BEFORE THE
NEW YORK STATE
PUBLIC SERVICE COMMISSION

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Proceeding on Motion of the Commission as to the
Rates, Charges, Rules and Regulations of
New York State Electric & Gas Corporation
for Electric Service

Case 19-E- ____

Proceeding on Motion of the Commission as to the
Rates, Charges, Rules and Regulations of
Rochester Gas and Electric Corporation
for Electric Service

Case 19-E- ____

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DIRECT TESTIMONY OF
RESILIENCY PLAN PANEL

Beverly L. Allen
Christian J. Bilcheck
Myles T. Collins
Juan V. Martinez
William H. Ransom
Robert C. Yardley Jr.

May 20, 2019

DIRECT TESTIMONY OF RESILIENCY PLAN PANEL

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I. INTRODUCTION

Q. Please state the names of the members on this Resiliency Plan Panel ("Panel").

A. We are Beverly L. Allen, Christian J. Bilcheck, Myles T. Collins, Juan V. Martinez, William H. Ransom, and Robert C. Yardley Jr.

Q. Ms. Allen, please state your title and business address.

A. I am the Director of Special Projects, Process and Technology. My business address is One Electric Parkway, Horseheads, New York 14845. In my current role, I am responsible for planning and executing resiliency plans for New York State Electric & Gas Corporation ("NYSEG"), Rochester Gas and Electric Corporation ("RG&E" and together with NYSEG, the "Companies"), and Central Maine Power Company.

Q. Please summarize your work experience and educational background.

A. I have been employed by NYSEG for 19 years. Prior to my current position, I was Director of Electric Distribution for NYSEG – Central Division. I earned a BS in Applied Mathematics from Rochester Institute of Technology and a BS in Electrical Engineering from Alfred University. My Curriculum Vitae ("CV") is set forth in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the New York State Public Service Commission ("PSC" or the "Commission") or any other state or federal regulatory agency?

A. No.

Q. Mr. Bilcheck, please state your title and business address.

A. I am Vice President, Asset Management & Planning for Avangrid Networks, Inc. ("Networks"). My business address is 100 Marsh Hill Road, Orange, Connecticut 06477.

DIRECT TESTIMONY OF RESILIENCY PLAN PANEL

Q. Please summarize your work experience and educational background.

A. I am responsible for transmission and distribution ("T&D") planning, non-wires alternatives ("NWAs"), investment planning, and asset management. I joined the United Illuminating Company in 1986 and am a registered Professional Engineer in the State of Connecticut. My CV is set forth in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the Commission or any other state or federal regulatory agency?

A. I have not previously testified before the Commission. I have, however, testified before state regulatory commissions in Connecticut (e.g., Department of Public Utility Control Docket No. 08-01-01 - Review of Peaking Generation Projects; Public Utilities Regulatory Authority ("PURA") Docket No. 17-12-03 - Investigation into Distribution System Planning of the Electric Distribution Companies) and in Maine (Public Utility Commission Docket No. 2018-194 - Commission Initiated Investigation into Rates and Revenue Requirements Pertaining to Central Maine Power Company).

Q. Dr. Collins, please state your title and business address.

A. I am Managing Consultant, Utility Services of Nexant, Inc. ("Nexant"). My business address is 101 2nd Street, Suite 1000, San Francisco, California 94105.

Q. Please summarize your work experience and educational background.

A. I joined Nexant's Utility Services group in 2016. At Nexant, I have focused on valuation methods for reliability and resilience investments. I led two large customer interruption cost studies for value-based reliability planning and worked with colleagues at Nexant and Lawrence Berkeley National Laboratory ("LBNL") to update a guidebook for electric utilities for estimating power system interruption costs. I am also working with

LBNL and the U.S. Department of Energy to draft a cost-benefit analysis guide for investments in electricity system resilience. I have worked on a variety of other projects, including evaluating load impacts from demand response programs, estimating savings from behavioral conservation programs, assessing market potential for demand response, and developing predictive models to improve business performance. Before coming to Nexant, I worked for five years at Southern California Edison, where I led strategy, planning, and analytics projects for the Customer Service organization. I have a Ph.D. in Policy Analysis from the Pardee-RAND ("RAND") Graduate School and an MPP from the University of California at Los Angeles. During my five years at RAND, I focused on energy policy, behavioral energy conservation, and new quantitative methods for planning under uncertainty. My CV is set forth in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the Commission or any other state or federal regulatory agency?

A. No, I have not.

Q. Mr. Martinez, please state your title and business address.

A. I am the Director – Integrated System Planning. My business address is 89 East Avenue, Rochester, New York 14649

Q. Please summarize your work experience and educational background.

A. In my current role, I manage the Avangrid Distribution Planning and NWA team. I have 10 years of experience in the network utility business, starting in Iberdrola Spain from 2009 to 2016 before being assigned to Networks in 2016. I have a BS in Industrial Engineering from Polytechnic University of Valencia and a MA in Design, Construction

and Maintenance of High Voltage Power Infrastructure from Comillas Pontifical University. My CV is set forth in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the Commission or any other state or federal regulatory agency?

A. No, I have not.

Q. Mr. Ransom, please state your title and business address.

A. I am the Director of Network Management for Networks. My business address is 1300 Scottsville Road, Rochester, New York 14264.

Q. Please summarize your work experience and educational background.

A. I am responsible for T&D network equipment and construction standardization, network maintenance policies and planning, and vegetation management. I joined NYSEG in 1988 and am a registered Professional Engineer in the State of New York. My CV is set forth in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the Commission or other state or federal regulatory agency?

A. Yes. I testified in the Companies' last rate cases, Cases 15-E-0283 et al.

Q. Mr. Yardley, please state your title and business address.

A. I am a Senior Vice President of Concentric Energy Advisors, Inc. My business address is 293 Boston Post Road West, Suite 500, Marlborough, Massachusetts 01752.

Q. Please summarize your work experience and educational background.

A I have more than 30 years of experience in the energy industry, having worked as a consultant and executive at energy consulting firms for most of my career. For slightly less than two of those years, I served as Chairman of the Massachusetts Department of

Public Utilities, the agency responsible for regulation of the electricity, natural gas, telecommunications, and water industries in the Commonwealth of Massachusetts. I have testified before state regulatory agencies and the Federal Energy Regulatory Commission ("FERC") on ratemaking, regulatory policy, earnings attrition, incentive regulation, integrated resource planning, distribution system planning, and emergency storm response. My qualifications are detailed more fully in my CV included in Exhibit __ (RPP-1).

Q. Have you previously testified in other proceedings before the Commission or any other state or federal regulatory agency?

A. I have not testified before the Commission but, as listed in Exhibit __ (RPP-1), I have testified before several state and provincial regulatory agencies and before FERC.

Q. What is the purpose of the Panel's testimony?

A. On June 27, 2018, Avangrid announced a 10-year plan to enhance the reliability and resiliency of our networks by implementing a series of programs, including more rigorous vegetation management and hardening standards, and investing in infrastructure on our worst performing circuits. These elements will work together with existing and proposed investments in Advanced Metering Infrastructure ("AMI") to enable us to restore power more quickly when our customers experience outages.

Our testimony describes the objectives, methodology, and results of the detailed 2019-2020 Resiliency Plan ("Resiliency Plan") to improve the Companies' resiliency. Our testimony presents specific proposals to enhance the resiliency on 40 NYSEG distribution circuits, 14 RG&E distribution circuits and 4 RG&E transmission lines to be addressed during the initial two years of the 10-year plan. We also explain how these

proposals are incremental to our Capital and Operations & Maintenance ("O&M") spend. Finally, our testimony will compare the incremental costs to the value of benefits such as fewer and shorter interruptions of service for our customers, lower restoration costs, avoided vegetation management costs, and avoided pole replacement costs.

Q. What time period is covered by the Resiliency Plan?

A. The overall time frame covered by the Resiliency Plan is a 10-year period starting in 2019. This testimony will focus on the initial five-year period, with an initial Benefit Cost Analysis ("BCA") for the years 2019 and 2020.

II. IDENTIFICATION AND SUMMARY OF EXHIBITS

Q. Is this Panel sponsoring any exhibits?

A. Yes. This Panel sponsors the following exhibits:

1) Exhibit __ (RPP-1) are the CVs of the witnesses testifying on this Panel;
2) Exhibit __ (RPP-2) provides information regarding tree-related outages at NYSEG and RG&E;
3) Exhibit __ (RPP-3) is the NYSEG and RG&E Resiliency Plan; and
4) Exhibit __ (RPP-4) provides an index of the Panel's workpapers. A copy of the workpapers will be provided to the New York State Department of Public Service Staff ("Staff").

Exhibit __ (RPP-3) includes six appendices that present circuit-specific plans and a Benefit-Cost Analysis prepared by Nexant. These appendices are: a) Appendix A, which is the Avangrid Distribution Resiliency Guide ("Resiliency Guide") or ("Guide"); b) Appendix B, which provides the Avangrid Transmission and Sub-Transmission Resilience Criteria; c) Appendix C, which is the NYSEG and RG&E Hardening, Topology

and Automation Investments by Circuit; d) Appendix D, which are NYSEG's 2019-2020 Resiliency Circuit Plans; e) Appendix E which are RG&E's 2019-2020 Resiliency Circuit Plans; and f) Appendix F, which provides the Resiliency Plan BCA for RG&E and NYSEG.

III. NEED TO ADDRESS RESILIENCY

Q. As a foundational matter, how do the Companies define "resiliency"?

A. We define resiliency as: 1) the prevention of and/or limitation of the scope and impact of outages when they occur; and 2) the ability to restore power expediently after a significant outage. Thus, resiliency is both the ability of a system to withstand forces that could potentially cause damage, as well as the ability to limit their impact and restore service when damage is experienced. The Resiliency Plan is primarily designed to address "major storms" that cause widespread outages, and storms that are less severe but still cause significant outages. The actions taken to address storms will also enhance the resiliency of the system in responding to other events that cause damage to electric facilities.

Q. Can you define "reliability"?

A. "Reliability" refers to the ability of an electric distribution utility to deliver the desired quantity of quality power to all customers when needed. Reliability is typically measured and reported for an annual period using a set of widely-accepted industry metrics. These metrics include the average duration of experienced power interruptions (i.e., the Customer Average Interruption Duration Index or "CAIDI"), the average number of interruptions per customer (i.e., the System Average Interruption Frequency Index or "SAIFI"), and the average duration of interruptions per customer in a year (i.e., the

System Average Interruption Duration Index or "SAIDI"). The Companies measure CAIDI and SAIFI both with and without major storms.

Actions that improve reliability include replacing equipment that has failed or is nearing the end of its useful life, trimming trees around wires to prevent outages that occur by contact during strong winds, removing "hazard" trees that are outside of our rights-of-way ("ROWs"), and protecting facilities from intrusions or damage by animals such as squirrels. Utilities also address reliability by applying national standards when designing and constructing new system infrastructure to meet expected weather and other operational conditions. Finally, it should be noted that actions that improve reliability may also contribute to improvements in resiliency. Similarly, our holistic plans to improve resiliency on the worst performing circuits will improve reliability on the targeted circuits.

Q. Why are the Companies increasing the focus on resiliency at this time?

A. The Resiliency Plan responds primarily to the number of storms of all types and severity that NYSEG and RG&E have experienced over the past decade, the substantial number of tree-related outages experienced during these storms and throughout the year, and an emerging consensus among customers and public officials that it is appropriate for the Companies to enhance the resiliency of their electric infrastructure. Staff, in its recently completed investigation of the 2018 winter and spring wind storms, observed:

> Due to the rise in storm intensity, dedicated storm hardening programs need to be developed and implemented throughout New York State to reduce damage from future weather events. The 2018 Winter and Spring Storms are examples of major storms that greatly impacted New York's electric distribution system in 2018. The experiences from the 2018 Winter and Spring Storms make it clear that storm hardening efforts are needed to

mitigate some of the impacts to the distribution infrastructure and customers.[1]

Q. Did the 2018 Staff Storm Report include a specific recommendation as to storm hardening and a resiliency plan?

A. Yes. Recommendation 88 calls for "[a]ll electric utilities [to] submit an actionable plan by July 1, 2019, which details future storm hardening measures including a budget, timeline, and major performance benchmarks."[2]

Q. Is the Resiliency Plan presented in testimony here and set forth in Exhibit __ (RPP-3) part of the Companies' response to Recommendation 88?

A. Yes. It is part of that response along with the AMI investments discussed in the testimony of the AMI Panel.

Q. Are the Companies able to determine the degree to which outages are caused by trees coming into contact with electric infrastructure?

A. Yes. The Companies maintain a database that tracks outage information including the time of each outage, the number of customers impacted, the duration of the outage, and the cause of the outage. It is clear from this evidence that: 1) trees are the major cause of outages; 2) tree-related outages occur throughout the year, predominantly during major storms of various types; and 3) that the largest contributor to tree-related outages is trees that are located outside of the Companies' ROWs. The 2015-2018 data for RG&E and NYSEG is presented in Exhibit __ (RPP-2). As shown in this exhibit, over 50% of

[1] Case 19-M-0285 - In the Matter of Utility Preparation and Response to Power Outages During the March 2018 Winter and Spring Storms, Report on 2018 Winter and Spring Storms Investigation at 157 (Apr. 18, 2019) ("2018 Staff Storm Report").

[2] Id. at 158.

outages are caused by trees located outside of the ROW in NYSEG and RG&E service areas.

Q. Are customer expectations with respect to both reliability and resiliency increasing?

A. Yes. This was made clear in testimony given by our customers in 2018 at public hearings and legislative hearings organized by the communities we serve.[3] The Companies believe that outage duration and the effectiveness of the utility's response to storms will be primary barometers for customer satisfaction. Tolerance for extended outages continues to diminish. These expectations point to the value of investing more in resiliency.

Q. How has the Companies' decision to prepare the Resiliency Plan been informed by the perspectives of customers and public officials that attended the 2018 public hearings?

A. Public meetings are opportunities for residential and business customers to share their perspectives with respect to the importance of electricity and the effect of outages on their business or life at home. Public officials are able to speak more broadly about the impacts on the communities they serve and provide input on how we can work collaboratively. For example, members of the New York State Senate, at a March 27, 2018 hearing attended by executives of NYSEG/RG&E, Central Hudson Gas & Electric Corporation, and Consolidated Edison, addressed the need for greater resiliency of electric distribution networks.

The legislative hearings, in particular, provide the Companies with the opportunity to identify areas of community collaboration. For example, the challenges

[3] For example, New York State Senate Hearing, March 27, 2018, New York State Assembly Hearing, May 29, 2018, and public hearings held as part of the 2018 Winter and Spring Storms Investigation in Case 19-M-0285.

associated with more aggressive tree trimming and removal of trees outside our ROWs are areas of potential collaboration that would benefit all customers.

Q. How does the Resiliency Plan address these concerns?

A. The Resiliency Plan (Exhibit __ (RPP-3)) presents the Companies' detailed plan to enhance the resiliency of our electric distribution system, starting with identifying the worst performing circuits for NYSEG and RG&E. Although the Companies have always reflected resiliency as a system planning objective, the Resiliency Plan elevates the attention given to resiliency by identifying incremental programs, along with information on the associated costs and benefits, that we have developed to directly improve the resiliency of our electric distribution network. As we shall describe in the next section of our testimony, the enhanced vegetation management ("EVM") program is designed to address our observed experience with tree outages. Our hardening program will target infrastructure on our worst performing distribution circuits and is coordinated and integrated with EVM and changes in topology that we will make on these same circuits. These programs, both individually and as a set of integrated, holistic, circuit-specific plans, will improve resiliency as we move down a prioritized list of our worst performing circuits.

As noted above, the Resiliency Plan also includes upgrades to four transmission lines at RG&E. These lines are connected to RG&E distribution substations that are part of the Resiliency Plan. As described in the next section, the Companies propose hardening investments that will supplement the distribution circuit plans while also addressing reliability concerns.

Q. Are these vegetation management expenses and capital investments incremental to amounts included in the Capital and O&M spend?

A. Yes. The Resiliency Plan proposes specific expenses and capital investments that target improvements in resiliency. Resiliency actions and associated expenditures are incremental to the activities included within the Capital and O&M spend. They will be identified and separately tracked.

Q. Does the Companies' recent storm experience support the need for the Resiliency Plan?

A. Yes. Storms vary significantly in terms of their nature, how much damage they cause, and geographic dispersion. The Companies have experienced 165 "major storms" (123 for NYSEG and 42 for RG&E) between 2012-2018.[4] These include ice storms, blizzards, hurricanes, wind storms, tornados, and lightning combined with wind and rain. As shown in Tables 1 and 2 in Exhibit __ (RPP-3), 48 of these "major storms," 12 of which occurred in 2018, experienced restoration periods that lasted at least 4 days. An average of 54,601 customers lost power during these 48 major storms. There were 50 other major storms over this same period that experienced three-day outages, with an average of 14,955 customers that lost power. The Resiliency Plan also targets improvements to reduce the damage and shorten the outage time required to restore power after less severe storms. NYSEG and RG&E have averaged 40 minor storms[5] per year over this same period, affecting an average of 3,760 customers.

[4] "Major storms" are identified and qualified according to Institute of Electrical and Electronics Engineers ("IEEE") Standard 1366 (updated 2003) for reliability reporting purposes.

[5] "Minor storms" are identified by NYSEG and RG&E on an operating division basis when 4% or more of the customers are interrupted and the number of daily interruptions is 2x more than the average day. These impacts must be caused by weather-related interruptions.

The number of storms and outages over the past decade support the conclusion that has been reached by the Companies, their customers, and public officials: there is a lot of work to be done on resiliency and it should begin as soon as possible.

IV. PROGRAMS THAT ENHANCE RESILIENCY

Q. Please describe the Resiliency Plan's programs.

A. The Resiliency Plan is a circuit-by-circuit plan that identifies specific actions on each circuit that are intended to: 1) reduce the number of customers that experience outages during major outage events; and 2) enable the Companies to restore power more quickly to impacted customers. The circuit plans consider each of three actions or programs that are combined to form a single, integrated, and holistic plan to enhance the resiliency on the circuit.

Q. Please identify these three resiliency action plan programs.

A. The Companies have developed three programs to enhance resiliency:

- EVM;
- Hardening; and
- Topology, with Automation on prioritized circuits.

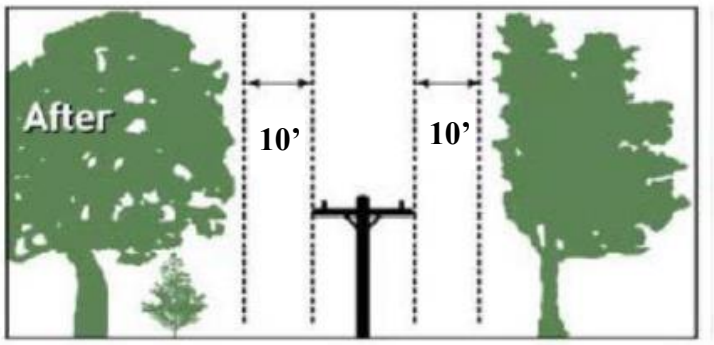
EVM will be performed on targeted circuits, using ground-to-sky clearances where appropriate. Hardening is represented by recently adopted construction practices/materials requirements. The hardening efforts are being applied to new construction throughout the NYSEG and RG&E service territories over the next year, including circuits that are included in the Resiliency Plan. Changes in topology work together with automation that segments the targeted circuits into smaller sections with

fewer customers, thus reducing the number of customers impacted by an outage event and the time required to restore power.

Q. Do the Companies propose any changes to their current vegetation management activities?

A. Yes. The Companies' EVM program has two components: 1) enhanced clearances; and 2) more aggressive hazard tree removal. The Companies are proposing to adopt "ground-to-sky" clearances in order to further reduce interruptions caused by falling branches during or after storms. This approach would be taken in connection with five-year cycle trim at RG&E and the proposed five-year cycle trim at NYSEG on distribution circuits, as discussed by the Vegetation Management Panel. This proposal is illustrated in Figure 1 below.

Figure 1: Ground-to-Sky Clearance



Second, the Companies will focus during the Resiliency Plan and beyond on removing so-called "hazard" trees. These trees generally are out of the ROW, but have caused a significant number of tree-related outages.

Q. Are the Companies requesting an increase in funding to finance the EVM program?

A. Yes. NYSEG and RG&E are requesting $35.5 million and $2.9 million (net of avoided vegetation management costs that would have otherwise been incurred absent the proposed EVM program), respectively, to fund EVM on distribution circuits included in the Resiliency Plan. This funding will allow the Companies to initiate ground-to-sky tree trim and more aggressive hazard tree removal on all three-phase circuits on the 54 distribution circuits addressed in the Resiliency Plan, as well as on all single-phase circuits in NYSEG's Brewster division. NYSEG and RG&E plan to spend approximately $3.0 million for EVM on an additional six circuits, not included in the 54 distribution circuits discussed in the Resiliency Plan. The Companies will spend these amounts in 2019 to gain experience with ground-to-sky clearing and more aggressive hazard tree removal, including experience engaging with communities and customers regarding the need for the EVM program.

Q. Why are the Companies including an EVM as part of the Resiliency Plan?

A. As shown in Exhibit __ (RPP-2), 56.7% of NYSEG and RG&E's combined outages during the 2015-2018 period were caused by trees or branches contacting wires and other electric equipment. The portion of these tree-related outages caused by out of the ROW trees is estimated at 63.7% for NYSEG and 41.5% for RG&E. Increased spending on the proposed EVM approaches will improve reliability performance under blue-sky conditions and minor weather events, as well as improve resiliency during major storms.

Q. Please describe the second resiliency program which is the Companies' Hardening program.

A. Hardening existing electric system infrastructure will reduce the number of outages. The Companies are addressing the hardening of infrastructure (e.g., poles, crossarms, and wires) by establishing minimum requirements that prescribe more robust construction practices and materials in the Resiliency Guide, attached as Exhibit __ (RPP-3, Appendix A). This Guide also includes minimum requirements for application of tree wire that replaces bare primary conductors with covered conductors capable of withstanding temporary contact with tree branches. The minimum requirements apply to all construction activities in the Companies' service territories and not only to the actions being taken as part of NYSEG and RG&E's enhanced Resiliency Plan. All requirements are compliant with the 2017 National Electrical Safety Code. The Companies are implementing these distribution hardening guidelines during 2019.

Q. Please describe the third resiliency program, which involves changes in topology accompanied by automation.

A. An electric distribution system's topology describes the configuration of infrastructure that comprises the distribution system, including each of its circuits. The Companies can enhance resiliency, including both the ability to limit the number of outages and to improve the speed of recovery by changing the topology through multiple strategies, including upgrading lines and enabling segmentation of circuits during outages to limit the number of customers that are impacted by a particular outage. Segmentation is achieved by adding automating feeder ties that allow the Companies to switch power flows around specific outages and thereby reduce the number of "downstream" customers

on a radial circuit that would otherwise be impacted by an event. The investments that support these strategies include upgrading and adding more circuits and lines, upgrading or adding substations, and undertaking other investments that support desired outcomes. Providing alternative sources of power by adding connected circuits also helps minimize outages.

The Companies' Resiliency Plan considers all of these options and proposes the combination of options for each distribution circuit that is the most cost-effective solution while complying with distribution system planning criteria. Topology changes work in concert with automated switches to facilitate customer segmentation (fewer outages) and faster restoration by restoring power to as many customers as possible before repairing the damage to the grid.

All topology-related construction will be performed in accordance with the Resiliency Guide and will comply with the material standards identified in the Guide.

Q. How does automation work with topology to improve the Companies' ability to restore power after an outage?

A. Automation allows the Companies to measure and control power flows on distribution circuits. It is enabled by switches and distribution reclosers, supported by telecommunications capabilities including remote terminal unit ("RTU") communications that connect these devices to the Companies' control center. The Resiliency Plan includes the accelerated deployment of two types of devices to enable automation functions on circuits: distribution reclosers and Security Control and Data Acquisition ("SCADA") switches. When combined with changes to topology that enable circuit segmentation, the Companies can deliver more granular fault isolation and alternate

circuit feeds so that outages can be constrained to smaller circuit segments (limiting the impact of an outage) and power can be restored faster. This is consistent with our long-term automation goal to increase the number of automated devices to support sectionalizing of customers along a circuit.

V. NYSEG AND RG&E 2019-2023 RESILIENCY PLAN

Q. What objectives did the Companies identify when designing the Resiliency Plan?

A. The Resiliency Plan reflects a balance between our customers' desire for increased resiliency and the need to maintain affordable rates for electric distribution service. It is an "enhanced" resiliency plan because it identifies incremental actions that can be taken by the Companies to improve resiliency.

Q. Please describe the Companies' approach to developing the Resiliency Plan.

A. The approach consisted of three distinct steps: 1) identify and rank the worst performing circuits from among NYSEG's 1,200 and RG&E's 885 circuits; 2) define a cost-effective plan for each distribution circuit; and 3) identify the circuits to be addressed in each year, based on rankings and other relevant criteria.

In the first step, the Companies eliminated circuits with an individual SAIFI below 2.2 (inclusive of major storms) and an individual SAIFI contribution lower than 0.14%. We also considered input from our Field Operations team regarding needs that they have identified. Using this approach, the Companies identified 139 and 138 of the "worst performing circuits" in NYSEG and RG&E's service territories, respectively. The 139 NYSEG distribution circuits are responsible for approximately 42% of the SAIFI under major storm conditions and 24% of the system circuit mileage. The 138 RG&E distribution circuits are responsible for approximately 68% of the SAIFI under major

storm conditions and 57% of the system circuit mileage. This initial step prioritizes the circuits with the greatest potential for improvement in the early years of the overall 10-year Resiliency Plan period while recognizing that we will want to spread the work out to smooth out any bill impacts.

Q. Are the circuits that will be addressed in a given year selected solely on their ranking?

A. No. These decisions are based on the initial rankings and other relevant criteria including feasibility, cost, value, and input from Field Operations. Among these criteria, feasibility is the biggest determinant, particularly in the early years of the Resiliency Plan. For example, it is not feasible to upgrade a substation or build a new substation within the first two years because of the long lead time required to plan, design, and execute such large, complex projects. Siting and building a new line is also challenging, depending on the length of the line and location. We expect the circuits planned to be addressed in 2021 and beyond to continue to shift with some circuits being moved up in response to recent performance issues, particularly if they impact large numbers of customers.

Q. How did the Companies determine the most cost-effective plan for each circuit?

A. The most cost-effective circuit plan starts with understanding the existing circuit topology and facilities. The Companies' distribution planners and field personnel are aware of historical performance issues on each circuit and the causes of outages. This knowledge informed decisions regarding specific investments that deserve serious consideration. All circuit plans include EVM as described above. In general, we examined topology and automation together, exploring opportunities to install reclosers and SCADA switches as a first step, which is a relatively (compared to new lines and substations) low-cost way to segment the circuit, thereby creating the ability to

automatically isolate an outage that would otherwise impact large numbers of customers.[6] New wire and more fully automated substations are additional options that require longer planning lead times.

Q. How does the plan for each circuit evolve from initial scoping to a final project plan?

A. There is a natural progression as we refine each plan before it is ready to be implemented. We start by focusing on the first two or three years and develop a preliminary holistic plan for hardening, topology, and automation. This plan is then refined by going out into the field and validating (or modifying) the plan based on observation and inspections to ensure that the plan makes sense and can be implemented. Tree wire is planned based on a field survey as part of the circuit-specific Resiliency Plans where there is a high degree of likelihood of tree contact. The next steps are engineering and the development of project plans that are detailed enough to enable procurement of materials and construction contracting. Each of these steps is necessary to make sound business decisions. The Resiliency Plan is updated each year to reflect the latest information. This process is repeated each year as the preliminary "out-years" circuit plans get closer to being implemented.

Q. How did the Companies identify the circuits to be addressed in each year of the initial two-year period?

A. As stated previously, the Companies used data regarding the worst performing circuits to prioritize which circuits would be addressed in the earlier years of the Resiliency Plan. The Companies identified capital spending during the initial two years of the Resiliency

[6] SCADA switches and reclosers cost between $50,000 and $75,000 per device, including a new pole.

Plan. NYSEG plans to invest $56.44 million ($16.76 million in 2019 and $39.68 million in 2020) in hardening, automation, and topology for the initial 40 circuits. RG&E plans to invest $25.54 million ($5.65 million in 2019 and $19.89 million in 2020).

Forty (40) NYSEG distribution circuits, 14 RG&E distribution circuits, and 4 RG&E transmission line upgrades were selected to be included in the Resiliency Plan.

This process is being replicated to identify circuits to be addressed during 2021-2023. We expect the circuits planned to be addressed in 2021 and beyond to continue to shift with some circuits being moved forward in response to recent performance issues, particularly if they impact large numbers of customers.

Q. Please describe the hardening actions proposed for the four RG&E transmission lines upgrades.

A. These transmission line hardening investments will improve the reliability of the network by increasing the likelihood that they will be available to meet the demand of customers served behind connected substations. At the same time, RG&E will increase resiliency of the overall network by increasing the likelihood that the transmission lines will be available when called upon to meet demand on a contingency basis, thus contributing to RG&E's ability to avoid outages and/or restore power expediently when there is a significant outage. Two of the transmission line upgrades are overhead transmission lines that support load on circuits that are connected to six substations on RG&E's 34.5kV system, including distribution substations that are included in the RG&E Resiliency Plan. Extended outages on either overhead line would increase the load on adjacent circuits, contributing to diminished resiliency of the overall electric system. All overhead transmission construction will be performed in accordance with Avangrid's

Transmission & Sub-Transmission Resiliency Criteria, attached as Appendix B to Exhibit __ (RPP-3).

RG&E's two other transmission lines are underground line upgrades with gas-filled cables. They are each connected to substations that are part of RG&E's Resiliency Plan. RG&E's objective is to enhance resiliency by eliminating single contingency conditions and contemporaneously replacing manually-operated vacuum switches with automated switches. The Companies propose to replace the existing aging and difficult-to-maintain gas-filled cable with ethylene propylene rubber cable for portions of the circuit.

Q. Please summarize the 2019-2023 Resiliency Plan.

A. As presented in Exhibit __ (RPP-3), the Companies plan to address 40 NYSEG distribution circuits, 14 RG&E distribution circuits, and upgrades to 4 RG&E transmission lines in 2019-2020. This plan is based on feasibility, cost, and value. Siting and building a new line is challenging, depending on the length of the line and location. Exhibit __ (RPP-3) includes Appendices D and E that present maps describing the current and proposed topology for each circuit for NYSEG and RG&E, respectively. The investments are summarized in Table 1 below.

Table 1: 2019-2020 Hardening, Topology and Automation Investments

Investment	NYSEG	RG&E-D	RG&E-T	Total
Hardening				
Replace >75 Yr Poles	$9,396,000	$588,000		$9,984,000
Replace DLI Poles	$2,100,000	$246,000		$2,346,000
Replace DLI HH/MH	$130,000	$140,000		$270,000
Rebuild Transmission – Eng.[7]			$865,500	$865,500
Upgrade Wire Section	$274,000	$78,750	$14,760,000	$15,112,750
Topology[8]				
New Line	$6,341,509	$5,242,500		$11,584,009
Doubled Circuit	$100,739			$100,739
Upgrade Wire Section	$13,455,138	$379,250		$13,834,388
Voltage Conversion	$10,059,000			$10,059,000
New Circuit Breaker (SS)	$1,400,000			$1,400,000
New Recloser	$40,000			$40,000
New Step Transformers	$150,000			$150,000
Diesel Generation	$4,000,000			$4,000,000
Load Transfer	$1,000,000	$12,650		$1,012,650
Automation				
New SCADA Switch	$6,145,000	$3,225,000		$9,370,000
New Recloser (SCADA)	$1,825,000			$1,825,000
Upgrade Voltage Regulators	$23,000			$23,000
Total	**$56,439,386**	**$9,912,150**	**$15,625,500**	**$81,977,036**

The Companies have prepared an estimate for the 2021-2023 Resiliency Plan as reflected in the NYSEG and RG&E Five-Year Capital Investment Plan, 2019-2023. These estimates are presented in the Table 2 below.

[7] As described in Appendix F, the BCA considers costs required by RG&E to build transmission lines L753 and L755 in 2021 of $7,789,500 in order to match benefits with the total costs of these projects.

[8] NYSEG will incur $3,772,412 of additional costs to complete investments in three circuits (1105722, 1501601, and 2402583) that began in 2019-2020 in order to match benefits with the total costs.

Table 2: 2021-2023 Estimated Resiliency Plan Investments ($000)

	2021	2022	2023
NYSEG – Capital Projects	82,277	94,498	98,347
RG&E – Capital Projects	35,907	41,770	43,743
Total	**118,184**	**136,268**	**142,090**

VI. BENEFIT COST ANALYSIS

Q. Please describe the BCA utilized by the Companies.

A. The BCA is a forward-looking analysis that compares the costs of an up-front investment with the net present value ("NPV") of benefits that accrue over multiple years. Regulators are often interested in a BCA when evaluating the costs of a new program (e.g., an energy efficiency program or portfolio of programs), or a significant investment that provides new functionality (e.g., AMI). The Resiliency Plan represents incremental investments that improve the Companies' ability to deliver distribution service by focusing directly on an attribute (resiliency) that is increasing in importance to customers and to New York State. The Companies retained an expert consultant, Nexant, to perform the BCA, which is attached as Exhibit __ (RPP-3, Appendix F).

Q. How are costs and benefits measured in the BCA?

A. Nexant applied a broader "societal" perspective to the Resiliency Plan to identify and incorporate the external benefits that accrue to customers from fewer outages and faster restoration times. The cost side of the BCA is represented by the increase in O&M costs attributable to the EVM program plus the investment costs attributable to hardening, topology, and automation activities.

Q. What types of benefits are reflected in the BCA?

A. The BCA measures four sources of incremental benefits:

1) Avoided Interruption Costs represent the largest benefit stream. When customers experience interruptions, they bear economic costs.[9] The Resiliency Plan investments are designed to reduce the frequency and duration of interruptions and thus deliver an economic benefit to customers. To estimate the value of the reduction in customer interruption costs associated with reductions in outage frequency and duration, Nexant used the Interruption Cost Estimation Model developed in partnership with LBNL for the U.S. Department of Energy.[10]
2) Avoided Restoration Costs are benefits from restoring power to customers less frequently due to fewer outages in future years. Restoration costs consist of both capital and O&M.
3) Avoided Vegetation Management Costs are costs which would be spent in the absence of the Resiliency Plan on "standard," non-EVM (in the base case). The difference between the total proposed investment expenditure and the base case costs is the incremental cost of the resiliency investment.
4) Avoided Pole Replacement Costs are costs which would be spent on replacing poles in the absence of the Resiliency Plan.

Benefits accrue over the 30-year BCA period of analysis, ending in 2049.

Q. What time period is addressed by the Resiliency Plan's BCA?

A. The BCA covers 2019-2020.

Q. Please summarize the results of the BCA.

A. The following two graphs present the BCA results for NYSEG and RG&E.

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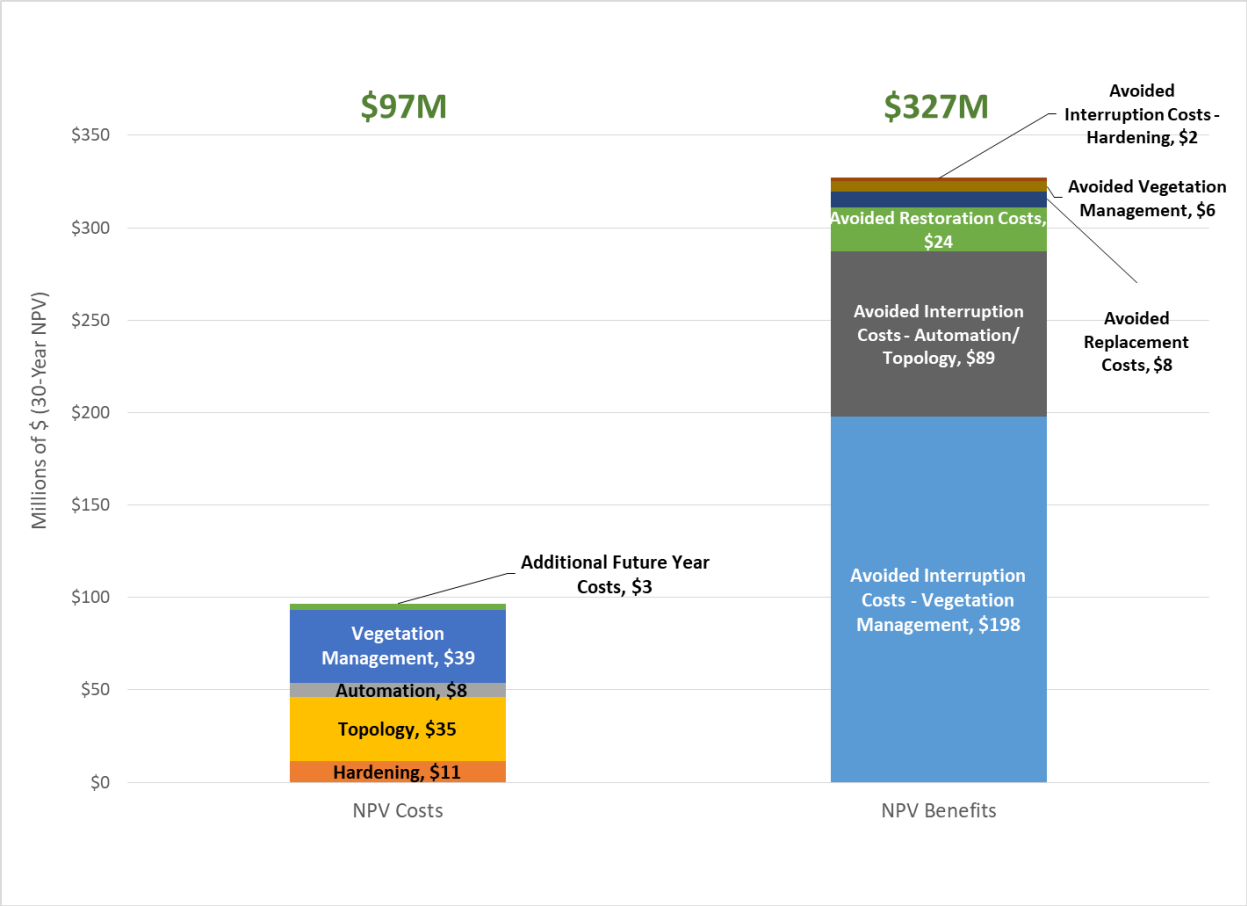
[9] Note that the terms "outage" and "interruption" are used interchangeably in this testimony.

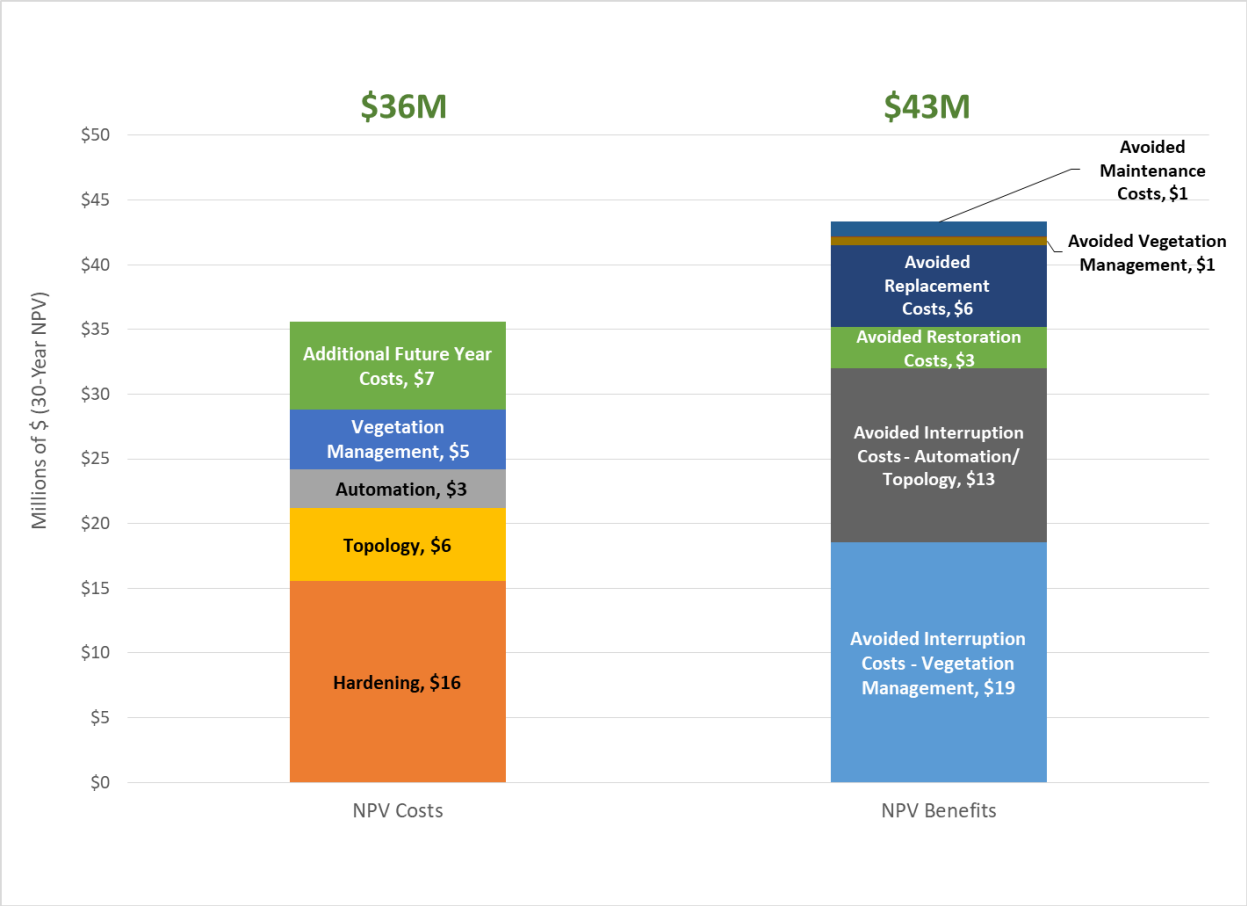
[10] ICE Calculator, Documentation, https://icecalculator.com/documentation.

Figure 2: NYSEG 2019-2020 Resiliency Plan NPV



The NPV of NYSEG benefits ($327 million over the 30-year period ending 2049) exceeds the NPV of costs ($97 million) by $230 million for a BCA ratio of 3.4 for NYSEG. Avoided Interruption Costs ($289 million) account for the overwhelming majority of NPV benefits. EVM is estimated to produce $198 million of Avoided Interruption Costs on an NPV basis. The combination of topology changes and enhanced automation that will reduce restoration times on the initial 40 NYSEG circuits is estimated to contribute $89 million to Avoided Interruption Costs.

Figure 3: RG&E 2019-2020 Resiliency Plan NPV



As shown above, the NPV of RG&E benefits ($43 million over the 30-year period ending 2049) exceeds the NPV of costs ($36 million) by $7 million for a BCA ratio of 1.2 for RG&E. Avoided Interruption Costs ($32 million) account for positive BCA results. EVM is estimated to produce $19 million of Avoided Interruption Costs on an NPV basis. The combination of topology changes and enhanced automation that will reduce restoration times is estimated to contribute $13 million to Avoided Interruption Costs.

VII. CONCLUSION

Q. Why are NYSEG and RG&E proposing the Resiliency Plan in this proceeding?

A. The Resiliency Plan will improve the resiliency of NYSEG and RG&E's electric distribution networks. The Resiliency Plan is designed to address all types of system impacts, including major regional storms causing widespread outages, storms that are less severe but still cause significant outages, and other events that can also disrupt the service of power to customers. The Resiliency Plan also enables the Companies to restore power more quickly when there are outages. As noted above, the number of storms and outages over the past decade and their impact on customers support the conclusion that has been reached by the Companies, their customers and public officials: there is a lot of work to be done and it should begin now. We have already taken steps to enhance resiliency by identifying new policies and practices that will increase the ability of the distribution network to withstand storms and other events that cause outages. In addition, the Companies are prepared to start more aggressive vegetation management practices (both cycle trim and danger tree work) while enhancing network topology so that power can be restored more quickly.

Q. Does this conclude the Panel's direct testimony at this time?

A. Yes.