHPs provide electric peak load benefits and gas system benefits.	A. GHP results in a reduced electricity demand of 0.5 kW/Ton of cooling.	GHP systems provide benefits to the electric grid system, reduce system costs, and provide viable option to mitigate the growing electric peak.
	B. GHP systems can be deployed to unserved natural gas communities or gas constrained areas which	A GHP system can be used to defer potential capital commitment for gas and electric utilities, reduce

	reduces peak average residential customer demand by up to 100 cubic feet per hour.	system costs, and provide a viable option to mitigate the growing peak demand for natural gas.
4. Project participants have a high customer satisfaction with the GHP system.	A. Project participants exhibit higher satisfaction after the Project evaluation period.	A GHP system is a favorable alternative to traditional systems (*e.g.*, higher-cost fuel oil or electrical resistance heat).

1.30 Test Population

The market size in terms of structures served on LI can be conservatively estimated to be prospective gas residential or commercial customers that are located more than 1,000 feet from an existing gas main. The number of independent underground heat exchangers for GHPs would be less assuming such infrastructure can be shared between adjacent buildings. Based on the National Grid gas saturation analysis, this population is as follows:

Residential:	104,590
Multi-family:	5,496
Commercial:	3,018

The primary participants of interest to the Project will be those currently with no access to natural gas. If the Project is unable to identify participants currently with no access to natural gas and/or a willingness to accommodate a shared community loop system, the Project will target communities in gas-constrained areas of LI.

1.40 Test Scenarios

Table 2: Test Scenarios

Scenario	Description
Carbon Reduction	
Reduction of carbon emissions	National Grid will estimate carbon reductions achieved by the GHP system to compare it to the traditional heating and cooling means of the Project participants. Since GHPs burns no fuel on-site to produce heat, it generates far fewer carbon dioxide emissions in the home compared to conventional systems.
Energy Savings	
Reduction in energy consumption for heating and cooling	National Grid will calculate and validate annual energy costs by comparing annual energy bills, normalized for weather, to determine the savings from the GHP system.
System Benefits	

Generates both gas and electric system benefits	National Grid will evaluate total benefits and costs relative to the natural gas peak design day and electric impacts. Natural gas system benefits can include the avoided cost of natural gas and electricity infrastructure, environmental benefits, and system load reduction. Electric system benefits can include improved load balance and reduced summer and winter peak demand. These benefits can reduce the need for additional costly electric and gas grid infrastructure upgrades.
Economic Growth	
Projected social and economic benefits	National Grid will initiate a REMI analysis to estimate customer benefits under various scenarios. Widespread adoption of GHPs can have increased social benefit to include improved quality of life relating to health benefits from reduced carbon emission and increased safety in homes with no carbon monoxide generated on-site. Economic benefits can include the number of jobs generated and economic growth potential with increased deployment of GHPs.
Customer Satisfaction	
Satisfaction with the GHP system	National Grid will assess the satisfaction of the Project's participants, once prior to installation, and another after the evaluation period. Participants should experience higher satisfaction rating as a direct result from energy savings, increased comfort, safety benefits, reduced operating costs, and other ancillary benefits of GHPs.

1.50 Milestones and Checkpoints

Table 3: Milestones

Action Items	Timing	Process Owner and Support
Coordinate external stakeholder outreach to review criteria, identify, and finalize targeted/optimal installation site(s. List of External Stakeholders to include at a minimum the following Suffolk County-NY, PSEG-LI, US Green Building Council, NYSERDA, GEONII	Jan 1 – Feb 28, 2017	Geothermal Pilot ("GP") Team, Government Relations, New York Jurisdiction
Participant site selection, site visits, and site screening.	March 2017 - June 2017	NES Project Manager GP Team

Develop request for proposals (“RFP”) with Procurement to identify potential qualified geothermal contractors. -Geothermal designer and engineering partner - Experienced geothermal well driller New York State Department of Environmental Conservation (NYSDEC)certified) - Above ground local HVAC contractor	April 2017 - June 2017	NES Project Manager GP Team
Develop Project participant monthly access charge	April 2017 – September 2017	GP Team, Regulation and Pricing, and Legal
Investigate and determine metering requirements, data reporting, and equipment selection.	June 2017 – October 2017	NES Project Manager, GP Team
Review customer billing with Specialty Billing Group (Off-System, “White Bill”).	June 2017 – September 2017	Specialty Billing, GP Team
Develop contract(s) for (i) turnkey contract for geothermal contractor (Geothermal Facilities and inside work scope) or (ii) separate contracts with geothermal contractor (Geothermal Facilities) and HVAC installer (inside work scope). In addition, develop Property Owner and/or Customer Sales Agreement.	July 2017	NES Project Manager, GP Team
Select geothermal/HVAC contractors and execute contract(s) to construct Geothermal Facilities and inside work scope.	August 2017	NES Project Manager, GP Team
Permitting, testing, construction, and installation of geothermal system; system commissioning including coordination logistics with customer equipment installation schedule.	July 2017– October 2017	NES Project Manager, GP Team
Select engineering partner for Project data collection, reporting, and M&V. Select technical study partner to evaluate achievement o project objectives.	April 2017 – August 2017	NES Project Manager, GP Team

Progress on implementation and Project performance to be reviewed during the Jurisdiction's monthly performance meetings. If any issues are identified, the Jurisdiction will require a performance improvement plan.	Year-End 2017-2019	NES Project Manager, GP Team, Policy & Evaluation
Final Summary Report to PSC reviewing policy options/recommendations, future business models/ownership, market potential assessment/scalability, economic/societal/customer value-added benefits, cost effectiveness, etc.	Dec 30, 2019	NES Project Manager, GP Team, Business Development, New York Jurisdiction, Regulatory Strategy

1.60 Checkpoints

Table 4: Checkpoints

Scenario	Description
Carbon Reduction	
Reduction in carbon emission	Measure: Avoided units of carbon dioxide emissions. How and When: End of each year of operation. Resources: Project Manager; Data Analytics Target: 60% reduction in carbon dioxide output emissions. Solution if off-target: Review and revise offering.
Energy savings	
Heating and cooling reductions	Measure: Percent reduction in heating costs How and When: Two years of historical energy consumption, if available, will be compared to end of each year of operation. Resources: Specialty Billing group, PSEG LI Target: 30% heating and cooling costs. Solution if off-target: Review and revise offering.
System Benefits	
Natural gas and electric system benefits	Measure: Avoided system costs to natural gas and electric infrastructure. Electric peak load reduction and increase in base load to the grid. GHPs can be deployed to unserved natural gas communities. How and When: End of each year of operation. Resources: Data Analytics Target: 0.5 kW/ton reduction of electricity for cooling; 100% in avoided natural gas demand for heating. Solution if off-target: Review and revise project plan.
Economic Growth	

Social and economic benefits	Measure: Total monetized benefits How and When: REMI Analysis in the final report to the PSC Resources: Data Analytics; REMI model for LI. Target: Monetized benefits exceeds social economic costs Solution if off-target: Review and evaluate.
Customer Satisfaction	
Satisfaction with the GHP system compared to conventional heating and cooling equipment	Measure: Percent of participants "satisfied" or better. How and When: Once prior to installation (baseline) and each end of each year of operation. Resources: Survey Target: Exceeds new natural gas conversion satisfaction reported Solution if off-target: Review and revise project plan.

1.70 Conditions and Barriers

The following list includes key dependencies and potential barriers that are anticipated and may need to be addressed during the progress of the Project:

- Coordination with county governments, electric utility and water companies (including permitting if required)
- Integration of construction activities (gas utility, aboveground and underground)
- Fuel oil and electric prices

2.00 Project Structure and Governance

2.10 Project Team

All Gas REV Demonstration projects are implemented by the Customer Solutions group in New Energy Solutions and include the following:

Overall Gas REV Program Administration	Chris Cavanagh
NES Procurement	John Spring

The Geothermal Demonstration Project is implemented by the following team:

Table 5: Project Team

Name	Department
Chong Lin	New Energy Solutions
Andy Barnes	NY Jurisdiction
Rich Caliendo	Customer Fulfillment
Ann Clarke	Policy and Evaluation
Eliza Davis	Procurement
Mitch Hoffman	Customer Fulfillment
Christopher McGovern	Customer Meter Services
Eric Szulak*	Business Development
* Initial project manager	

2.20 Roles and Responsibilities

Table 6: Project Roles

Stakeholders	Responsibilities	Description
National Grid	Project Management	Overall project management and coordination with county governments, PSEG LI, water companies, NYSERDA, and other stakeholders.
	Stakeholder and Project Participant Engagement	Outreach and recruitment of potential Project participants and Project partners.
	Procurement	Execution of contracts and sales agreements.
	Pricing and Billing	Responsible for developing proposed geothermal billing structure and review of customer billing with Specialty Billing Group.
	Data Collection & Data Analytics	Provides support for data analysis and monitoring.
Project Participant	Participation in Project as agreed	Provide access to equipment and energy consumption data.
Geothermal Contractor	Well Drilling	Responsible for the construction, permitting, and engineering of the underground heat exchanger.
Geothermal HVAC Contractor	Installation of the heat pump	Responsible for the engineering, purchase, permitting, installing, and maintenance of the HVAC components.
GEO-NII	Technical support on the site selection process	Collaborate on the site selection process including site visits and preparing candidate site studies.
NYSERDA	Performance Validation and M&V	NYSERDA will provide M&V support to validate participant energy savings and system performance. The findings will then be used to evaluate market solutions to increase widespread adoption of GHPs and maximize benefits to the customer.

2.30 Governance

The Project is being managed through National Grid's NES team who is solely responsible for successful implementation. In accordance with the 2016 KEDNY and KEDLI rate proceedings, one incremental project manager has been hired specifically for the gas REV program which includes the geothermal demonstration. In addition, the Market Development team in the Customer area is providing additional project

management support. The Project will be tracked and monitored by an existing Performance Excellence (PEx) hub prior to any spending. The Project is supported by a dedicated procurement team in NES. In addition, there is substantial support required by several departments and groups and each is identified in the project timelines in section 3.00 of this plan.

In accordance with National Grid policies, all of the gas REV demonstration projects require the approval of the Senior Executive Sanctioning Committee regardless of size. This approval covers all capital and first year expenses and the approval process will be repeated for years two and three of the Project

Since the gas REV demonstration funding was included in the 2016 KEDNY and KEDLI rate case order, implementation plans have been submitted to the Regulatory team, the major element of which are being tracked as regulatory obligations. In addition, all projects and progress are subject to regularly scheduled reviews by the New York jurisdiction and other senior executives.

3.00 Work Plan

	Geothermal Heat Pump Pilot Program - Implementati	Participating Groups								CY 2017														CY 2018												CY' 2019											
	Activities	NES	CBD	Procurement	Legal	CMS	Gas Sales	Jurisdiction	Other	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
1.00	External Stakeholder Outreach (Jan17 - Feb17)																																													
1.10	Initiate discussions with interested entities - Suffolk County, PSEG-LI, NYSERDA, GEONII, local water utility, etc.	X	X				X	X																																					
1.20	Review Pilot Project Goals & Objectives	X	X				X	X																																					
1.30	Identification of optimal site/location criteria	X	X				X	X																																					
1.40	Utility Coordination - PSEG, Water Utility	X	X				X	X																																					
2.00	Recruitment - Participant Site Selection (Mar17 - Jun17)																																												
2.10	Identify areas without gas service availability		X				X		System Engrg																																				
2.20	Identify/Develop target participant criteria (Low Income, Public Building, Multi-family, etc.)	X	X				X																																						
2.30	Customer Outreach & Education - discuss Geothermal Pilot ownership model for below/above ground assets	X	X				X	X																																					
2.40	List of Potential Customer Pilot Sites - Internal Review	X	X				X	X	VP Mkt Dev																																					
2.50	Participant Site Selection/Notify Selected Site(s)	X	X				X	X	VP Mkt Dev																																					
3.00	Develop Customer Service Agreement (Mar17 - Sep17)																																												
3.10	Develop Customer Agreement(s) & Terms & Conditions	X	X	X	X																																								
3.20	Develop Geothermal pilot participant monthly access charge	X	X		X				Regulatory & Pricing																																						
3.20	Identify any Real Estate Issues/future Easements as needed	X	X		X				Real Estate																																				
4.00	Internal Planning & Operational Issues (Jun17-Oct17)																																												
4.10	Determine Metering Requirements, Equipment Selection, Data Monitoring & Reporting, Installer	X	X			X			outside consultant																																				
4.20	Develop Customer Billing "White Bill" format with Specialty Billing Group	X	X		X	X			Specialty Billing																																				
4.30	Geothermal ground loop Construction-Contractor oversight, infrastructure mapping, Level of Company Crew Involvement, future O&M, etc.	X	X			X			NG Construction, Engrg Dsn																																				
5.00	Procurement-Geothermal Contractor Selection (Apr17-Aug17)																																												
5.10	Identify Supply Pool of Qualified Geothermal Contractors (DEC certified, below ground scope), Design Engineers, and local HVAC Contractors (above ground scope)	X	X	X		X	X		GEONII																																				
5.20	Finalize Scope of Work Document, Design Specifications, Project Schedule	X	X	X		X	X		GEONII, NG Construction, EngDsn																																				
5.30	Execute Sourcing strategy - Develop and issue RFP to pre-qualified Geothermal Contractor Team (Turnkey EPC Contractor, Design-Build)	X	X	X	X																																							
5.40	Develop Geothermal Pilot Construction Contract	X	X	X	X																																							
5.50	Review & Evaluate Contractor Proposals & Select GeothermalContractor	X	X	X	X																																							
5.60	Execute Contract with Geothermal Contractor	X	X	X	X																																							
6.00	Geothermal Pilot Installation (Jul17-Oct17)																																												
6.10	Testing, Permitting, Construction, & Installation of Geothermal Ground Loop System	X	X					X	selected Contractor																																					
6.20	Customer HVAC Equipment Installation	X	X			X			selected Contractor																																					
6.30	System Testing/Commissioning/Post Inspection	X	X			X			selected Contractor, NG Construction & Project Engrg																																						
7.00	Engineering Technical Assistance (Nov17-Aug19)																																												
7.10	Energy Use Data collection & analysis	X	X			X			Engrg TA Firm																																					
7.20	Conduct Ongoing Technical Study on Geothermal Pilot Project Objectives including: validate installation costs & customer energy savings, cost/benefit analysis on gas & electric peak demand-cost avoidance, Environmental and Economic Benefit Analysis, Life Cycle Cost Savings, etc.								Engrg TA Firm																																					
7.30	Periodic Regulatory Updates/Status Reporting on Geothermal Pilot Project Performance	X	X					X	VP Mkt Dev Engrg TA Firm																																					
8.00	Final Summary Report to Regulators (Dec19)																																												
8.10	Compile Results & Issue Final Report	X	X					X	VP Mkt Dev Engrg TA Firm																																					
8.20	Review of Policy Options/Recommendations, Future Business Models/Ownership, Market Potential Assessment/Scalability, Economic/Societal/Customer value-added benefits, cost-effectiveness and affordability	X	X					X	VP Mkt Dev Engrg TA Firm																																					

Key
NES: New Energy Solutions
CBD: Customer Business Development
CMS: Cust. Meter Services

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

3.10 Project Budget

The cost of the demonstration projects is divided into Capital Costs and annual operations and maintenance ("O&M") costs as presented in the rate filing for Cases 16-G-0058 and 16-G-0059. These costs only cover estimated incremental direct Project costs.

Table 8: Budget

Geothermal Demonstration Project		
CY	Capital	O&M
2017	$300,000	$50,000
2018	n/a	$50,000
2019	n/a	$50,000
Total	$450,000	

3.20 Reporting Structure

Reporting progress to the PSC shall, at a minimum, be in accordance with the requirements of the Commission's order[20] for Cases 16-G-0058, 16-G-0059 *et al*. This order requires annual reports 45 days after the end of each rate year. Additional interim reporting is anticipated when major milestones are accomplished. In addition, progress is reported as regulatory obligations tracked by the Regulatory area. The Project will result in a final report detailing findings and recommendations.

The Project could result in scalable new products or services being made available to customers. If successful, the Project will result in a deployment plan derived from the Project findings and current market conditions. Since one of the core policy objectives of REV is "market animation," there could be a deployment of product concepts that this Project indicates will be successful. Such a deployment will most likely be accomplished through the creation of new partnerships potentially with some of the service providers supporting this Project or with other new entrants.

[20] Cases 16-G-0058, 16-G-0059 *et al*., *supra* note 1, Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

Appendix

- REV Alignment
- Carrier® Geothermal Heat Pumps

REV Alignment

NY's REV initiative has developed a series of Core Policy Objectives. In addition, for the natural gas products and services and services it is self-evident that safety is an additional outcome resulting in the following set of generic objectives for Gas REV.

Focus of Proposed Pilots	Aligned Services							
		Detect Leaks	Locate & Reduce Leaks	Flood Detection	Reduce Gas System Constraints (Automation)	Promote High Efficiency and Smart Appliances	Manage Gas Electric Interdependency	New Sources of Supply and Renewable Gas
	Safety Improvement	✓	✓	✓		✓		
	Modeling the Network for Growth	✓	✓		✓	✓	✓	✓
	Generation And Environment	✓	✓	✓	✓	✓	✓	✓

Focus of Proposed Pilots	Aligned Gas Objectives							
		Maximize Safety	Minimize Environmental Impact	Maximize Energy System Reliability	Improve Customer Affordability	Improve Operational Efficiency	Improve Access to Gas Service	Value Added/Choice Services for Customers
	Safety Improvement	✓	✓	✓				✓
	Modeling the Network for Growth	✓	✓			✓	✓	✓
	Generation And Environment	✓		✓	✓	✓	✓	✓
METRICS		Incident Frequency	GHG Reduction (CO_2e)	Forced Outages	Total Customer Energy Bills [$]	O&M[$] per Unit of Sendout	Capital Efficiency [$/cust](Financial)	Adoption/New Revenue[$]

After a review of these objectives the next step is translate them into specific initial objectives and metrics for gas service overall and each demonstration project as described in their respective implementation plans The figure below identifies one view of a series of utility services and also a set of gas service objectives and identifies pilot program focus and broad metrics that would be aligned with this service and objectives. This is the basis for the selection of Gas REV Projects. The alignment with REV principles for the geothermal demonstration project is described as follows:

REV Objective	Demonstration Alignment
New Utility Business Model	The Project will consider the potential broadening of gas utility service and potentially enable new service offerings. The project will collect data and analyze participant savings to inform future pricing and rate design modifications.
Identify Economic Value	The Project will identify economic savings for customers associated with the installed geothermal system and the potential for electric and gas system utilization benefits
Reduction of Carbon Emissions	The Project will upgrade existing heating equipment and have significant associated carbon emissions reductions.
Greater Consumer Choice	The implementation of a geothermal program will provide a viable option for non-gas customers to provide low-cost heating.
System-wide Efficiency	The implementation of a geothermal program could support local electric peak load reductions and support managed gas expansion.
New Source of Supply	The project will promote geothermal or ground source heating and cooling into the efficient mix of resources on the energy systems.

Sample GHP Manufacturer: Carrier® Geothermal Heat Pumps[21]

Geothermal Product Selection Guide

PACKAGE UNITS

GC
Ultimate Luxury
"Best" overall. Exceptional comfort, performance and control

GP
Upscale
Great choice for excellent performance and reliability

GB
Entry Level
Standard, solid performer at a base tier price

Features	GC	GP	GB
Sizes	2, 3, 4, 5, 6	2, 3, 4, 5, 6	1.5, 2, 2.5, 3, 3.5, 4, 5
AHRI Ratings (13256-1) Closed Loop (GLHP)	3.8 – 4.7 COP 18.5 – 32.0 EER	3.5 – 4.0 COP 15.5 – 24.5 EER	3.7 – 4.3 COP 18.5 – 21.7 EER
Ground Water (GWHP)	4.5 – 5.2 COP 23.1 – 37.0 EER	4.0 – 4.6 COP 19.6 – 30.0 EER	4.3 – 5.2 COP 22.7 – 28.1 EER
Refrigerant	Puron® refrigerant	Puron® refrigerant	Puron® refrigerant
Compressor	Two-stage unloading scroll	Two-stage unloading scroll	Single-stage scroll
Blower	Variable-Speed ECM Constant CFM	Variable-Speed ECM Constant CFM	Multi-Speed ECM Constant Torque
Cabinet Configurations	Vertical upflow Vertical downflow Horizontal	Vertical upflow Vertical downflow Horizontal	Vertical upflow Horizontal
Stages (* with Auxiliary)	Three stages heating* Two stages cooling	Three stages heating* Two stages cooling	Two stages heating* One stage cooling
Control	Infinity® Touch™ Control Wi-Fi® remote access Advanced diagnostics	Microprocessor control	Microprocessor control
Air Coil	Tin-plated copper tubing	Tin-plated copper tubing	Tin-plated copper tubing Coated coil
Air Filter	MERV 13, 2"	MERV 8, 2"	MERV 8, 2"
Cabinet Insulation	Closed cell foam	Closed cell foam	Fiberglass
Compressor Blanket	Yes	Yes	No
Desuperheater	Optional Internal mount pump	Optional Internal mount pump	Optional Internal mount pump
Auxiliary Heat	Optional Internal mount on vertical units	Optional Internal mount on vertical units	Optional Internal mount on vertical units
Infinity® Touch™ Control/ IAQ Products	Yes	No	No
Smart Start	No	Optional (field installed)	Optional (field installed)
Zone Control	Infinity® Zoning System	Optional	Optional
ENERGY STAR® Qualified	All sizes	All sizes	All sizes

* Ratings are subject to change. See AHRI.org for official ratings.

[21] *See* http://www.carrier.com/residential/en/us/products/geothermal-heat-pumps/

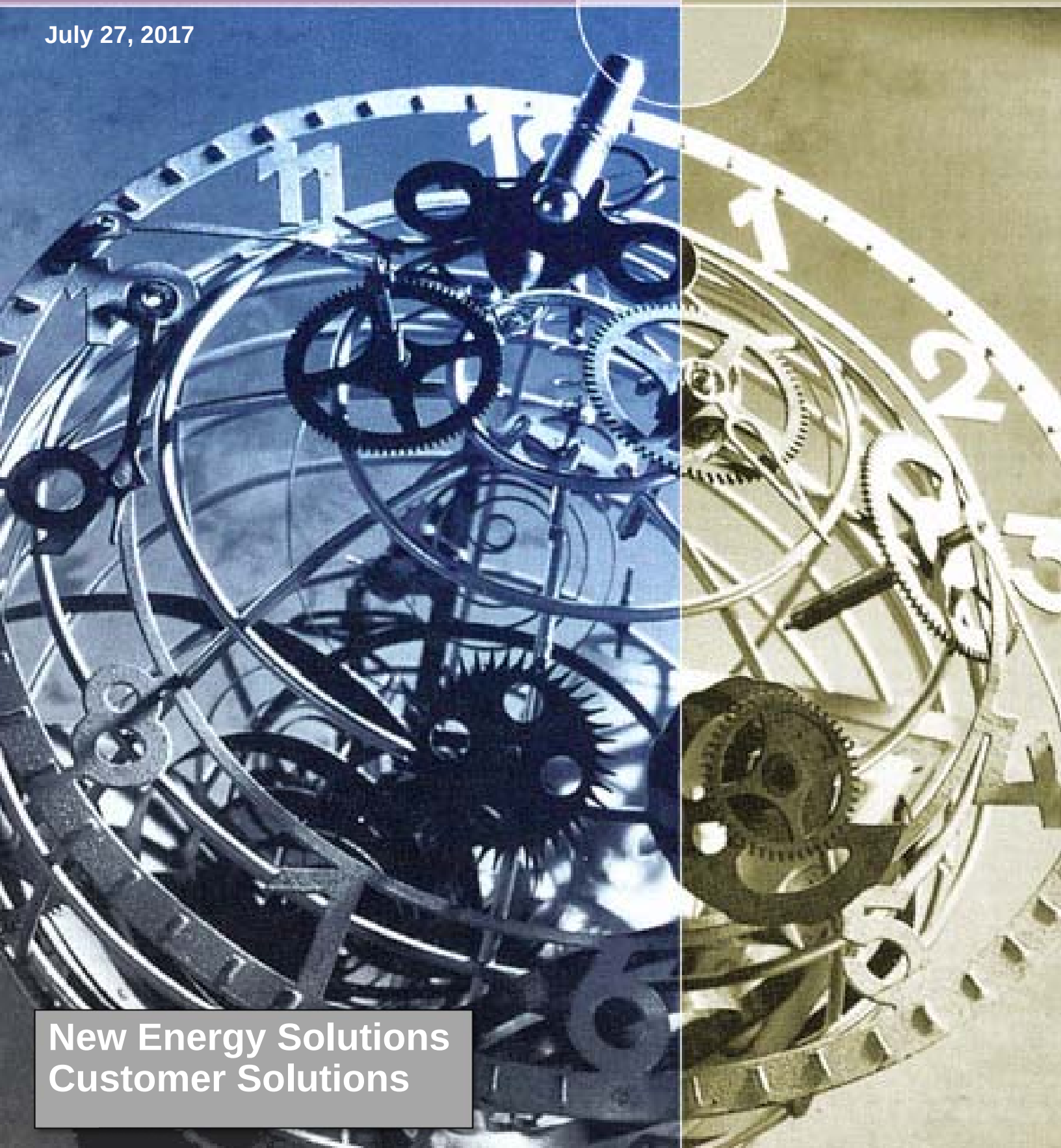
Implementation Plans for Gas REV Demonstration Projects

MicroCHP Demonstration
New York City & Long Island

nationalgrid

HERE WITH YOU. HERE FOR YOU

July 27, 2017



New Energy Solutions
Customer Solutions

MicroCHP Demonstration Project
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Appendix

Executive Summary

KeySpan Gas East Corporation d/b/a National Grid ("KEDLI") and The Brooklyn Union Gas Company d/b/a National Grid NY ("KEDNY") (collectively "National Grid" or the "Companies") are implementing a micro combined heat and power ("microCHP") demonstration project with twenty (20) units to assess the feasibility of the emerging technology in Long Island ("LI") and New York City ("NYC") (the "Project"). The objectives of the Project are to assess the feasibility of new business models that could potentially realize the economic, resiliency, and environmental benefits of microCHP in residential and light commercial markets.

The Project will include the installation of microCHP units in residential (both single family and multifamily) and/or small commercial buildings in electrically constrained areas – ten (10) units in NYC and ten (10) on LI. This will allow National Grid to document and validate customer benefits, gas and electric utility benefits, and associated environmental and social benefits.

National Grid will coordinate with external stakeholders, including equipment and service providers and community groups, to conduct outreach and enroll customers. Optimal installation sites will be determined based on several criteria such as technology suitability, net energy metering ("NEM") eligibility, and building characteristics.

The Project is a test-and-learn demonstration and was designed in accordance with the principles of the New York State Public Service Commission's ("Commission" or "PSC") Reforming the Energy Vision ("REV") proceeding.[1] The Project was approved through the 2016 KEDLI and KEDNY rate proceedings.[2] The purpose of this implementation plan is to describe National Grid's detailed execution plans for the Project.

The Project was designed to align within REV policy outcomes in several ways. National Grid believes that it is possible to create more mutually beneficial relationships with customers by leveraging critical infrastructure, customer outreach and engagement, energy insights, and other actionable information. Towards that end, the following metrics will be used to determine the feasibility of the Project:

- Energy Cost Savings
- Utility System Benefits
- Economic Growth
- Resiliency Benefits
- Customer Satisfaction
- Carbon Reduction

[1] Case 14-M-0101, *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision* ("REV Proceeding").

[2] Case 16-G-0058, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service* and Case 16-G-0059, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service et al*., Joint Proposal (filed September 7, 2016), Sections 9.9 & 13; and Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

The results of the Project will be reported to the PSC and recommendations for a full-scale program or further study will be made based on the learnings from this project.

1.00 Demonstration Project Design

The Companies, through the Project, will demonstrate the feasibility of new business models that could potentially realize the benefits of microCHP in residential and small commercial buildings. These markets represent a significant opportunity that is currently underserved due to market barriers such as high initial cost and lack of incentives for microCHP systems. Here are the primary business models that could, if successful, be facilitated by a regulated utility:

- Shared savings (facilitated by third-party financing)
- Customer ownership (dependent on customer willingness and initial cost of the system)
- Utility ownership (subject to regulatory approval)

Additional partnerships will be evaluated, such as the potential to aggregate multiple microCHP systems to provide relief for electric load constrained areas. A critical requirement to test this use case will be the ability to dispatch microCHP systems during demand response ("DR") events. This may be a role for both gas and electric utilities and third-party providers to enable this market.

In order to accomplish the above objectives, the Project will test the challenges and assess the benefits of microCHP technology for (1) customers, (2) gas utilities, and (3) electric utilities, and (4) environmental impact. To demonstrate the benefits, the Project requires the customers' participation and analysis of the data from the installation and operation of the microCHP units. The Project will analyze and document the following attributes of microCHP technology:

- Installed Cost
- Operating Cost
- Changes in Gas Usage and Associated Costs
- Changes in Electricity Consumption and Savings
- Electric and Gas Load Profiles and Peak Load Diversity
- Quantity and Value of Exported Power
- Customer Value of Resiliency
- Electric Utility Value for Demand Response

The final report to the PSC will include customer satisfaction and the analysis of benefits relative to the costs of microCHP technologies in LI and NYC. Additionally, the

report will review and suggest potential financing mechanisms such as shared savings strategies or the NY Green Bank financing model in a fully developed market.

1.10 Project Component Details

Twenty (20) microCHP units will be installed in residential (both single family and small multifamily) and small commercial buildings in LI and NYC to provide heat and produce hot water. These units will also generate electricity to serve a portion of the electric load. Furthermore, these units will be compensated under the Value of Distributed Energy Resources ("VDER") Phase One tariff for generation injected into the electric grid and provide power during electric supply events.[3] This functionality to provide ancillary services will be offered to both electric utilities, Consolidated Edison Company of New York, Inc. ("Con Edison") and PSEG Long Island ("PSEG-LI"). This component of the Project will require coordination with Con Edison and PSEG Long Island to strategically identify potential participants located in targeted areas of electric grid constraint. Additional considerations will be given to prospective participants who are eligible to participate in The Neighborhood Program (offered by Con Edison)[4] and Beneficial Areas for Fuel Cells[5] (offered by PSEG Long Island).[6]

Moreover, Project will evaluate an attribute related to resiliency, which is capability to generate backup power. The microCHP units will have an optional black-start functionality to provide power to critical functions in an event of a power outage, which can be of considerable value to customers. Project participants will be required to choose essential appliances to be isolated on a single circuit. The perceived value of backup power to the Project participants will be assessed. For a small amount of operating hours in a year (*i.e.*, during demand response events or power outages), the units will be electric-led and the release of some excess heat will be unavoidable. However, the environmental impact of this limited-duration operation will be minimal. The extent of heat release will be determined and the actual generation efficiency and overall system efficiency on an annual basis will be calculated.

The Companies both have special gas service classifications for residential distributed generation ("DG") service, No. 1DG (150) in LI and No. 1B-DG in NYC, which discount any incremental gas distribution costs. In order to test the economic attractiveness of microCHP technology, a shared savings arrangement will be sought with Project participants, whereby the participant has no or a reduced upfront cost but will be asked to effectively share with the service provider a portion of the actual energy cost savings. This aspect of the Project will be managed by a shared savings service provider with experience in energy efficiency financing.[7] These service providers typically offer to

[3] In New York, microCHP up to 10 kW in size and fuel cells up to 2 MW in size are subject to the Standardized Interconnection Requirements ("SIR"), available at www.dps.ny.gov/distgen.htm
[4] *See* The Neighborhood Program, available at https://www.coned.com/en/save-money/rebates-incentives-tax-credits/the-neighborhood-program
[5] Fuel cells are also a form of microCHP.
[6] *See* Beneficial Areas for Fuel Cells, at https://www.psegliny.com/files.cfm/BeneficialAreasFuelCellInstal.pdf

fund all capital costs and recover their investment through the difference in utility bills and the new charges to the customer over time through an incremental charge on the utility bills which will be offset by savings in energy use. (See sample proposal in the Appendix).

1.11 Participant Targeting

Eligible building types for the Project can be single-family residences, apartment units, or multi-family housing. Small commercial customer applications, such as restaurants, hospitality, and nursing homes, will also be considered. Prospective participants shall agree to share two (2) years of electric and natural gas consumption data with National Grid to determine technology suitability and estimate energy savings. National Grid and the equipment partner will conduct a brief site assessment to determine site feasibility. First, prospective participants must demonstrate the following requirements prior to be considered:

- National Grid gas customer
- Non-gas constrained areas
- Technical suitability
- Utility accounts in good standing
- No financial encumbrances
- Technology suitability
- Buildings properly maintained with no outstanding permit violations
- Internet access
- Easy access for service and data collection

The Project will give additional consideration to National Grid customers located in the following areas:

- FEMA Flood Zones[8]
- Areas considered low-to-moderate income ("LMI")
- New York City - buildings within The Neighborhood Program of Con Edison
- Long Island – buildings within the PSEG-LI Beneficial Areas for Fuel Cells

National Grid will leverage the equipment providers' potential customer lists to generate the first demonstration projects. Such projects have not proceeded due to concerns over high first-costs and product availability that this project will address if the business models are proved viable.

[8] *See* https://msc.fema.gov/portal

1.12 MicroCHP Partner Selection Process

The Project entails demonstration of commercially available and emerging microCHP solutions. Currently, commercially available microCHP solutions in the U.S range from 1 to 7 kW of electric generation capacity. A two-phase approach to engage potential microCHP suppliers will benefit the Project and allow for the participation of market-ready and near-market-ready solutions at the appropriate time. In Phase One (2017-2018 heating season), the Project will focus on commercially ready microCHP units. In Phase Two (2018-2019 heating season), the Project will explore both market-ready and near-market-ready microCHP technologies. The manufacturers for Phase One have been chosen after completion of a questionnaire and in-person meetings to determine both the suitability of their product and a vision that includes large-scale deployment in residential and light commercial markets. These are currently underserved markets but have a significant growth potential if the business models are proved successful. The potential microCHP providers are as follows and data sheets for each microCHP of interest are attached in the Appendix entitled "Potential Suppliers and Products of Interest in Phase One:"

- Marathon Engine Systems - ecopower® microCHP
- Yanmar Energy Systems
- M-TriGen Power Generation Systems Solutions
- Qnergy
- Aisin

The M-Trigen unit has the added benefit of offering an option for a small gas engine driven air conditioning system. While this product feature adds complexity and cost, it also increases the end-customer energy savings, electric utility benefits, and gas load factor benefits. This unit is not ready for Phase One but will be considered for Phase Two.

In addition, other microCHP providers such as Panasonic, have expressed interest in the Project, for a first U.S. demonstration of its microCHP system using a 1 kW Polymer Electrolyte ("PEM") fuel cell. Kyocera has also expressed interest in participating in the Project with its Solid Oxide Fuel Cell ("SOFC") system. These potential providers will be considered in Phase Two of the project.

1.13 Customer/Stakeholder Engagement and Communications

Since the Project goal is to enroll twenty (20) customers, market engagement will be targeted. The preferred choice for communication with customers will be through the manufacturers of microCHP and through their local agents/representatives. National Grid will also support such efforts through its community and government affairs representatives and through existing sales and marketing channels including:

- National Grid sales and community representatives
- Collaboration with other industry partners

- Targeted direct mail
- Outbound telemarketing
- Social media

Large-scale marketing and advertising is not necessary or justified for the Project. Potential participants may be tracked by National Grid's GridForce customer relationship management system.

1.14 Background on MicroCHP

CHP generally refers to as an efficient and clean approach to onsite generation of electricity and heat. The technology would capture the heat that would otherwise be wasted up the smokestack in standard power plants to provide useful thermal energy that in turn can be used for space heating, domestic hot water, and other applications.[9] Hence, a microCHP is a smaller engine or fuel cell with a capacity of 10 kW or less designed for residential or light commercial applications. Such systems generally operate in place of, or supplement, a building's heating system, operating only when there is a need for heat or configured for near continuous operation year round. These systems can also be tied to a building's domestic hot water loop to provide hot water to the building. CHP technologies provide benefits to the electric grid by operating in parallel with the grid and are usually capable of exporting excess power to the grid.

CHP technologies are predominately found in hospitals, retirement centers, hotels, dormitories, and similar facilities as these types of facilities are good candidates due to their near-continual demand for hot water.[10] The application of microCHP technology for residential and light commercial premises is uncommon in the U.S. However, these systems have reached significant adoption in Japan and Europe with the deployment of more than 120,000 engine-based units and another 120,000 fuel cells in Japan. Given that these products have gained significant market adoption in other advanced countries, National Grid believes further research and demonstration is necessary to understand the benefits and cost effectiveness of the current technology specific to LI and NYC.

National Grid investigated the technology in 2011 through a prior demonstration using a 1 kW engine-based unit in residential applications supported by the New York State Energy Research and Development Authority ("NYSERDA"). The results show substantial cost savings and carbon reduction potential (see Figure 2 below).[11] Typically, the electricity purchased from the grid decreased significantly (ranging from 23% to 51%) after the installation of the microCHP unit with an increase in gas consumption from 2% to 21% on an annual basis and about 10% in the winter peak.

[9] *See* Combined Heat and Power (CHP) Partnership, available at https://www.epa.gov/chp/what-chp
[10] Brooks, K. *et al*., *Business Case for a Micro-Combined Heat and Power Fuel-Cell System in Commercial Applications*, *Pacific Northwest National Laboratory* (October 2013), available at: http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22831.pdf
[11] *See The Potential Impact of Micro-CHP In New York State*, Final Report, NYSERDA, PON 1105 (August 2011).

The project will not result in the installation of any microCHP units in areas with local gas distribution constraints nor will future deployment in such areas be supported.

Figure 2. Benefits Generated by the Installed MicroCHP during the 2011 Test Period

Site	1	2	3	4	5
Test Period	8/09-7/10	8/09-7/10	2/09-1/10	2/09-1/10	2/09-1/10
Cost of Operation – Old Furnace or Boiler [1]	$1,478.06	$1,243.76	$2,757.51	$2,188.31	$2,702.43
Cost of Operation – freewatt [2]	$916.67	$703.74	$1,630.25	$1,516.59	$1,644.98
Operating Cost Savings with freewatt	$561.39	$540.02	$1,127.26	$671.71	$1,057.45
freewatt Power Generation [kWh]	3,258	3,673	4,579	2,856	3,928
Average Electric Rate [$/kWh]	0.155	0.164	0.213	0.201	0.210
Average Res. Gas Rate [$/Therm]	1.072	1.056	1.273	1.353	1.356
Average DG Gas Rate [$/Therm]	0.963	0.968	1.047	1.151	1.166
Annual Heating Load [Million BTU]	69.8	47.7	107.2	93.1	109.0
CO_2 Emissions – Old Furnace or Boiler [3] [Pounds]	16,249	13,247	24,189	18,859	22,923
CO_2 Emissions – freewatt [Pounds]	11,016	8,372	17,414	14,982	16,238
CO_2 Emissions Reduction with freewatt [Pounds]	5,233	5,055	6,776	3,877	6,685
freewatt Capacity Factor	31.0%	34.9%	43.6%	27.2%	37.4%

(1) Includes cost of power displaced by freewatt generation
(2) Assumes with net metering and with reduced cost DG gas rate
(3) Includes estimated CO2 emissions from power plant for power displaced by freewatt

1.20 Test Statements

This Project aims to demonstrate the benefits of microCHP and the viability of such technology for residential and small commercial applications in LI and NYC. CHP technology today has proven to be cost effective in large commercial and industrial applications. However, microCHP systems are just beginning to develop and enter the market for residential and small commercial applications. The Project seeks to identify current challenges and benefits for increasing awareness and greater adoption of microCHP technology. In the Project, National Grid will test the validity of the hypotheses shown in Table 1, Test Statements, below. The results of hypothesis testing will be tracked and then used to inform subsequent offerings to customers in LI and NYC.

Table 1: Test Statements

Overarching Test Statements	**If…**	**Then…**
MicroCHP technology creates new value for customers, gas utilities,	A. If the potential attributes of cost savings and resiliency are successfully demonstrated in	Customers will consider the technology attractive and will increasingly adopt

and electric utilities, and provides social and environmental benefits.	LI and NY.	microCHP technology.

The following supporting test statements will provide a more focused evaluation of the benefits to the customer, utilities, and the environment:

Table 2: Supporting Test Statements

Supporting Test Statements	**If…**	**Then…**
1. The installed microCHP units generate significant energy cost savings (30% or greater).	A. Project participants see energy cost savings of 30% or more from the use of high-efficiency microCHP units.	MicroCHP technology can produce clear value for our customers
2. MicroCHP provides benefits to critical infrastructure in terms of a peak load reduction of 1 kW or more.	A. Project participants can produce electricity on-site and export excess electricity using microCHP units.	MicroCHP technology can be used to defer potential capital commitments for gas and electric utilities, reduce network losses, and provide a viable option to mitigate the growing peak demand
	B. Project participants can produce each unit of energy with less electric infrastructure demands and no new demand for infrastructure for existing gas customers.	
3. MicroCHP can provide power during electric demand response events and power outages.	A. The installed microCHP units can provide reliable electricity year-round and/or to critical functions during the event of a grid disruption or grid constraint.	Reliability benefits will be realized by and quantified for our customers.
4. MicroCHP units reduce carbon emissions by more than 30%.	A. The installed microCHP units generate both heat and electricity at a higher efficiency, (85 %+) compared to conventional generation.	Carbon reductions will be achieved and quantified

5. Program participants have a high customer satisfaction with the microCHP.	A. Program participants exhibit high satisfaction with the benefits provided by the microCHP units.	MicroCHP technology will be accepted by our customers and significant market penetration can be enabled.

1.30 Test Population

The Project's focus will be on single residential, multi-residential, and small commercial customers within the Companies' service territories. While there are several parameters to be considered, such as space availability, compatibility with existing equipment, and condition of the space, the market size for potential microCHP customers can be conservatively estimated as the following for LI and NYC:

For KEDNY, the Project focuses on buildings located within The Neighborhood Program offered by Con Edison. In Table 3 below, the number of potential customers in residential buildings corresponds to Con Edison's customer segment "Multi Family 1-4." The number of potential customers in multifamily buildings corresponds to Con Edison's customer segment "Multi Family > =5." Lastly, the number of potential customers in small commercial buildings corresponds to Con Edison's customer segment "Retail", "Restaurant", and "Grocery."

Table 3: Potential MicroCHP Market in KEDNY in Electric Constrained Areas

Building Type	Potential Customers (Count)
Residential (1-4)	175,160
Multifamily (5 and up)	85,381
Small Commercial	7,051
Total	267,592

See attached Appendix entitled "The Neighborhood Program" for the map provided by Con Edison.

In order to test the potential to provide relief to electric constraint areas, both Con Edison and PSEG-LI have expressed interest in cooperating in the Project through a Memorandum of Understanding ("MOU") with National Grid. This arrangement will enable the electric utility to remotely operate the test equipment and also allow for confidential review of relevant system performance data. No customer data will be disclosed without written customer approval. For KEDLI, the Project focuses on buildings located within electric constrained areas of PSEG-LI, also known as Beneficial Areas for Fuel Cell Distribution-Connected Resources (see attached Appendix entitled Beneficial Areas for Fuels Cells Provided by PSEG-LI for these eight areas). Direct data for the potential market for microCHP in LI is not yet available as it is today for microCHP potential in NYC. However, in 2006 a high level estimate of homes on LI that could use standard backup generators was conducted and it was conservatively projected that 40,000 homes, or 10 percent of existing LI residential customers, were suitable. Since a microCHP unit will also provide heating, the potential is much higher and the peak electric demand avoided is estimated to be in excess of 200 MW on LI.

Please see attached Appendix for maps of electric constraint areas provided by PSEG-LI.

1.40 Test Scenarios

Table 4: Test Scenarios

Scenario	Description
Energy Cost Savings	
Reduction of energy costs for electricity generation and heating	National Grid will collect and analyze energy data to project energy cost savings from heat recovered during the generation of electricity and export of excess power to the electric grid.
System Benefits	
Generates both gas and electric system benefits	National Grid will evaluate total benefits of microCHP relative to gas and electric system benefits. System benefits can include the avoided cost of gas and electricity infrastructure, environmental benefits, and system load reduction.
Economic Growth	
Projected social economic benefits	National Grid will initiate a Regional Economic Models Inc. ("REMI") analysis to illustrate customer benefits under various scenarios.
Resiliency	
Ability to provide electricity at times of electric grid constraint and power outage	National Grid will analyze load reductions to the electric grid during electric supply events at each microCHP unit. The Project will also analyze units' ability to provide partial backup power during power outage events.
Carbon Reduction	
Reduction of carbon emissions	National Grid will estimate carbon emissions through data collection at each microCHP unit to estimate carbon reductions.
Customer Satisfaction	
Satisfaction with service	National Grid will assess overall satisfaction through a survey of the Project participants at end of the evaluation period to assess whether the microCHP unit met or surpassed expectations.

1.50 Milestones

Table 5: Milestones

Actions	Timing	Process Owner
1. Customer needs analysis and identifying target customer type.	January 2017 – March 2017	Micro CHP Team
2. Coordination with electric utilities (Con ED and PSEG-LI); identify electric constrained areas.	January 2017 – December 2019	NES
3. Stakeholders engagement; collaboration with industry groups and key agencies (ARPA-E, community partners and organizations, etc.) Phase 1	January 2017 – October 2017	NES and Customer Business Development ("CBD")
4. Stakeholders engagement; collaboration with industry groups and key agencies (ARPA-E, community partners and organizations, etc.) Phase 2	January 2018 – October 2018	NES and Customer Business Development ("CBD")
5. Solution development (vendor selection and eligible equipment criteria); secure pricing. Phase 1	January 2017 – June 2017	NES
6. Solution development (vendor selection and eligible equipment criteria); secure pricing. Phase 2	January 2018 – June 2018	NES
7. Completion of legal contracts with customers, vendors and mutual agreement with partner electric utilities. Phase 1	March 2017 – October 2017	Micro CHP Team
8. Completion of legal contracts with customers, vendors and mutual agreement with partner electric utilities. Phase 2	March 2018 - October 2018	Micro CHP Team
9. Customer selection and enrollment. Phase 1	June 2017 – September 2017	CBD
10. Customer selection and enrollment. Phase 2	April 2018 – September 2018	CBD
11. Schedule and install customer equipment – Phase 1 (readily available technologies).	July 2017 – November 2017	NES
12. Schedule and install customer equipment – Phase 2 (for developing technologies).	July 2018 – November 2018	NES
13. Measurement and verification; Coordination with electric utilities on system usage.	October 2017 – December 2019	NES Project Manager
14. Meet with Staff how to assess the impact of a broader penetration of the Micro CHP pilot on peak demand.	As Needed 2017-2019	Micro CHP Team
15. Progress on implementation and program performance to be reviewed during the Jurisdiction's monthly performance meetings. If any issues are identified, the Jurisdiction will require a performance improvement plan.	As Needed 2017-2019	Micro CHP Team

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

1.60 Checkpoints

Table 6: Checkpoints

Scenario	Description
Energy Cost savings	
Reduction in energy costs	Measure: Percent reduction in heating costs and electricity purchased from the grid. How and When: Two years of historical energy consumption will be compared to end of each year of operation. Resources: Specialty billing group, Con Edison and PSEG-LI Target: 25% reduction in heating costs; 10% reduction in annual consumption (kWh) Solution if off-target: Review and revise
System Benefits	
Gas and electric system benefits	Measure: Estimate system costs to gas and electric infrastructure. How and When: End of each year of operation Resources: Data analytics Target: Load factor improvement for electric and gas at each demonstration site. Solution if off-target: Review and advise
Economic Growth	
Social economic benefits	Measure: Total monetized benefits How and When: REMI analysis in the final report to the PSC Resources: REMI Target: Monetized benefits exceeds social economic costs Solution if off-target: Review and advise
Resiliency	
Provide electricity at time of electric grid constraint and power outage	Measure: Production of electricity in the event of a power disruption or a peak energy demand event. How and When: Analysis of electricity consumption-monthly and during duration of power outage Resources: Con Edison, PSEG-LI, and National Grid's Data Analytics group Target: Displace at least 1 kW or grid-supplied power during an outage or an electric DR event Solution if off-target: Review and revise
Customer Satisfaction	
Satisfaction with the microCHP system compared to conventional equipment	Measure: Percent of Project participants' "satisfied" or better How and When: Once prior to installation (baseline) and at end of each year of operation Resources: Survey Target: Exceeds utility satisfaction Solution if off-target: Review and revise
Carbon Reduction	

Reduction in carbon emission	Measure: Avoided units of carbon dioxide emissions How and When: End of each year of operation Resources: Project Manager; Data Analytics Target: 30% reduction in output emissions Solution if off-target: Review and advise

1.70 Conditions and Barriers

The following list includes anticipated key dependencies and potential barriers that may need to be addressed during the progress of the Project:

- Coordination with electric utilities (Con Edison and PSEG-LI)
- Inconsistent product availability
- High installation costs for low volume sales
- Customer participation
- Sizing of microCHP units to the electricity demand of the participant

2.00 Project Structure and Governance

2.10 Project Team

The Project is being implemented by the Customer Solutions group in New Energy Solutions ("NES") and includes the following:

Overall Gas REV Program Administration	Chris Cavanagh
NES Procurement	John Spring

The Project is implemented by the following team:

Table 7: Project Team

Name	Department
Matt Foran	Customer Business Development
Stephen Peltier	EE Procurement
Chris Cavanagh	NES Project Manager
Lauren Perry	NY Jurisdiction
Paula Schoelermann	CMS/AMI
Donald Chahbazpour	Climate Change Compliance
Rishi Sondhi*	Customer Business Development
*Initial project manager	

2.20 Roles and Responsibilities

Table 8: Project Roles

Stakeholders	Responsibilities	Description
National Grid	Project Management	Overall project management and coordination with electric utilities, potential suppliers, and other stakeholders.
	Stakeholder & Customer Engagement	Outreach and recruitment of potential Project participants, vendors, and partners.
	Project participant selection	Responsible for screening and selecting customers to participate in the Project.
	Procurement	Execution of contracts and sales agreements.
	Pricing & Billing	Responsible for customer billing with specialty billing group.
	Data Collection & Data Analytics	Provides support for data analysis and monitoring.
Project Participant	Participation in program as agreed	Provide access to equipment and energy use data. Participate in project evaluation surveys.
MicroCHP Equipment Partner	Identifying potential Project participants	Responsible for prospecting qualified potential leads to participate in the Project.
	Installation of microCHP units	Responsible for the installation, permitting, and sizing of microCHP units.
Shared Savings Service Provider	Implementing share savings mechanisms	Responsible for implementing shared cost savings between the Project and the Participants.

2.30 Governance

The Project is being managed through National Grid's NES team who is solely responsible for successful implementation. In accordance with the 2016 KEDLI and KEDNY rate case proceedings, one incremental project manager has been hired specifically for the gas REV program which includes the Project. In addition, the Customer Solutions team in the Customer area is providing additional project management support. The Project is included in an existing Performance Excellence ("PEX") hub prior to any spending commitments. The Project is supported by a dedicated procurement team in NES. In addition, there is substantial support required by several departments and groups and each is identified in the project timelines in Section 3.00 of this plan.

In accordance with National Grid policies, the entire Gas REV Demonstration Program requires the approval of the Senior Executive Sanctioning Committee. This approval covers all capital and first year expenses and the approval process will be repeated for years 2 and 3 of the project.

Since the Gas REV Demonstration program funding was included in the KEDLI/KEDNY rate case order, implementation plans have been submitted to the Regulatory team, the major elements of which are being tracked as regulatory obligations by National Grid. In addition, all programs and their respective progress are subject to regular scheduled reviews by the New York jurisdiction and other senior executives.

3.00 Work Plan

Micro Combined Heat and Power Demonstration

	Activities	Participating Groups							CY 2017													CY 2018											
		NES	ADA	CMS/AMO	Gas Sales	GP	CBD	Jurisdiction	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
1.00	Customer Targeting (1/2017-3/2017)																															
1.10	Identification of suitability	X	X	X	X			X																								
1.20	Customer data analysis	X	X	X																												
1.30	Identify ideal locations/areas	X	X	X	X			X																								
1.40	Customer needs analysis	X	X	X	X		X																									
1.50	Identify target customer types	X	X	X	X	X																										
1.60	Transition to recruitment (section 3 below)																															
2.00	Utility Coordination (1/2017-6/31/2017)																															
2.10	Outreach and Education	X			X																											
2.20	Execute agreements (for data exchange)	X			X																											
2.30	Identify load constraint areas (electric)	X			X																											
2.40	Customer targeting	X			X		X																									
2.50	Data integration & exchange protocols	X			X	X																										
3.00	Recruitment (2/2017-12/2017)																															
3.10	Develop participant criteria	X			X		X																									
3.20	Develop customer agreements	X			X	X	X																									
3.20	Develop outreach plan materials	X			X	X	X																									
3.30	Customer enrollment	X			X		X																									
4.00	Stakeholder Engagement (1/2017-9/2017																															
4.10	Develop Stakeholder Map	X					X	X																								
4.20	Develop Stakeholder Collateral	X					X	X																								
4.30	Initial Meetings & Cadence as needed	X				X	X	X																								
4.40																																
5.00	Vendor Selection & Contracts (1/2017-7/2017)																															
5.10	Internal Stakeholder RACI	X				X																										
5.20	Identification of Vendors	X				X																										
5.30	Identification of Technologies	X				X																										
5.40	Scope of Work	X				X																										
5.40	Go-to-Market Strategy	X				X																										
5.50	Issue RFP(s)/Sole Source?	X				X																										
5.60	Vendor Selection & Compliance	X				X																										
5.70	Contracts	X				X																										
6.00	Installation																															
6.10	Installs Phase 1- (7/2017-10/2017)	X		X																												
6.20	Installs Phase 2- (3/2018- 8/2018)	X		X																												
7.00	Measurement and Verification 7/2017-12/2018)																															
7.10	Data collection & synthesis	X		X																												
8.00	Regulatory Updates as Needed							X																								

Key

NES: New Energy Solutions
ADA: Advanced Data Analytics
CMS: Cust. Meter Services
GS: Gas Sales
GP: Global Procurement
CBD: Customer Business Development
JR: Jurisdiction

Note: As the Implementation Plan is an evolving, working document, refinements to scope of work and milestones are expected as the Project progresses. Modifications will be captured in quarterly reports and meetings with Staff.

3.10 Project Budget

The cost of the Project is divided into capital costs and first year operations and maintenance ("O&M") costs as presented in the rate filing for Cases 16-G-0058 and 16-G-0059. These costs only cover estimated incremental direct Project costs.

Table 10: Budget

Gas Technology for Electric Constraints MicroCHP Heating System Integration		**KEDNY**	
	FTE or Quantity	2017 Capital	O & M
Units (Estimate)	10	$390,062	
Customer Pmts (=Blr Lease+1/2 savings)	10		($23,160)
Maintenance	10		$3,500
Shared Savings Service Provider (1/4 savings)	10	$6,950	
Subtotal		**$397,012**	**($19,660)**
		KEDLI	
	FTE or Quantity	2017 Capital	O & M
Units (Estimate)	10	$390,062	
Customer Pmts (=Blr Lease+1/2 savings)	10		($23,160)
Maintenance	10		$3,500
Shared Savings Service Provider (1/4 savings)	10	$6,950	
Subtotal		**$397,012**	**($19,660)**
Total	1.	**$794,025**	**($39,320)**

3.20 Reporting Structure

Reporting progress to the PSC shall, at a minimum, be in accordance with the requirements of the Commission's order[12] for Cases 16-G-0058, 16-G-0059 *et al*. The order requires annual reports 45 days after the end of each rate year. Additional interim reporting is anticipated when major milestones are accomplished. In addition, progress is reported as regulatory obligations tracked by National Grid's Regulatory area. The Project will result in a final report detailing findings and recommendations.

3.30 Partnerships

The Project could result in scalable new products or services being made available to customers. If successful, the Project will result in a deployment plan derived from the Project findings and current market conditions. Since one of the core policy objectives of REV is "market animation," the deployment of those product concepts that this Project indicates will be successful will most likely be deployed through at least the facilitation of the market but more likely through facilitation as

[12] Cases 16-G-0058, 16-G-0059 *et al*., *supra* note 1, Order Adopting Terms of Joint Proposal and Establishing Gas Rate Plans (issued December 16, 2016).

well as the creation of new partnerships. Facilitation of new markets for gas technologies has traditionally included free technical advice for customers, rebates, advisory services for service providers, and support for future product development through R&D programs. In this case, product testing for the M-Trigen product is being conducted by the Gas Technology Institute ("GTI") and will be supported by the Companies, using separately approved R&D funds. National Grid will be one of fifteen (15) gas companies supporting this project.[13] New partnerships will potentially include some of the service providers included in the Project or with other new entrants. National Grid's New York gas companies have extensive experience in developing successful alliances. Previous examples include the following:

- Oil – Gas Heating Conversions (Value Plus Installer Program)[14]
- Natural Gas Vehicles and US DOE Clean Cities
- Energy Efficiency Program Implementation[15]
- Utility Energy Service Contracts ("UESC") for government customers

For the Project, several forms of partnerships are expected to be tested and analyzed as discussed in Section 1.00. The primary among these with will be partnerships with equipment manufacturers and financing providers. The system provider partnership could include leveraging marketing and sales support as well as technical or logistical support. Similarly, financing partner would collaborate with the Companies and the equipment partner(s) to accelerate market growth by sharing energy savings with customers. This model can eliminate or reduce high upfront costs and is similar to practices in the commercial DG sector utilizing power production agreements as well as financing arrangements in the energy efficiency market.

In addition, collaboration with electric utilities and NYSERDA to provide relief for the constrained areas described herein will also be tested and could include new models to aggregate electric capacity from large numbers of small microCHP sites and/or the expansion of existing incentive programs to include microCHP.

Another potential business model that may be evaluated is utility ownership. However, this option will be decided after regulatory review including prohibitions against National Grid owning or developing generation in New York State established at the time of the acquisition of KeySpan by National Grid in 2007.[16]

[13] GTI Utilization Technology Development ("UTD") Project 2.16.H
[14] https://www.nationalgridus.com/NY-Home/Convert-to-Natural-Gas/Find-a-Contractor
[15] https://cleancities.energy.gov/coalitions/long-island
[16] *See* Order for Case 06-M-0878 dated July 6, 2007 section VII B 2(a).

Appendix

- REV Alignment
- The Natural Gas Distribution Vision
- Potential Suppliers and Products of Interest in Phase One.
- The Neighborhood Program Offered by Con Edison
- Con Edison Electric Constrained Networks
- Beneficial Areas for Fuels Cells by PSEG Long Island
- Typical Customer Agreement
- Shared Savings Proposal (Sealed)

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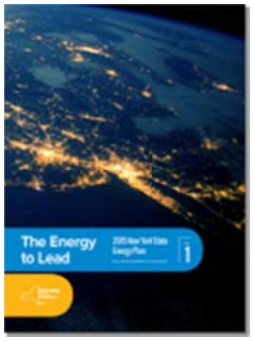
REV Alignment

NY's REV initiative has developed a series of Core Policy Objectives. In addition, for the natural gas products and services and services it is self-evident that safety is an additional outcome resulting in the following set of generic objectives for Gas REV.

Focus of Proposed Pilots	Aligned Services							
		Detect Leaks	Locate & Reduce Leaks	Flood Detection	Reduce Gas System Constraints (Automation)	Promote High Efficiency and Smart Appliances	Manage Gas Electric Interdependency	New Sources of Supply and Renewable Gas
	Safety Improvement	✓	✓	✓		✓		
	Modeling the Network for Growth	✓	✓		✓	✓	✓	✓
	Generation And Environment	✓	✓	✓	✓	✓	✓	✓

Focus of Proposed Pilots	Aligned Gas Objectives							
		Maximize Safety	Minimize Environmental Impact	Maximize Energy System Reliability	Improve Customer Affordability	Improve Operational Efficiency	Improve Access to Gas Service	Value Added/Choice Services for Customers
	Safety Improvement	✓	✓	✓				✓
	Modeling the Network for Growth	✓	✓			✓	✓	✓
	Generation And Environment	✓		✓	✓	✓	✓	✓
METRICS		Incident Frequency	GHG Reduction (CO_2e)	Forced Outages	Total Customer Energy Bills [$]	O&M[$] per Unit of Sendout	Capital Efficiency [$/cust](Financial)	Adoption/New Revenue[$]

After a review of these objectives the next step is translate them into specific initial objectives and metrics for gas service overall and each demonstration project as described in their respective implementation plans. The figure below identifies one view of a series of utility services and also a set of gas service objectives and identifies demonstration program focus and broad metrics that would be aligned with this service and objectives. This is the basis for the selection of Gas REV Demonstration projects.



New York State has been supportive of the cost-effective and environmentally responsible expansion of the natural gas service. "Expansion of the natural gas system complements the economic development efforts encompassed by Governor Cuomo's recently released New York Energy Highway "Blueprint"[17]…that "accelerating utility capital and operation and maintenance spending on the State's…natural gas infrastructure will result in enhanced reliability and safety for utility customers while generating substantial economic development benefits for the State's overall economy."[18]

In addition several initiatives in the 2015 New York State Energy Plan support the advanced development of the natural gas infrastructure and services including initiatives 7, 12, 13, 15, 28, and 29.

The alignment with REV principles for the Project is described as follows

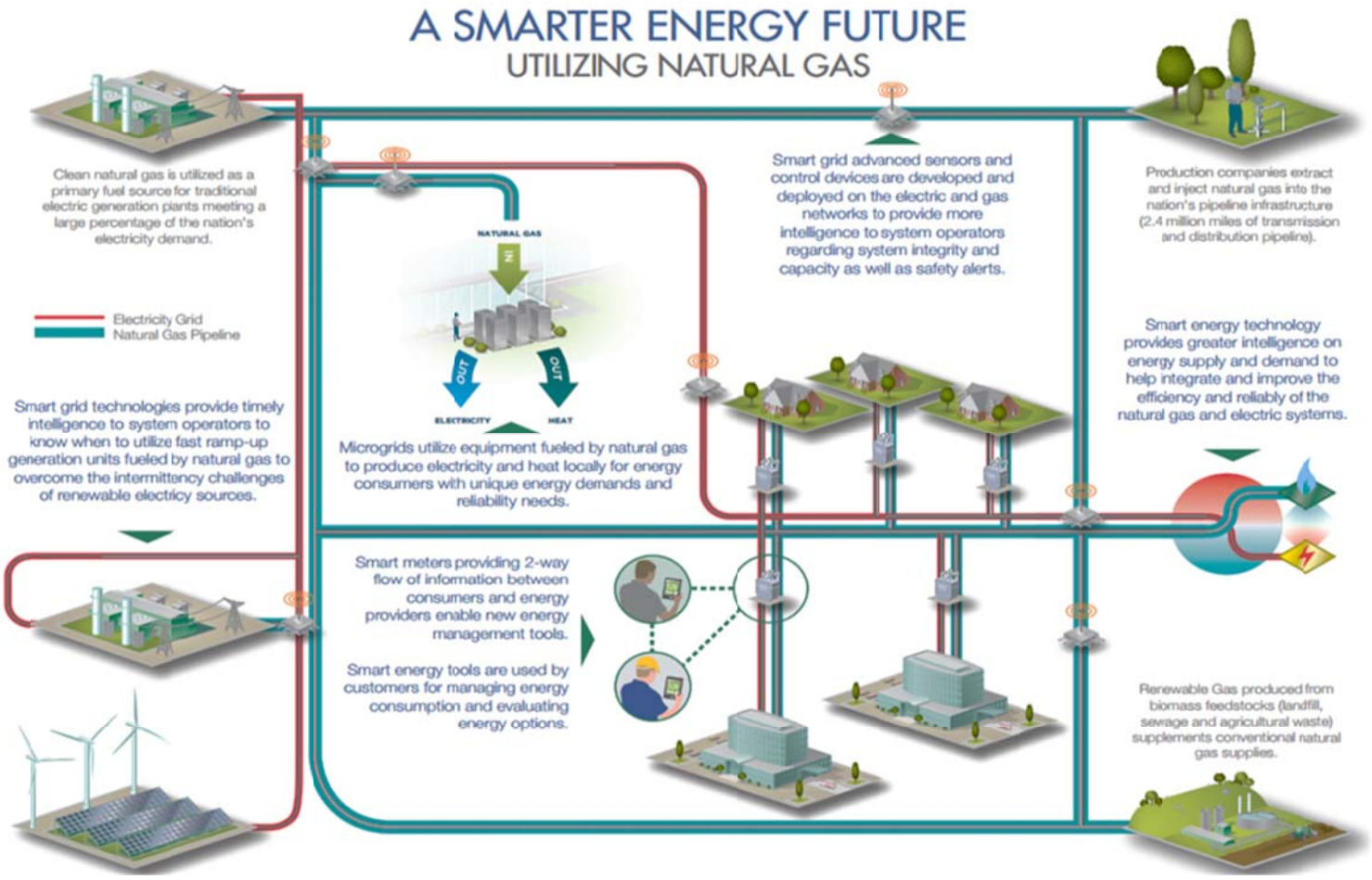
Alignment with New York State Energy Initiatives

REV Objective	**Demonstration Alignment**
Identify Economic Value	The Project will identify broad economic benefits associated with microCHP technology.
Reduction of Carbon Emissions	The Project will test high-efficiency microCHP technology which recovers waste heat thus reducing overall carbon emissions.
Greater Consumer Choice	The Project will demonstrate the feasibility of microCHP in residential and small commercial applications in LI and NYC. MicroCHP can be a clean and efficient way of generating heat and electricity onsite.
System-wide Efficiency	MicroCHP technology supports system-wide efficiency. The technology is associated with reductions in electric transmission and distribution losses. Efficient microCHP uses less fuel than separate conventional boilers and electric generation combined.
Maximize Energy System Reliability and Resiliency	The Project will demonstrate microCHP as a viable option to provide power to the customer during electric supply demand response events and grid outages.

[17] Case 12-G-0297, *Proceeding on Motion of the Commission to Examine Policies Regarding the Expansion of Natural Gas Service*, Order Instituting Proceeding and Establishing Further Procedures (issued November 30, 2012), p. 5, n. 8.
[18] *Id.,* n. 9.

The Natural Gas Distribution Vision

The US natural gas distribution industry has also developed a future vision on smart energy. This vision has been developed by the American Gas Association and the Gas Technology Institute. It is summarized as follows:[19]



[19] *See* https://www.aga.org/sites/default/files/natural_gas_in_a_smart_energy_future_2014.pdf

This vision is remarkably similar to the core REV principles in terms of using information to animate markets for energy efficiency and renewable energy but it also includes the benefits of greater interaction between the natural gas and electricity markets. What it does not include is the need for a new emphasis on safety. The gas industry's vision identifies many advantages in which natural gas, effectively integrated, has the potential to deliver the following:

- Improved safety, energy security, and environmental performance;
- A more efficient infrastructure, with the ability to provide demand response, accommodate emerging technologies, and new sources of supply;
- Improved demand response for electric distribution through switching heating and cooling loads to natural gas and through the use of distributed generation;
- Greater consumer choice resulting in maximum energy value; and
- More optimized energy value from renewable wind and solar through the use of fast ramping dispatchable generation."[20]

"Natural gas infrastructure continues to grow in the U.S., and this growth provides opportunities to support aggressive goals for energy productivity while improving service and options for customers through the use of interactive smart electric and natural gas energy grids."[21] National Grid's Gas REV Demonstration Program is intended to merge the concepts of REV and the industry's vision as it applies to New York State with a new focus on safety and resiliency on both sides of the customer's meter.

.

[20] *Natural Gas in a Smart Energy Future: A strategic resource for electricity and a smart resource for homes and businesses*, Gas Technology Institute ("GTI") and Navigant Consulting, January 2011, GTI-11/0001, p. 1; *available at*: http://www.gastechnology.org/Expertise/Documents/Natural_Gas_in_a_Smart_Energy_Future_02-22-2011_FINAL.pdf

[21] *Natural Gas Infrastructure: Enabling Energy Productivity, Alliance Commission on National Energy Efficiency Policy*, Washington DC, January 2013, p. 13, *available at*: https://www.ase.org/sites/ase.org/files/natural_gas_report_2-5-13.pdf

Potential Suppliers and Products of Interest in Phase One

Yanmar

CP5WN/CP10WN Specs

Model			CP5WN		CP10WN	
			CP5WN-SNB	CP5WN-SPB	CP10WN-SN (B)	CP10WN-SPB
Power	Output	Rated Output	5 kW		10 kW	
		Voltage	240/120 V, 60 Hz (208 V, 277 V)		240/120 V, 60 Hz (208 V, 277 V)	
		Phases/Wires	Single phase, 3 wire		Single phase, 3 wire	
		Modulation	*0.3 to 5 kW with optional CT/Transducer kit (*1)*		*0.3 to 10 kW with optional CT/Transducer kit (*1)*	
Fuel	Gas type		Natural gas	Propane gas	Natural gas	Propane gas
	Pressure	Standard	8 in WC (2 kPa)	11 in W/C (2.8 kPa)	8 in WC (2 kPa)	11 in WC (2.8 kPa)
		Range	4 - 10 in WC (1 - 2.5 kPa)	8 - 13 in W/C (2 - 3.3 kPa)	4 - 10 in WC (1 - 2.5 kPa)	8 - 13 in WC (2 - 3.3 kPa)
	Consumption (LHV)		60,700 BTU (17.8 kW)		107,500 BTU (31.5 kW)	112,800 BTU (33.1 kW)
			0.61 therms/hr	0.72 Gallon (*3)	1.08 therms/hr	1.34 Gallon (*3)
	Consumption (HHV) (*3, *4)		67,300 BTU (19.7 kW)	66,000 BTU (19.3 kW)	119,100 BTU (34.9 kW)	122,800 BTU (36.0 kW)
			0.67 therms/hr	0.72 Gallon (*3)	1.19 therms/hr	1.34 Gallon (*3)
Heat output	Rated recovered heat		34,100 BTU/h (10 kW)		57,300 BTU/h (16.8 kW)	65,200 BTU/h (19.1 kW)
	Rated hot water temp.	Inlet	140°F (60°C)		149°F (65°C)	
		Outlet	149°F (65°C)		158°F (70°C)	
	Rated Hot water flow rate		7.3 GPM (27.6 L/min)		12.7 GPM (48.2 L/min)	
	Maximum hot water temp. (Outlet)		163°F (73°C)		172°F (78°C)	
Input power	Voltage, Frequency		240V, 60Hz		240 V, 60 Hz	
	Starting current		12.5 A		21.7 A	
	Power consumption	Radiator fan stop	0.23 kW		0.39 kW	
		Radiator fan run	0.33 kW		0.71 kW	
Gross Efficiency (LHV)	Overall efficiency		84%		85%	88%
	Electrical generation efficiency		28%		31.5%	30%
	Exhaust heat recovery ratio		56%		53.5%	58%
Sound level	Radiator fan stopped		51 dB (A)		54 dB (A)	
	Radiator fan operating		54 dB (A)		56 dB (A)	
Dimensions	Width		43.3 in (1,000 mm)		57.9 in (1,470 mm)	
	Depth		19.7 in (500 mm)		31.5 in (800 mm)	
	Height		59.1 in (1,500 mm)		70.5 in (1,790 mm)	
	Net weight		882 lb (400 kg)		1,653 lb (750 kg)	1,664 lb (755 kg)
Maintenance Interval			10,000 hrs		10,000 hrs	
Standard Warranty			2 Years; Unlimited Hours		2 Years; Unlimited Hours	
YES Product Protection	5 Years / 30,000 hrs		Optional		Optional	
	10 Years / 60,000 hrs		Optional		Optional	
	15 Years / 90,000 hrs		Optional		Optional	
Emissions & Certifications			EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified (*2)		EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified (*2)	

*1: The minimum modulation amount is dependant on the CT and Transducer specifications.
*2: External inverter models
*3: Propane gas calculations for fuel consumption are based on converting LHV to HHV: LHV=84,250 BTU/Gallon, HHV=91,420 BTU/Gallon
*4: Natural gas calculations for fuel consumption are based on converting LHV to HHV: LHV= 983 BTU/scf, HHV = 1,089 BTU/scf

YANMAR ENERGY SYSTEMS CATALOG 2016

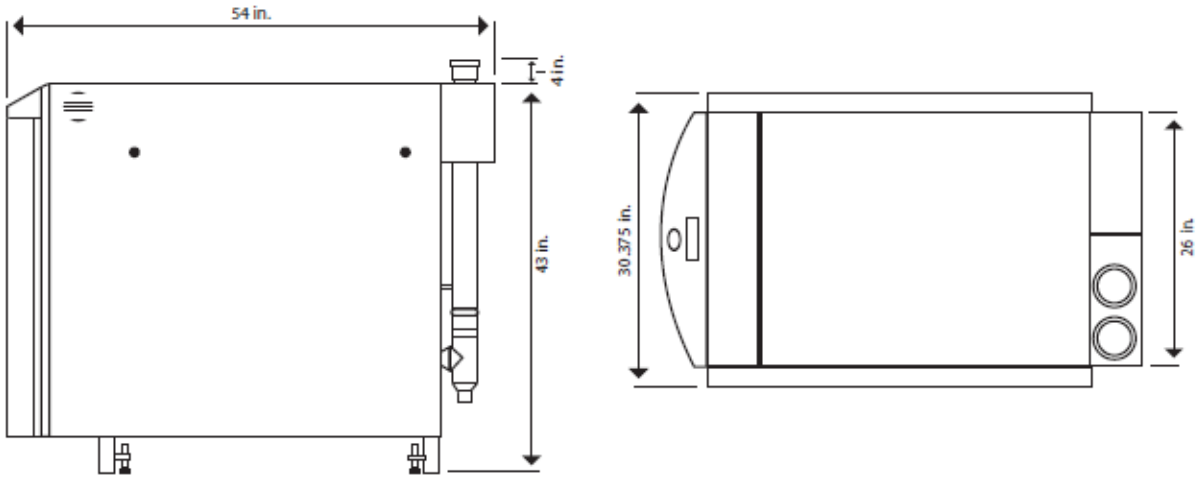
9

nationalgrid

Marathon

ecopower

4.4 kW microCHP



SYSTEM SPECIFICATIONS

ecopower microCHP Specifications	
Operating Voltage (single phase)	240 VAC / 208 VAC (207 - 253V)
Frequency	60 Hz
Dimensions (L x W x H)	54" x 30.375" x 43"
Power Factor	0.98 - 1
Exhaust Gas Temperature	< 180° F
Certified Test Data	
Electrical Output Range	1.2 - 4.4 kW
Thermal Output Range	13,000 - 47,000 BTU/hr
Gas Consumption Range	NG 0.21 - 0.65 therms/hr LPG 0.26 - 0.78 gal/hr
Overall Efficiency	93%
Average Sound Level @ 1m	55 dB (A)
Average NOx Emissions	0.005 lb/MWh
Approvals	
UL Standards	UL 1741, UL 2200
CSA Standards	CSA C22.2 No. 14-10, 100-04, 107.1-01
Emissions Compliance	EPA Certified

Intertek

Certified third party results tested in accordance with established EPA, ISO, and ASERTTI laboratory testing protocols. System performance can be affected by atmospheric conditions and energy content of fuel.

Aisin

May.16.2013; February 24, 2017
AISIN Seiki, CO., Ltd.
Energy Engineering Dept.

COREMO specification list

ITEMS				Specifications
Model Number				GECC15B1N
Installation				Outdoor (only)
Dimensions			mm	H1018×W700×D400
Weight			kg	143
Basic specifications	Connections	Fuel Gas		R1/2
		Heating water (In&Out)		R1/2
		Limited height from boiler	m	Upper 1m, Lower 3m
		Drain	mm	φ17
		Elec. Supply		Single-phase 3 wires 101V/202V
	Noise level	Rated & Max. power operation	dB(A) 46	(with 1.5kW power generation and ventilation fan operating)
		Night mode operation	dB(A) 45	(with 1.2kW power generation and ventilation fan operating)
		Silent mode mode	dB(A) 43	(with 0.75kW power generation and ventilation fan operating)
	Ambient Temp.		℃	-25 - 25℃
Power generation	Power output range	Rated operation	kW	0.5 - 1.5
		Night mode operation	kW	0.5 - 1.2
		Silent mode operation	kW	0.5 - 0.75
	Voltage		V	202V
	Current	Rated operation	A	2.5 - 7.5
		Night mode operation	A	2.5 - 6.0
		Silent mode operation	A	2.5 - 3.75
	Power factor			over 0.95
	Frequency		Hz	50/60
Heat recovery	Heat output	Rated operation	kW	3.7kW (at 1.5kW power generation)
		Night mode operation	kW	1.4 - 2.7
		Silent mode operation	kW	1.4 - 2.1
	Rated flow rate		L/min 5	
Efficiency	Elec. Efficiency		% (LHV)	26% (at 1.5kW power generation)
	Total Efficiency		% (LHV)	90% (at 1.5kW power generation)
Power consumption	Water pump (for Coolant)		W	24
	Water pump (for Heating Water)		W	24
	Ventilation fan		W	11
Engine	Type			4 cycle-single cylinder-OHV
	Displacement		cc	245
	Rotational speed at idling		rpm	1300
	Rotational speed at rated operation		rpm	1750
	Gas consumption		kW	5.8(LHV)
Combustion	Fuel			13A (Japanese town gas)
	Gas consumption		kW	5.8 (LHV)
	NOx		ppm	150 (at night operation)
Enclosed parts	Current sensors, Remote controller, wires for current sensor & remote controller			
Gas Pressure	2psi on natural gas or propane			

Aisin will be releasing a new model in 2017.
- The model is slightly smaller and lighter.
- The plate exchanger will change from single to double wall.
- Seamless integration with domestic hot water tank will save approximately $500 in balance of plant cost
- The new model can be installed indoor or outdoor.

Dimensions

COREMO

General Specifications

Operating Mode 4 kW 5 Ton System	Gas Heat Pump (GHP)			Gas Heat Pump and Continuous Power with UPS (CCHP)			Operating Mode 4 kW 8 Ton System	Gas Heat Pump (GHP)			Gas Heat Pump and Continuous Power with UPS (CCHP)		
Refrigerant 410A	kW	Btu/h	%	kW	Btu/h	%	Refrigerant 410A	kW	Btu/h	%	kW	Btu/h	%
Fuel Consumption	26.9	91,650		29.6	100,914		Fuel Consumption	29.9	102,150		32.6	111,094	
Power DC	-	-	-	3.7	12,474	12.4	Power DC	-	-	-	3.7	12,474	11.2
Power AC	-	-	-	3.4	11,601	11.5	Power AC	-	-	-	3.4	11,601	10.4
Engine Heat Recovery	11.8	40,326	44.0	13.0	44,402	44.0	Engine Heat Recovery	13.2	44,946	44.0	14.3	48,881	44.0
Refrigerant Heat Recovery	22.0	75,000	81.8	22.0	75,000	74.3	Refrigerant Heat Recovery	35.2	120,000	117.5	35.2	120,000	108.0
Cooling	17.6	60,000	65.5	17.6	60,000	59.5	Cooling	28.1	96,000	94.0	28.1	96,000	86.4
Total	**51.4**	**175,326**	**191.3**	**56.2**	**191,876**	**190.1**	Total	**76.5**	**260,946**	**255.5**	**81.3**	**277,355**	**249.7**

Operating Mode 6 kW 5 Ton System	Gas Heat Pump (GHP)			Gas Heat Pump and Continuous Power with UPS (CCHP)			Operating Mode 6 kW 8 Ton System	Gas Heat Pump (GHP)			Gas Heat Pump and Continuous Power with UPS (CCHP)		
Refrigerant 410A	kW	Btu/h	%	kW	Btu/h	%	Refrigerant 410A	kW	Btu/h	%	kW	Btu/h	%
Fuel Consumption	26.9	91,650		37.9	129,313		Fuel Consumption	29.9	102,150		40.9	139,493	
Power DC	-	-	-	7.7	26,246	20.3	Power DC	-	-	-	7.7	26,246	18.8
Power AC	-	-	-	6.0	20,472	18.9	Power AC	-	-	-	6.0	20,472	17.5
Engine Heat Recovery	11.8	40,326	44.0	16.7	56,898	44.0	Engine Heat Recovery	13.2	44,946	44.0	18.0	61,377	44.0
Refrigerant Heat Recovery	22.0	75,000	81.8	22.0	75,000	58.0	Refrigerant Heat Recovery	35.2	120,000	117.5	35.2	120,000	86.0
Cooling	17.6	60,000	65.5	17.6	60,000	46.4	Cooling	28.1	96,000	94.0	28.1	96,000	68.8
Total	**51.4**	**175,326**	**191.3**	**63.9**	**218,144**	**168.7**	Total	**76.5**	**260,946**	**255.5**	**89.0**	**303,623**	**217.7**

The following apply to all models

Inlet Hot water temperature	120 to 160 °F
Outlet Hot water temperature (optional)	140 to 180 °F
Hot water flow rage	2 to 4 gal/min

AC Output

Output power (continuous) at 25 °C (77 °F)	4000/6000 W
Overload 30 min / 60 sec at 25 °C (77 °F)	8500 W / 12000 W
Output power (continuous) at 40 °C (104 °F)	4000/6000 W
Output frequency (selectable)	50 / 60 Hz
Output voltage	L-N: 120 V +/- 3%; L-L 240 V +/- 3%
Total harmonic distortion (THD) at rated power	<5%
Idle consumption search mode	<8 W
Power factor corrected	0.98
Compatible battery types	Gel, AGM, LiON
Battery bank range	100 – 1000 Ah

The PowerAire system is designed to not exceed the noise level of a conventional outdoor HVAC condenser

General Specifications

AC Input

AC 1 (grid) input current (selectable limit)	3 – 60 A (60 A default)
AC 2 (generator) input current (selectable limit)	3 – 60 A (60 A default)
Automatic transfer relay rating / typical transfer time	60 A / 8 ms
AC input voltage limits (bypass / charge mode)	L-N: 78 - 140 V (120 V nominal); L-L 160 – 270 V (240 V nominal)
AC input frequency range (bypass / charge mode)	55 – 65 Hz (default); 52 – 68 Hz (allowable)

Weights & Dimensions

Dimensions (LxWxH)	60"x30"x70" (1.52 x 0.76 x 1.77m)
Weight	Approx. 1500 lbs. (680 Kg)

Features

System monitoring and network communications available

Intelligent features Grid sell, peak load shaving, additional generator support, prioritized consumption of battery or external DC energy, HVAC cool and heat monitoring, off-grid AC coupling, frequency Control

Multi-unit operation

single and Split Phase: up to 4 units in parallel.
Three Phase: up to 12 units in multi-cluster configuration with external AC contractor

Regulatory approval - Entire Unit Safety Conformance

ETL Listed	Intertek 5000729
ANSI STD	Z21.40.2 R(2002)
ULSTD	1995
ULSTD	2200
CSA STD	C22.2 No. 100
CSA STD	C22.2 No. 236
CGA STD	2.17
CGA STD	2.92 R(2002)

Inverter Conforms to:

UL1741, CSA 107.1
EMC directive FCC and Industry Canada Class B
Interconnect IEEE 1547 and CSA 107.1

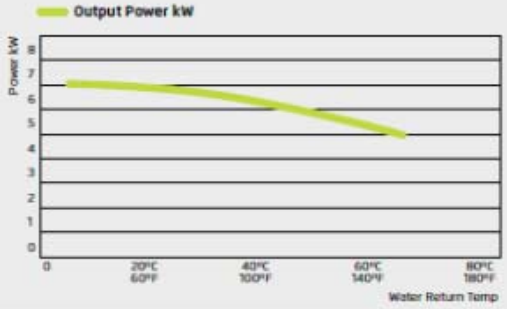
m-trigen
Power Generation Systems Solutions

713 469-5735
10555 W. Little York Rd.
Houston TX 77041
Www.mtrigen.com

Intertek

nationalgrid

ELECTRIC POWER OUTPUT VS. WATER RETURN TEMPERATURE



Qnergy is an energy technology company which develops innovative, cost effective and efficient ways to energize the future. With more than 40 years of expertise and proven reliability, Qnergy brings proprietary, high-performance Stirling engine technology to the marketplace for commercial, industrial and residential applications.

QB80 STIRLING ENGINE

The QB Series Engines are the most powerful of their kind available in the market. Manufactured using proven automotive-style lean processes, this flexible, free-piston Stirling engine is built to perform effectively maintenence free. Its unique frictionless design ensures reliability.

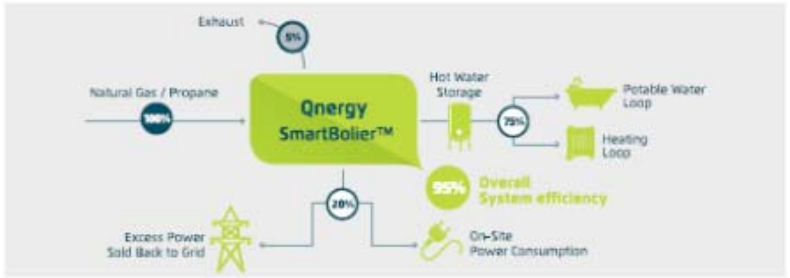
The engine incorporates only 66 parts contributing to its simplicity and longevity. The QB engines are incorporated into products for space and water heating as well as remote power for oil & gas, telecom, and other off-grid applications.

Headquarters & Engineering A. En-Harod Ihud, 18960 Israel
Manufacturing & Engineering A. 300 West 12th Street, Ogden, Utah 84404 USA
www.Qnergy.com

QNERGY SmartBoiler™

Qnergy
Renewable. Reliable. Resilient.

Features	Benefits
Maintenance free generator. Hermetically sealed environment (engine level) - zero maintenance System is designed for boiler-like maintenance cycle	No oil change No bearings No gearbox
High efficiency engine. Up to 95% overall system efficiency	Low emissions and reduced operation costs
Low vibration level (engine is suspended using straps)	Ease of implementation in residential buildings
Flexibility Gas agnostic engine (external combustion) Grid frequency independent (worldwide 50/60 Hz deployment)	Can work on any gas Worldwide deployment
Cascading solution = Modularity	Fast expansion



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The Neighborhood Program Offered by Con Edison

Eligible Neighborhoods Brooklyn: Greenpoint, East Williamsburg, Bushwick, Bedford-Stuyvesant, Crown Heights, East Flatbush, Brownsville, East New York, Cypress Hills. Queens: Richmond Hill, Howard Beach, Broad Channel, Ozone Park, South Ozone Park, Woodhaven, Kew Gardens

Con Edison Electric Constrained Networks[22]

Borough : QN. Network: Richmond Hill				
Segments	Account Counts	Annualized Consumption	High Demand 1 Year**	Max kVA
Education	90	24,433,651	10,430	11,989
Entertainment	27	4,436,601	1,956	2,248
Grocery	219	19,501,751	4,954	5,694
Hospital	7	688,840	231	265
Industrial	214	15,031,384	5,515	6,339
Lodging	4	965,346	407	467
Miscellaneous	2,086	109,364,669	34,341	39,473
Multi Family >=5	12,080	54,492,011	20,956	24,088
Multi Family 1-4	64,919	358,545,652	131,781	151,473
Nursing Home and Community Care	61	13,429,223	3,893	4,475
Office	5,647	83,267,366	34,658	39,837
Restaurant	371	25,882,170	8,674	9,970
Retail	1,169	41,614,241	17,744	20,395
Warehouse	49	1,183,872	690	793
Total	**86,943**	**752,836,776**	**276,231**	**317,507**

Borough: BK. Network: Richmond Hill				
Segments	Account Counts	Annualized Consumption	High Demand 1 Year**	Max kVA
Education	55	19,577,362	8,327	9,572
Entertainment	47	4,073,261	1,461	1,680
Grocery	193	17,233,273	4,456	5,122
Hospital	6	1,175,531	365	420
Industrial	158	10,952,850	5,378	6,181
Lodging	7	1,375,857	505	581
Miscellaneous	1,015	74,052,231	20,423	23,474
Multi Family >=5	8,006	90,044,322	24,849	28,562
Multi Family 1-4	29,892	156,076,563	55,856	64,202
Nursing Home and Community Care	86	22,548,751	7,313	8,406
Office	4,651	80,164,409	29,781	34,231
Restaurant	218	18,385,501	5,581	6,415
Retail	793	47,925,569	16,953	19,486
Warehouse	54	2,799,550	1,409	1,620
Total	**45,181**	**546,385,030**	**182,658**	**209,951**

[22] *See* https://conedbqdmauction.com/documents/

**High Demand at customer specific peak, not tied to network peak time

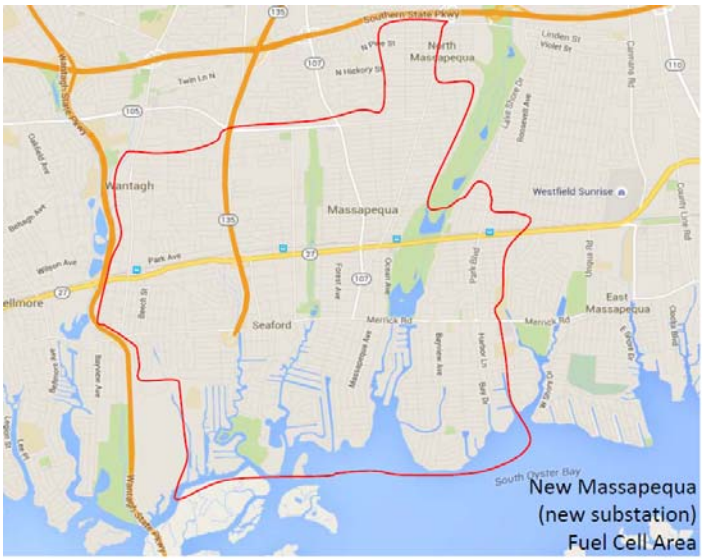
Borough: BK. Network: Crown Heights				
Segments	Account Counts	Annualized Consumption	High Demand 1 Year**	Max kVA
Education	145	37,459,380	14,700	16,897
Entertainment	26	2,265,271	741	851
Grocery	280	27,296,287	7,199	8,275
Hospital	45	111,026,339	22,231	25,553
Industrial	286	13,943,767	5,198	5,975
Lodging	9	1,848,483	594	682
Miscellaneous	1,770	40,791,827	17,416	20,018
Multi Family >=5	33,614	223,482,090	67,728	77,848
Multi Family 1-4	39,890	198,057,112	72,410	83,230
Nursing Home and Community Care	262	21,918,494	6,741	7,748
Office	7,801	178,936,103	59,555	68,454
Restaurant	312	18,445,732	5,579	6,412
Retail	1,251	60,328,483	25,484	29,292
Warehouse	34	1,189,103	667	767
Total	**85,725**	**936,988,471**	**306,243**	**352,003**

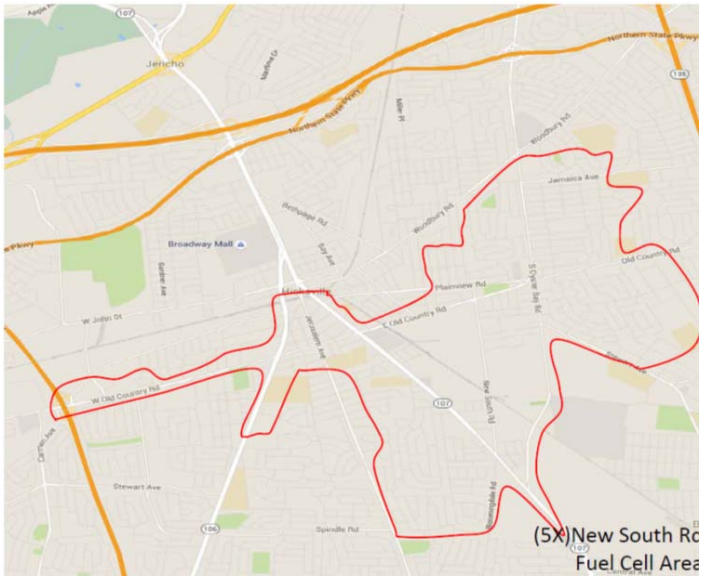
Borough: BK. Network: Ridgewood				
Segments	Account Counts	Annualized Consumption	High Demand 1 Year**	Max kVA
Education	94	30,175,651	11,846	13,617
Entertainment	31	1,822,096	673	773
Grocery	384	31,368,383	8,679	9,976
Hospital	17	31,381,210	6,501	7,473
Industrial	388	32,400,833	14,353	16,498
Lodging	5	124,772	54	62
Miscellaneous	2,557	65,750,136	29,166	33,524
Multi Family >=5	31,681	180,610,043	58,052	66,726
Multi Family 1-4	40,459	184,524,979	68,796	79,076
Nursing Home and Community Care	181	17,662,077	6,728	7,733
Office	11,299	225,577,160	76,101	87,472
Restaurant	420	26,086,622	8,399	9,654
Retail	1,441	85,518,962	37,933	43,601
Warehouse	177	7,907,666	3,653	4,199
Total	**89,134**	**920,910,590**	**330,934**	**380,384**

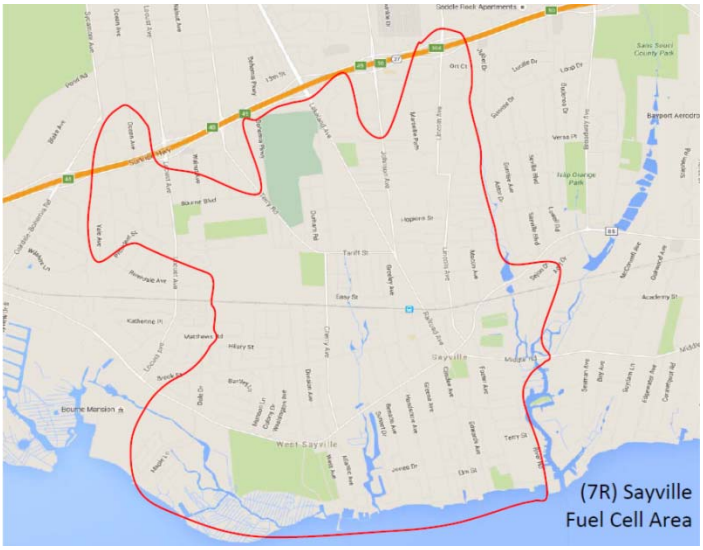
**High Demand at customer specific peak, not tied to network peak time

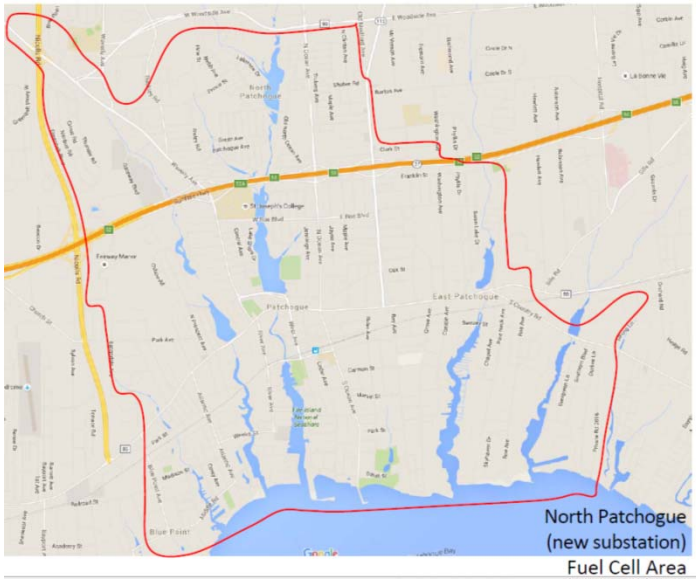
nationalgrid

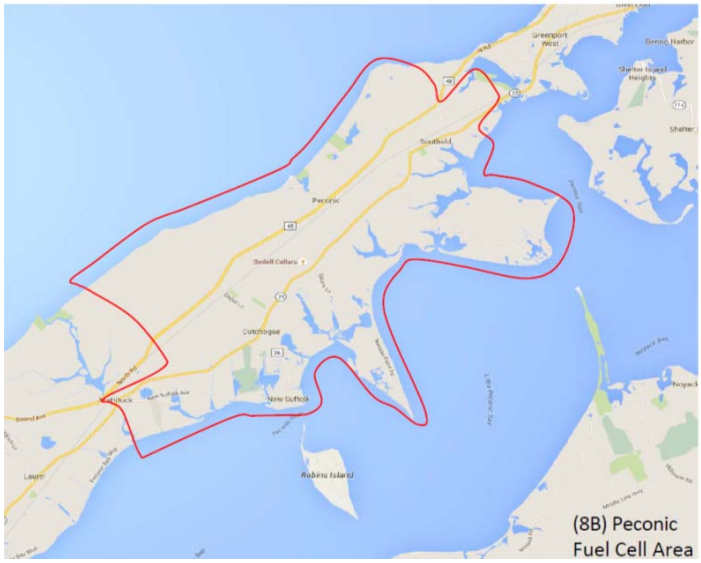
Beneficial Areas for Fuels Cells Provided by PSEG-LI



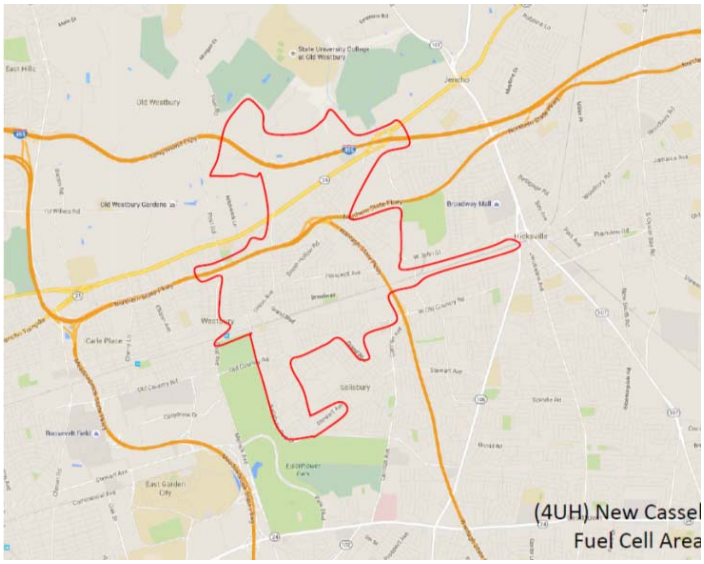


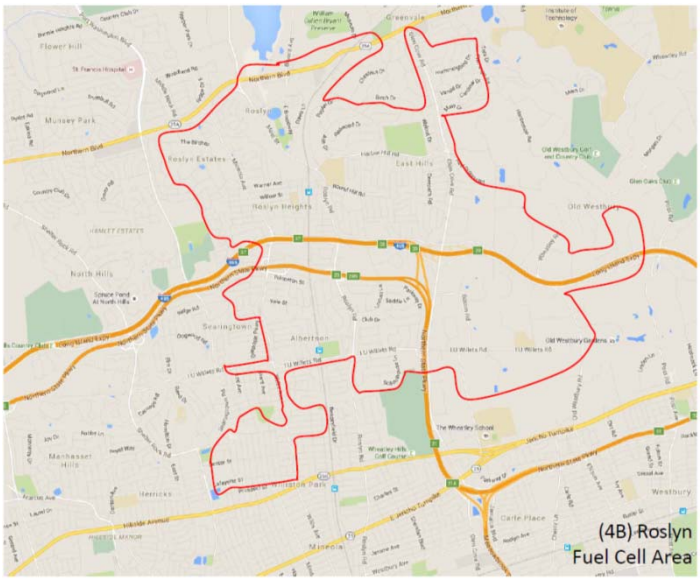





(8B) Peconic
Fuel Cell Area


(9A) Riverhead
Fuel Cell Area


(4UH) New Cassel
Fuel Cell Area


(4B) Roslyn
Fuel Cell Area

nationalgrid

Micro-CHP REV Demonstration
Sealed Proposal

Prepared for: National Grid

Prepared by: Sealed Inc.

May 10, 2017

Sealed Inc. ("Sealed") proposes to work with National Grid to demonstrate the efficacy of Combined Heat and Power technology in residential buildings ("Micro-CHP"). In support of the Micro-CHP Demonstration, Sealed will provide the following services:

- Provide the contractual framework for customers to pay with their energy bill savings
- Consult with National Grid and technology partners on pricing tests to determine the best price point (upfront cost, shared savings, etc.) for the Micro-CHP technology
- Provide all billing services and collection related to customers paying with their energy bill savings
- Provide training to National Grid and technology partners that engage with customers on Sealed's HomeAdvance program that allows customers to pay with their energy savings
- Provide marketing materials on HomeAdvance to National Grid and technology partners
- Enroll customers on the Sealed platform, including walking them through all HomeAdvance program requirements (ACH billing, etc.)
- Work with National Grid and technology partners to design any customer surveys
- Collect and analyze data on the energy savings performance of the Micro-CHP systems

Sealed and National Grid will share in the energy bills savings produced by the Micro-CHP systems. Specifically, Sealed will split any non-customer savings with National Grid on a 50/50 basis.

In order to execute the Demonstration, Sealed will leverage its existing technology. Sealed will calculate baseline energy usage leveraging our patent-pending energy analytics. Actual energy usage will then be compared to this baseline to determine

energy savings. Sealed will then bill the customer based on these energy savings using proprietary energy bill software.

Sealed will also leverage its existing HomeAdvance financing product and invest in other efficiency improvements via a warehouse line of credit with the New York Green Bank. Where customers have the opportunity to reduce their energy usage by adding insulation, sealing air leaks, installing more efficient lighting and other efficiency technologies, Sealed will invest in and manage the installation of these improvements as well.

Sealed's ultimate goal is to finance 100% of the Micro-CHP systems through a combination of customer bill savings and monetization of grid benefits. By demonstrating the deployment of systems, the actual system costs and savings will be determined, enabling an analysis of what (if any) improvements in technology, cost, financing terms, and/or subsidy are required for scalable.

By leveraging private capital and monetizing the grid benefits of Micro-CHP, National Grid and Sealed can demonstrate the efficacy and scalability of an exciting new technology that has the potential to significantly reduce residential energy usage and emission.