PROCEEDING ON MOTION OF THE COMMISSION AS TO THE RATES, CHARGES, RULES AND REGULATIONS OF THE BROOKLYN UNION GAS COMPANY FOR GAS SERVICE

PROCEEDING ON MOTION OF THE COMMISSION AS TO THE RATES, CHARGES, RULES AND REGULATIONS OF KEYSPAN GAS EAST CORPORATION FOR GAS SERVICE

Testimony and Exhibits of:
Simi Rose George

May 20, 2016

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Before the Public Service Commission

THE BROOKLYN UNION GAS COMPANY d/b/a NATIONAL GRID NY and KEYSPAN GAS EAST CORPORATION d/b/a NATIONAL GRID

Direct Testimony

of

Simi Rose George

May 20, 2016

I. INTRODUCTION & QUALIFICATIONS

Q. Please state your name, title, and business address. By whom are you employed and in what capacity?

A. My name is Simi Rose George. I am Manager, Natural Gas Distribution Regulation, in the U.S. Climate and Energy Program at Environmental Defense Fund ("EDF"). My business address is 123 Mission Street, San Francisco, California, 94105.

Q. On whose behalf are you submitting testimony in this proceeding?

A. I am submitting this testimony on behalf of EDF.

Q. Please provide a summary of your education and experience.

A. I hold a master's degree in Public Administration/International Development from the John F. Kennedy School of Government, Harvard University, and a law degree from the National Law School of India University. I have been employed at EDF since 2014. At EDF, I manage several initiatives demonstrating the benefits of, and creating pathways for the adoption of, new and beneficial technologies providing data and analytics for the purpose of enhancing the design and implementation of gas distribution system modernization efforts. Prior to joining EDF, I worked with the London offices of two international law firms, Linklaters LLP and Clifford Chance LLP. At both firms, I advised multinational clients on cross-border investments and other projects, with an emphasis on the energy and infrastructure sectors. My resume is included as Exhibit 1.

II. SUMMARY, PURPOSE & SCOPE OF TESTIMONY

Q. Please provide a summary of your testimony.

A. The system modernization and maintenance efforts proposed by The Brooklyn Union Gas Company d/b/a National Grid NY ("KEDNY") and KeySpan Gas East Corporation d/b/a National Grid ("KEDLI") (together, "National Grid" or "the Companies") in order to enhance the reliability and integrity of their distribution systems are necessary and appropriate.

Sophisticated technologies allowing for the collection of previously unavailable data on utility asset conditions have emerged. Gas utilities such as KEDLI and KEDNY now have the opportunity to enhance the capital efficiency of their system modernization and maintenance efforts by leveraging such data and analytics. Specifically, the design and implementation of the Companies' pipe replacement and leak repair programs can be advanced using newly available, spatially attributed leak flow rate data gathered through advanced leak detection and leak quantification methods. National Grid and EDF are collaborating on a suite of pilot projects in CY 2016 and beyond demonstrating the potential to enhance the Companies' leak repair and pipe replacement efforts using such data.

Among other things, a new leak survey methodology incorporating the use of advanced mobile leak detection and leak quantification being piloted by EDF will provide National Grid with detailed information on the relative leakiness of its mains and advance the Companies' efforts to implement their leak repair and pipe replacement programs as effectively as possible. EDF and National Grid are also collaborating to more accurately quantify the methane emissions reduction impacts associated with new technologies pioneered by National Grid (e.g., Cast Iron Joint Sealing Robot ("CISBOT")) in order to derive a more accurate understanding of their benefits.

From a longer term perspective, EDF and National Grid will collaboratively explore the scope to build on and enhance the Companies' existing hazard ranking algorithm using leak flow rate data. These efforts seek to enhance the foundational basis of National Grid's system modernization and maintenance efforts.

It is anticipated that these pilot projects will create pathways for the integration of the underlying advanced leak detection and quantification methods into regular utility operations, and thereby help optimize ratepayer, environmental and system-wide outcomes.

The consideration of spatially attributed leak flow rate data has broader benefits extending to the regulatory assessment of the need for, and design of, such projects. This

Commission and its counterparts across the country are called on to balance customer costs and interests with the need for pipe replacement and leak abatement. The absence of granular information on asset conditions, particularly the relative leakiness of underground mains, complicates the tasks of assessing the extent of need and overseeing programs once approved. As explained in further detail below, commercially available advanced leak detection and quantification methods provide data and perspective around underground infrastructure conditions, leakiness, program need and program design, and can serve as tools for this Commission and other regulatory entities to better balance need with cost.

Q. Are you providing any appendices or attachments to your testimony?

A. Yes, I have the following exhibits.

Exhibit 1: Resume of Simi Rose George

Exhibit 2: Sample leak map reflecting spatially attributed leak flow rate data

Q. What is the purpose and scope of your testimony?

A. The purpose of my testimony is to comment on the Companies' proposed accelerated pipe replacement, enhanced leak surveillance and leak repair efforts, and the potential benefits to customers, and the environment associated with the use of new technological solutions (including advanced leak detection and leak quantification methods) in designing and implementing leak repair and pipe replacement activities. My testimony also discusses the broader benefits of using data gathered using these new methodologies from a regulatory perspective, i.e., to assess the extent to which pipe replacement and/or leak repair efforts are needed, achieve the optimal balance between ratepayer interests and the need for system modernization efforts, and improve utility project implementation. In this vein, I outline a suite of projects that National Grid and EDF have agreed to collaborate on, in order to advance the use of new technologies to better execute National Grid's system modernization and maintenance efforts.

III. THE COMPANIES' PROPOSED ACCELERATED PIPE REPLACEMENT AND LEAK REPAIR EFFORTS

Q. Please summarize your understanding of the Companies' proposed Pipeline Integrity and Reliability Programs, and other proposed initiatives to minimize leaks and improve system integrity and reliability.

A. The Companies propose a Gas Safety and Reliability Surcharge to accelerate their leak prone pipe ("LPP") replacement efforts. Both Companies propose to significantly increase their rate of removal of LPP in the Rate Year and Data Years. It is proposed that KEDNY will replace at least 50 miles per year and KEDLI will replace at least 115 miles per year.[1] For KEDNY, this represents a 100 percent increase over its 2012 target, and for KEDLI, its new pipe replacement target represents a 130 percent increase over its 2014 target.[2] In addition, National Grid proposes an incentive mechanism to fund increases in LPP replacement going beyond the proposed annual baseline targets by more than five and 20 miles respectively.[3] National Grid notes that if these incentive targets are achieved, the Companies would eliminate all LPP on their systems within 20 years.[4]

In addition, over a three-year period starting with the Rate Year, the Companies propose to reduce their backlog of non-hazardous leaks annually by an average of 100 and 500 leaks, respectively, with a view to enhancing system performance and reducing methane emissions, thereby benefiting ratepayers, the environment and the system as a whole.[5] National Grid proposes to use the Gas Reliability and Safety Surcharge to fund the repair of leaks beyond the above baseline targets based on their respective average leak repair costs, subject to a total cap of 50 additional leaks per year.[6] Further, the Companies are proposing additional leak surveillance

[1] Testimony of the Gas Infrastructure & Operations Panel, Book 4 – KEDLI, at p. 17.
[2] *Ibid*, at p. 28.
[3] Testimony of Kenneth D. Daly, Book 1, at p. 40.
[4] *Id.*
[5] Testimony of the Gas Safety Panel, Book 6, at p. 46.
[6] *Ibid*, at p. 50.

activities, and targets for reducing their hazardous leaks, keeping in mind the greater safety risks associated with these leaks.[7]

Recognizing that system modernization needs must be balanced with ratepayer interests, National Grid proposes to utilize technology that will extend the life of LPP until they can be replaced. These technologies include CISBOT, a robot which seals joints in large diameter leak prone mains at lower cost than traditional joint sealing, and cured in place ("CIP") lining, which can increase the longevity of LPP until it is replaced.[8]

Q. WHAT IS YOUR ASSESSMENT OF THE LEAK-PRONENESS OF NATIONAL GRID'S DISTRIBUTION SYSTEM?

A. The Companies operate systems with relatively high levels of LPP - nearly half of the mains on both systems are leak-prone.[9] Cast iron and unprotected steel, which constitute a significant proportion of the LPP on both companies' systems, are known to be "high-risk" pipe.[10] In view of these risks, PHMSA introduced requirements in the early 1970s requiring buried or submerged steel pipeline to be protected against external corrosion. Because these requirements do not apply to pipelines installed pre-1971, they continue to corrode and must therefore be replaced.[11]

The positive correlation between aging, corrosion-prone gas infrastructure and leak rate, identified in EDF's analysis of data gathered through its survey of leaks on utility systems across the country, which is described in Dr. Joseph von Fischer's testimony, is reflected in the Companies' distribution systems. For instance, the current leak rate for all distribution pipes on KEDLI's system is 0.13 leaks per mile, whereas the corresponding figure for LPP is more than

[7] Testimony of the Gas Safety Panel, Book 6, at p. 46.
[8] Testimony of the Gas Infrastructure and Operations Panel, Book 4 – KEDLI, at p. 32.
[9] *Ibid*, at p. 20.
[10] For instance, PHMSA has recognized the heightened risk of failure associated with cast iron pipelines, on account of the degrading nature of iron alloys, age of such pipelines and pipe joint design. Relative to unprotected steel, cast iron is more susceptible to main breaks leading to the leakage of large volumes of gas, whereas unprotected steel is more likely to develop slow leaks that can be detected over time. See generally Pennsylvania PUC Staff Report, "Inquiry into Philadelphia Gas Works' Pipeline Replacement Program", April 21, 2015, ("PUC Staff Report"), available at http://www.puc.pa.gov/NaturalGas/pdf/PGW_Staff_Report_042115.pdf, at p. 15-16.
[11] *Id.*

double that figure, at 0.28 leaks per mile.[12] Further, KEDLI has observed a recent upward trend in the LPP leak rate as these facilities continue to age and deteriorate.[13] Thus, the challenges associated with LPP are becoming more pressing as the Companies' distribution systems continue to age. This is not only a public safety issue, as recognized by the Companies,[14] but also an important economic issue, given the large volumes of natural gas being released into the atmosphere, the costs of which are borne by ratepayers. Additionally, this is an environmental challenge because methane, the primary constituent of natural gas, is a potent greenhouse gas, more than 84 times more potent than carbon dioxide over a 20-year timeframe.

Q. PLEASE COMMENT ON THE COMPANIES' PIPELINE REPLACEMENT EFFORTS.

A. Through their proposed accelerated replacement efforts, the Companies expect to eliminate all LPP on their systems in 20 years.[15] Along with Pennsylvania, New York has the highest percentage of highly leak-prone mains (i.e., cast iron and unprotected steel) on its distribution system. In all, the state as a whole has over 11,000 miles of such mains, second only to Pennsylvania by a small margin.[16]

The Companies' proposed accelerated pipe replacement efforts are necessary and appropriate. These efforts not only advance the Commission's stated goal of replacing all LPP in New York in the next 20 years[17], but are also consistent with the stand adopted by key federal agencies on the issue of aging natural gas pipeline infrastructure. For instance, in 2011, the U.S. Department of Transportation ("DOT") and the Pipeline and Hazardous Materials Safety Administration ("PHMSA") jointly issued a Call to Action to accelerate the repair and

[12] Testimony of the Gas Infrastructure and Operations Panel, Book 4 – KEDLI, at p. 22
[13] *Id.*
[14] Testimony of Kenneth D. Daly, Book 1, at p. 40.
[15] *Ibid*, at p. 44.
[16] Department of Energy, "Quadrennial Energy Review: Energy Transmission, Storage, And Distribution Infrastructure", April 2015, "QER", at p. 2-21, available at http://energy.gov/epsa/downloads/quadrennial-energy-review-full-report,
[17] Case 15-G-0151.

replacement of cast iron and bare steel pipelines. According to PHMSA, 16 states have completely eliminated cast or wrought iron natural gas distribution lines within their borders.[18]

There are significant public safety, ratepayer and environmental benefits to be gained from thoughtfully designed, economically efficient, and well-executed pipeline replacement projects. These benefits are widely recognized by key stakeholders. For example, as noted by the U.S. Department of Energy in the Quadrennial Energy Review ("QER") released in August 2015, the replacement of leak-prone pipelines enhances safety by reducing the risk of main breaks and pipe failure, and reduces harmful methane emissions.[19] Additionally, as the costs of leaked gas are borne by ratepayers, pipeline replacement programs advance ratepayers' interests by reducing the amount of natural gas leaked into the atmosphere and reducing future leak maintenance and repair costs.

IV. DESIGN AND IMPLEMENTATION OF THE COMPANIES' PIPE REPLACEMENT AND LEAK REPAIR EFFORTS

Q. Please explain relevant aspects of the prevailing utility and regulatory context as it relates to the use of advanced leak detection technology and leak quantification methods by utilities.

A. ***Utility context:*** Since the 2011 PHMSA/DOT Call to Action to accelerate the repair, rehabilitation, and replacement of the highest-risk pipeline infrastructure, sophisticated technologies allowing for the collection of previously unavailable data on utility asset conditions have emerged. Utilities can employ such data to supplement existing information on asset risks, and thereby design and target system modernization and maintenance efforts more effectively. As discussed in further detail below, utilities are beginning to leverage such data and analytics to enhance system integrity and capital efficiency.

[18] These states are: Alaska, Arizona, Hawaii, Idaho, Montana, North Carolina, North Dakota, New Mexico, Nevada, Oklahoma, Oregon, South Carolina, Utah, Vermont, Wisconsin and Wyoming. See generally, PUC Staff Report, at p. 33.
[19] QER, *supra*, at p. 2-18.

Gas utilities are beginning to move beyond regulatory compliance towards proactive asset risk and integrity management in response to a number of factors, including regulatory advancements, and an increased focus on pipeline safety.[20]

Advanced leak detection and quantification methods have significant ratepayer, environmental and system-wide benefits. In order to demonstrate these benefits and create pathways for the adoption of such advanced technologies by utilities, EDF has engaged with a number of major utilities including Public Service Gas and Electric ("PSE&G"), New Jersey's oldest and largest utility as well as Consolidated Edison ("Con Edison") and National Grid in New York, as described in further detail below.

Broadly speaking, utilities are not yet routinely using leak flow rate (i.e. the volume of methane emissions released from a given leak over time) to prioritize their leak abatement or pipeline replacement activities but several are beginning to explore the use of leak quantification methods. Following its 2013 rate case, Con Edison and other rate case participants, including state and city agencies as well as EDF and other NGOs formed a collaborative to consider methane leak reduction opportunities. This collaborative has since developed a project to test leak quantification methods, with the objective of identifying a method for the quantification of leaks on Con Edison's system to facilitate the prioritization of such leaks for repair using leak flow rate, in conjunction with other factors. NYSEARCH, a research, development and demonstration organization serving gas utility member companies, and other utilities, including National Grid, have since joined the effort. As part of this initiative, EDF and Con Edison recently entered into a collaborative pilot project to quantify gas leaked from Con Edison's Type 3 leak backlog and develop a prioritization scheme for the repair of those leaks.[21] Similarly, in California, Pacific

[20] PricewaterhouseCoopers, "A new view on pipeline risks: How spatial analytics can empower asset management for gas utility companies", April 2016, available at https://www.pwc.com/us/en/power-and-utilities/publications/assets/pwc_gas_pipeline_spatial_analytics_april_2016.pdf.
[21] http://www.coned.com/newsroom/news/pr20141217.asp

Gas & Electric Co. ("PG&E") is exploring the integration of leak quantification technology into its leak management efforts.[22]

Similar to other major utilities, the Companies use a risk ranking algorithm to prioritize LPP replacement. This algorithm calculates a relative risk score for each LPP segment using various factors – this score along with an assessment of other factors and risks is the basis on which the Companies prioritize LPP replacement.[23]

Regulatory/Policy context: Under federal rules establishing integrity management requirements for gas distribution pipeline systems (the "Distribution Integrity Management Program for Natural Gas Distribution Sector" or "DIMP"), operators are required to develop and implement a distribution integrity management program. While the rules do not explicitly require utilities to quantify leaks, they state that (a) pipeline operators must consider all reasonably available information to identify threats to pipeline integrity and (b) the number and severity of leaks can be important information in evaluating the risk posed by a pipeline in a given location. Under the rules, operators are required to consider the following categories of threats to each gas distribution pipeline: corrosion, natural forces, excavation damage, other outside force damage, material or welds, equipment failure, incorrect operations, and other concerns that could threaten the integrity of its pipeline. Sources of data may include, but importantly, are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.

With technology evolving to make leak quantification methods commercially available and viable, and PHMSA rules requiring operators to consider all relevant data points in identifying threats to pipeline integrity, it is clear that the prevailing regulatory framework not

[22] See generally http://www.pge.com/en/about/newsroom/newsdetails/index.page?title=20150126_pge_launches_next_phase_of_its_industry-leading_gas_leak_management_strategy, and http://www.pge.com/about/newsroom/newsreleases/20121101/pgampes_use_of_picarro_technology_enhances_natural_gas_system_safety_throughout_pgampe_service_area.shtml.
[23] Testimony of the Gas Infrastructure & Operations Panel, Book 4 – KEDLI, at p. 55.

only allows for newly available data such as spatially referenced leak flow rate data to be considered in evaluating threats to pipeline integrity, but in fact, underscores the need to do so.

V. BENEFITS OF INTEGRATING ADVANCED LEAK DETECTION AND LEAK QUANTIFICATION METHODS INTO UTILITY LEAK REPAIR AND PIPE REPLACEMENT PROJECTS

Q. Please provide an overview of EDF's engagement with utilities on the integration of advanced leak detection technology and leak quantification methodology into utilities' pipe replacement and leak repair programs.

A. In collaboration with Google Earth Outreach, Colorado State University ("CSU"), and various natural gas utilities, EDF is managing a project that uses Google Street View cars equipped with Picarro methane concentration analyzers to quantify methane leaks from distribution pipelines. The goals of this project are to demonstrate the benefits of state-of-the-art technological solutions, create pathways for the integration of leak quantification and advanced leak detection technology into utility operations, and to enhance transparency with respect to utilities' leak abatement efforts by publishing online maps showing the location and size of leaks in utilities' distribution systems. These maps have been referenced in several reports and presentations, including for instance, the U.S. Department of Energy's ("DOE") QER, which was released in April 2015.[24] Further explanation of the methodological approach and scientific research underpinning this project is contained in Dr. Joseph von Fischer's written testimony.

Last year, New Jersey's oldest and largest utility, PSE&G, and EDF engaged on a collaborative pilot project in the context of PSE&G's proposed accelerated pipe replacement program demonstrating how leak flow rate data can be used as a valuable layer of data, in conjunction with asset risk assessments generated using hazard ranking algorithms/models, to the benefit of utilities, customers and the environment. EDF gathered leak flow rate data for sections

[24] Department of Energy, "Quadrennial Energy Review: Energy Transmission, Storage, And Distribution Infrastructure", April 2015, "QER", available at http://energy.gov/epsa/downloads/quadrennial-energy-review-full-report. EDF's methane leak maps are referenced at p. 2-20.

of PSE&G's infrastructure targeted for replacement through a mobile leak survey using Google Street View cars that were specially outfitted with methane sensors. PSE&G shared information with EDF on the location and type of its pipelines, enabling the collection of leak flow rate data that could be spatially-attributed to specific pipes targeted for replacement.

In November 2015, the New Jersey Board of Public Utilities ("BPU") approved a settlement agreement among PSE&G, EDF and other stakeholders relating to a proceeding initiated by PSE&G, in which it sought approval for an accelerated pipe replacement program.[25] As part of this settlement, PSE&G received BPU approval to implement a $905 million pipe replacement program over a three-year time frame. Under the terms of this settlement, after taking into account safety considerations, PSE&G is required to consider data gathered by EDF on the volume of methane emissions leaked from its pipes, in conjunction with other relevant factors to identify those that are most in need of replacement. PSE&G has already started using this dataset in prioritizing its pipeline replacement efforts.[26]

Other utilities across the country are exploring the integration of this new and beneficial methodological approach into their leak operations. For instance, Con Edison and EDF recently entered into a collaborative arrangement to develop a program to prioritize the repair of non-hazardous Type 3 leaks on Con Edison's system. Under this program, researchers from CSU plan to survey over 300 leaks constituting Con Edison's Type 3 leak backlog, and characterize these leaks into "small," "medium," and "large" emitters. In order to facilitate this survey, Con Edison has provided EDF with location information for its Type 3 leak backlog, including information on underground infrastructure locations, under the terms of a non-disclosure agreement. Con Edison will prioritize the repair of a specified percentage of these Type 3 leaks classified based on

[25] Decision and Order of the New Jersey Board of Public Utilities In The Matter Of Public Service Electric And Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recovery Mechanism, November 16, 2016, available at http://www.nj.gov/bpu/pdf/boardorders/2015/20151120/11-16-15-2F.pdf.

[26] T. Johnson, "Utilities must reduce methane leaks from natural gas pipelines, says new bill", February 5, 2016, available at http://www.njspotlight.com/stories/16/02/04/utilities-must-clamp-down-on-methane-leaks-from-natural-gas-pipelines-says-new-bill/.

emissions flow rate and/or leaks totaling a specified percentage of emissions – this specified percentage will be determined by Con Edison in consultation with relevant stakeholders.

Q. How can data gathered using advanced leak detection and quantification methods assist the Commission and National Grid in assessing the extent of need for, and benefits from, proposed system modernization and leak abatement projects?

A. Along with other state public utility commissions around the country, this Commission is tasked with the challenge of balancing ratepayer interests in keeping natural gas rates stable and affordable, and utility and broader public safety interests in addressing gas infrastructure modernization and maintenance needs. The evaluation of proposed pipeline replacement programs by state regulatory entities necessitates a robust cost-benefit analysis, requiring careful scrutiny of all available information.

New data such as that made available through commercially available state-of-the-art leak detection and leak quantification methods can assist utilities and the Commission in addressing this challenge by offering more granular and detailed information on the leakiness of natural gas systems than has ever been previously available. Spatially-attributed leak data developed by connecting leak flow rates with information on the nature and location of the associated utility infrastructure can aid in effective and transparent decision making, offering significant benefits to utilities and regulatory agencies. For instance, such data can help characterize the condition of pipeline systems, and highlight where the needs for leak repair and pipeline replacement programs are greatest. Spatially-referenced leak data can improve the design and implementation of such programs by allowing utilities to focus on the sections of their infrastructure with the largest leaks or the highest leak density (i.e. leaks per mile of pipeline), where appropriate, after taking safety considerations into account. Exhibit 2 contains a sample leak map, based on randomly generated data, reflecting the type of data and visual tool that can be developed using advanced leak detection and leak quantification methods.

Similar leak maps were developed as part of the PSE&G-EDF pilot project by overlaying PSE&G's infrastructure maps over leak maps reflecting the location and relative size of leaks on their system. This approach allows utilities to develop an actionable, visual tool reflecting areas of their infrastructure that are in particular need of replacement or repair efforts.

By comparing "before" and "after" scenarios, reflecting reductions in volumes of leaked gas achieved through the implementation of such programs, utilities, the Commission, and other stakeholders can evaluate the effectiveness of pipe replacement and leak repair efforts in reducing system-wide leaks.

Currently, National Grid uses emission factors associated with cast iron and unprotected steel mains to estimate methane emissions reductions from pipeline replacement activities, as reported under the U.S. Environmental Protection Agency's Subpart W of the Clean Air Act.[27] However, actual methane emission reductions would likely be different when measured. Leak quantification methodologies, and the leak maps and other visual tools that can be developed using these methods, allow regulatory agencies responsible for allocating ratepayer money to better assess the need for pipeline replacement or leak repair on different pipeline materials.

From a longer term perspective, there is potential for data gathered using these methodologies to be used to supplement utility hazard ranking algorithms, to order to enhance the foundational basis used by utilities to identify sections of infrastructure that are most in need of replacement/repair. Many major utilities use proxy variables for leak flow rate (e.g., a combination of pipe diameter and pressure) in their hazard ranking models to get a broad understanding of the volume of leaking gas that could accumulate in an enclosed space, which is a necessary parameter to include in risk assessments. With leak quantification methodologies now becoming commercially available, actual, measured leak flow rate can be used instead of estimates generated using a proxy variable. Measured leak rates that can be geographically attributed to infrastructure allow a more direct risk assessment to be made than would be possible

[27] Testimony of the Gas Infrastructure & Operations Panel, Book 4 – KEDLI, at p. 25.

with the use of proxy variables, and can therefore serve as a valuable parameter in main replacement prioritization.

In summary, these new methods provide additional data and perspective around underground infrastructure condition, leakiness and program need, and can serve as tools that can help regulatory agencies such as this Commission to better balance program need with ratepayer interests in maintaining stable rates.

This is illustrated by a recent report by PricewaterhouseCoopers which discusses the benefits of using new data analytics for improved utility asset management, and opportunities to integrate data gathered using cutting edge technologies, such as mobile leak detection technology, into utilities' risk management efforts.[28] The authors point out that traditional risk assessment has relied heavily on subject-matter experts who may use qualitative or subjective data to make decisions about risk mitigation actions. The report notes that by integrating spatial analytics with data on asset conditions, gas utilities can obtain a rigorous snapshot of asset risks in near real-time, showing where and when leaks are likely occur, which can inform investment planning and project prioritization. Leak flow rate could potentially serve as a useful parameter to assess asset conditions. The report includes a case study relating to a major gas distribution utility which sought to optimize its prioritization of capital replacement projects. This company had invested in Picarro mobile leak detection technology, and sought to use incremental data gathered using this technology along with historical data to develop a predictive model. For a $15 million asset portfolio, this effort led to the following outcomes: an estimated 3.9X more leaks avoided, 3.6X greater leaks/mile replaced and 4.1X more O&M expense cost savings for the same capital investment. [29] This is a powerful example of the significant benefits to utilities from using data

[28] PricewaterhouseCoopers, "A new view on pipeline risks: How spatial analytics can empower asset management for gas utility companies" (2016) available at https://www.pwc.com/us/en/power-and-utilities/publications/assets/pwc_gas_pipeline_spatial_analytics_april_2016.pdf.
[29] *Id.*

that can be now be gathered using cutting edge technologies to enhance their asset management efforts.

Q. Please outline the benefits of leak quantification and advanced leak detection methods.

A. Leak data gathered by EDF using mobile leak survey techniques in the service territories of a number of utilities across the U.S. suggests that the majority of methane emissions from natural gas distribution systems are attributable to a relatively small number of large leaks, as opposed to clusters of small leaks. This finding is supported by multiple independent sources. For instance, a 2014 Stanford University study noted, based on many independent experiments, that a small number of large leaks are responsible for a large fraction of the leakage from natural gas systems.[30]

Together, these findings underscore the need for utilities to replace leak prone pipeline materials on their distribution systems, and the benefits of using leak quantification technology to prioritize such efforts. Using leak quantification techniques to identify large leaks would allow National Grid to address these leaks first as part of pipeline replacement and leak repair programs, after addressing those leaks/pipelines that pose a safety risk, thereby facilitating cost effective leak abatement and infrastructure improvement.

Ratepayers and society as a whole stand to benefit from this approach. First, the larger reductions in lost gas that leak prioritization can achieve translates into savings for ratepayers who generally pay both for gas delivered as well as gas lost on the pipeline system. With the exception of hazardous leaks, which utilities are required to repair immediately, leak quantification can be used to prioritize non-hazardous leaks for repair, thus improving cost-effectiveness, by capturing the highest volumes of gas per dollar spent on leak repair.

Finally, there are societal benefits from reducing the amount of gas leaked. Methane makes up about 90% of pipeline quality natural gas,[31] and is a greenhouse gas 84 times more potent than carbon dioxide over a 20-year time horizon. Considering impacts on climate, methane emissions therefore come with a cost to society.[32] The social cost of methane has been estimated at $140 - $1300/ton of methane, depending mainly on modeling assumptions and the types of damages included in the calculations.[33] The Commission has previously considered the costs of climate change, which are currently external to the costs of natural gas, in an order establishing the benefit cost analysis framework of Reforming the Energy Vision.[34]

Similarly, there are benefits associated with the use of advanced leak detection technology, which is more sensitive than traditional leak detection equipment and is therefore capable of finding more leaks. A growing number of utilities are adopting or exploring the adoption of such new and advanced leak detection equipment. For instance, California-based utility, Pacific Gas & Electric ("PG&E") piloted the use of Picarro analyzers in 2013. PG&E notes that this technology is 1,000 times more sensitive than any other commercially available instrument, with the pilot indicating that the Picarro technology finds many more leaks than traditional leak survey instruments.[35]

CenterPoint Energy, which serves customers in Arkansas, Louisiana, Minnesota, Mississippi, Oklahoma and Texas has also piloted the technology. Centerpoint Energy has

[31] A. Demirbas. (2010). Natural Gas. In Methane Gas Hydrate (p. 47). Springer. http://doi.org/10.1007/978-1-84882-872-8

[32] IPCC. (2013). *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis*. Retrieved from http://www.ipcc.ch/report/ar5/wg1/#.Ut_4FxDna00.

[33] Estimates from the following references converted to 2011$. Estimates are based on a 3% discount rate unless otherwise indicated. Hope, Chris W. "The marginal impacts of CO2, CH4 and SF6 emissions." Climate Policy 6.5 (2006): 537-544 (Ramsey discount rate with pure rate of time preference of 3%); Marten, Alex L., and Stephen C. Newbold. "Estimating the social cost of non-CO 2 GHG emissions: Methane and nitrous oxide." Energy Policy 51 (2012): 957-972; Marten, Alex L., et al. "Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates." Climate Policy 15.2 (2015): 272-298; Waldhoff, Stephanie, et al. "The Marginal Damage Costs of Different Greenhouse Gases: An Application of FUND." Economics 8.31 (2014) (Ramsey discount rate with pure rate of time preference of 1%);

[34] State of New York Public Service Commission. January 21, 2016. CASE 14-M-0101. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision.

[35] PG&E Testimony in 2016 Gas Rate Case, Chapter 9, Gas Operations Technology, at p. 9-24.

conducted pilots in Houston and Minneapolis to evaluate Picarro's performance compared to current methods - both pilots reported more than 5x improvements in leak find rate.[36]

The California Public Utilities Commission reports that utilities experienced a 21% increase in the number of leaks detected from 2013 to 2014, due partly to the use of advanced leak detection technologies being employed.[37] As utilities start adopting more sensitive surveying equipment, leak backlogs are likely to grow, increasing the need for, and benefits of, prioritizing leak abatement activities by considering leak flow rate. PG&E, for instance, plans to test this technology for the purposes of quantifying the volume of fugitive emissions associated with its facilities, recognizing that this would improve site efficiency and safety, minimize losses and reduce greenhouse gas emissions.[38]

Q. Please describe the pilot projects that EDF is conducting in collaboration with National Grid.

A. EDF and National Grid have agreed to collaborate on a suite of pilot projects, in order to advance the use of new technological solutions to better design and execute its system modernization and maintenance efforts. EDF and National Grid have previously collaborated on the mapping of methane leaks in various sections of its service territory. Additionally, National Grid has participated in a number of research studies aimed at gaining a better understanding of methane emissions from distribution systems, and is actively engaged in several industry collaborative efforts to advance the integration of new technologies to assess methane emissions. The new suite of collaborative pilot projects are intended to build on National Grid's long-running and ongoing efforts to enhance its pipe replacement and repair efforts and minimize leaks on its system.

[36] CenterPoint Energy, "Picarro Leak Surveyor: A Step Change in Leak Detection Capability", July 2015, available at https://southerngas.org/images/PSC_Tal_Centers.pdf.
[37] Mrowka, A., Charkowicz, E., & Magee, C. (2016). Analysis of the Utilities' May 15th, 2015, Methane Leak and Emissions Reports Required by Senate Bill (SB) 1371 (Leno) and Rulemaking (R.) 15-01-008.
[38] PG&E Testimony in 2016 Gas Rate Case, Chapter 9, Gas Operations Technology, at p. 9-24.

This Commission and its counterparts around the country are required to balance ratepayer costs and interests with the need for pipe replacement and leak abatement. Detailed information on the subsurface conditions and the relative "leakiness" of underground mains has hitherto been unavailable, which complicates the task of assessing the extent of need and overseeing programs once approved. As explained in further detail below, the projects that EDF and National Grid have agreed to collaborate on build on EDF's previous collaborative efforts with major utilities, including National Grid, and are aimed at providing additional data and perspective around underground infrastructure condition, leakiness and program need, to help utilities and the Commission balance the need for pipe replacement/repair efforts with the associated costs. The key components of this collaborative initiative are outlined below, and described in further detail in the testimony of Dr. Joseph von Fischer:

- **Pilot project addressing National Grid's leak-prone infrastructure in Staten Island**

This pilot project is aimed at using leak flow rate data gathered through EDF's survey of National Grid's service territory in Staten Island in 2014[39] to better prioritize efforts to repair/replace the KEDNY's leak-prone infrastructure in Staten Island. EDF and National Grid propose to launch this project in summer 2016, with a view to making actionable data available to the utility for the implementation of leak repair/pipe replacement efforts in Staten Island in CY 2017.

- **Pilot project addressing National Grid's leak-prone infrastructure in Long Island**

This project will employ a methodological approach similar to the first project outlined above, and is aimed at better addressing leak-prone infrastructure located in KEDLI's service territory in Long Island using leak flow rate data. EDF proposes to dispatch a Google Street View car to Long Island by spring 2017 or earlier to survey sections of KEDLI's service territory located there that have been identified for pipe replacement in 2017.

- **Development of emission factors for CISBOT**

[39] An overview of the data as well as maps reflecting the results of this survey can be accessed at http://www.edf.org/climate/methanemaps.

Emission factors have not yet been developed for CISBOT, making it challenging to accurately estimate its impact in terms of reducing system-wide emissions. This project is aimed at addressing this challenge by developing emission factors specifically for CISBOT. EDF and National Grid anticipate that a survey of the relevant sections of KEDNY's service territory in New York City, and additional locations where CISBOT has been used more intensively than other sections of National Grid's service territory, would form the most appropriate basis for this technical project.

- **Explore integration of leak flow rate into hazard ranking algorithm**

Over the longer term, EDF and National Grid will collaborate to explore the potential for leak flow rate to be incorporated as a distinct variable, with the appropriate weight, into National Grid's hazard ranking algorithm.

Q. What are the anticipated benefits of these projects?

A. Building on National Grid's ongoing efforts to minimize leaks on its system, the suite of collaborative projects is anticipated to offer the following incremental benefits:

- Opportunity for National Grid and the Commission to gain previously unavailable leak flow rate data, to use this data to better prioritize leak repair and pipe replacement efforts in Staten Island and Long Island, and develop a broadly applicable prioritization framework for such efforts incorporating leak flow rate.
- Opportunity to correlate leak size with the underlying cause of the leak (for example: corrosion, material or welds) by considering leak data provided by EDF in conjunction with utility infrastructure information.
- Opportunity for National Grid to perform validation studies to evaluate leak detection technology and/or leak quantification methodology.
- Opportunity for National Grid to build on its understanding of the operational aspects of using new and advanced leak detection equipment/technology, which is employed by EDF-

CSU for the purposes of conducting the leak survey, by identifying limits of deployment considering factors such as traffic, atmospheric conditions, GPS availability, etc.

- Provide preliminary basis for any future GHG credits/reductions efforts.
- Opportunity to develop more refined analyses of the impact of CISBOT on emissions reduction, allowing for an improved assessment of its benefits, relative to costs.
- From a longer term perspective, this collaboration offers National Grid the opportunity to consider the potential to enhance its hazard ranking algorithm by incorporating leak flow rate as a new variable, with the appropriate weight.

These benefits are consistent with National Grid's objectives as stated in its testimony; that is, to accelerate reductions of natural gas leaks on its distribution system with a view to enhancing overall system reliability and integrity.[40]

Q. What are your recommendations in relation to the implementation of KEDLI and KEDNY's pipe replacement efforts?

A. The Companies would enhance the cost-effectiveness of their leak repair and pipe replacement programs by using data on leak flow rate, such as that being provided by EDF, as a factor in prioritizing pipeline replacement and leak repair. Focusing on the largest leaks first, after addressing those that pose a safety threat, will provide enhanced benefits to ratepayers by reducing the amount of lost gas, and will also offer environmental benefits, as discussed above. Accordingly, it is recommended that KEDLI employ data on leak flow rate that will be gathered by EDF in its Long Island service territory in order to prioritize its leak repair and replacement activities there across the Data Year and Rate Years, as appropriate. Similarly, it is recommended that KEDNY employ such data previously gathered by EDF in its service territory in Staten Island in order to prioritize its leak repair and replacement activities there across the Data Year and Rate Years.

[40] Testimony of the Gas Infrastructure & Operations Panel, Book 4 – KEDLI, at p. 17.

From a longer term perspective, it is recommended that KEDLI and KEDNY consider the scope for including new data available in the form of leak flow rate into their hazard ranking algorithm, in order to enhance the foundational basis of their system modernization and maintenance efforts.

VI. CONCLUSION

Q. Please summarize your recommendations and conclusions.

A. Based on my review of testimony submitted on behalf of the Companies, my conclusions and recommendations are as follows:

(1) The Companies' proposed accelerated pipe replacement efforts are necessary and appropriate.

(2) The Companies would enhance the cost-effectiveness of their leak repair and pipe replacement programs by using data on leak flow rate, such as that being provided by EDF, as a factor in prioritizing pipeline replacement and leak repair. Focusing on the largest leaks first, after addressing those that pose a safety threat, will provide enhanced benefits to ratepayers by reducing the amount of lost gas, and will also provide environmental benefits. This Commission should continue to advance its efforts to further the use of industry best practices by New York utilities by recognizing the benefits of this emerging best practice and creating a pathway for its integration into the Companies' proposed accelerated pipe replacement and leak repair efforts.

(3) In the longer term, New York utilities and this Commission should move in the direction of enhancing the foundational basis of utilities' system modernization and maintenance efforts. It is therefore recommended that KEDLI and KEDNY consider the scope for including leak flow rate as a new variable, with the appropriate weight, into their hazard ranking algorithms, in order to enhance the foundational basis of their system modernization and maintenance efforts.

Q. Does this conclude your testimony?

A. Yes.

Testimony of Simi Rose George

Exhibit___(SRG-1)

Resume of Simi Rose George

SIMI ROSE GEORGE

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Education

2012–2014 **HARVARD UNIVERSITY, John F. Kennedy School of Government (HKS)** — Cambridge, MA
Master in Public Administration in International Development

2003–2008 **NATIONAL LAW SCHOOL OF INDIA U. (NLSIU)** — Bangalore, India
Bachelor of Arts, Bachelor of Laws (Honors)

Experience

2015- **ENVIRONMENTAL DEFENSE FUND** — San Francisco, CA
Manager, Natural Gas Distribution Regulation, U.S. Climate & Energy

- Supervising EDF's interventions in regulatory proceedings across the U.S. in collaboration with in-house legal and science teams
- Developing and managing relationships with key stakeholders, including state regulatory entities, utilities, and external collaborators
- Contributing to the strategic vision behind EDF's policy initiatives for the U.S. natural gas distribution sector
- Supervising research and analyses relating to local distribution pipeline safety, lost and unaccounted for gas, and quantification of methane emissions from local distribution system pipelines.

2010 –2012 **LINKLATERS LLP (top five international law firm)** — London, UK
Associate

- Advised multinational energy companies and financial institutions on a range of projects, including cross-border investments, with an emphasis on the energy and infrastructure sectors
- Managed relationships with key client contacts, financial advisers and local counsel in various jurisdictions

2008 –2010 **CLIFFORD CHANCE LLP (top five international law firm)** — London, UK
Foreign Qualified Lawyer, Energy & Infrastructure Group

- Responsible for managing legal due diligence on a range of projects including mergers, acquisitions and project finance transactions
- Managing legal research and analysis to support the negotiation, and execution of international investment projects in emerging markets in Asia, Africa and Europe

Publications

Fine, J., George, S. & Moss, S. (2016, June). System reliability and environment to be helped by non-event demand response. Natural Gas & Electricity 32/11, ©2016 Wiley Periodicals, Inc., a Wiley company.

Testimony of Simi Rose George

Exhibit___(SRG-2)

Sample Leak Map

Sample Leak Map Reflecting Spatially Attributed Leak Flow Rate Data