



Isaias Task Force 30-Day Report Briefing

September 23, 2020

TIMELINE

COMPREHENSIVE REVIEW INITIATED

- Tropical Storm Isaias hit
- Task Force Established for Review of PSEG Long Island storm performance
- Information requests initiated
- Communication protocols established and implemented

September

90-DAY REPORT

- Preliminary findings provided

February

August

November

30-DAY REPORT

- Immediate corrective actions provided to mitigate risk during 2020 storm season

180-DAY REPORT

- Final report issued

AUGUST 4: TROPICAL STORM ISAIAS

- Approximately 530,000 customers impacted
- Up to 644,967 total outages
- PSEG Long Island's Outage Management System (OMS) failed
- Customers could not reach PSEG Long Island by telephone, text, mobile app, social media or website
- Life Sustaining Equipment (LSE) customer lists reportedly out of date
- Customers reported that AMI meters recorded usage during outages
- Estimated Time of Restoration (ETR) wrong and frequently revised
- Customers complained that restoration was too long (up to 8 days for 99% restored)

AUGUST 5: LIPA CREATES TASK FORCE

LIPA establishes Isaias Task Force (ITF)

- **Leaders:** Mujib Lodhi, Chief Information Officer & Rick Shansky, Senior VP of Operations Oversight
- **Steering Committee Members:** DPS Office of Investigations and Enforcement & Office of Resilience and Emergency Preparedness (OREP)
- **Independent Technical & Operations Expertise:**
 - PA – Lead consultant
 - EnerNex – AMI/SmartGrid analysis
 - Ulligent – Customer Communication & call center analysis
 - tieBridge – Program management & independent verification and validation support

AUGUST 10: LIPA RECOMMENDATIONS

- Expedite AMI deployment & accelerated integration into outage management system to improve service restoration performance
- Explore using mutual assistance agreement with National Grid to expand T&D damage survey during restoration
- Review T&D system resiliency during Isaias to promote further effective investments in storm hardening

AUGUST 12: LIPA RECOMMENDATIONS

- Undertake a thorough analysis of the root causes underlying the failures of PSEG Long Island's customer communications and outage management systems
- Inform LIPA of the progress made on assessing and improving the capacity, resiliency, and redundancy of the customer communications and outage management systems
- Inform LIPA whether failure analysis tools are being employed to analyze the problems and their findings, so far
- Inform LIPA of actions taken with Verizon to mitigate the circuit congestion issues observed during the storm

TASK FORCE OBJECTIVES

Conduct a comprehensive, independent review of PSEG Long Island's communications and service restoration systems before, during, and after Isaias, to:

- Identify root causes (operational and technical) of failures
- Report to the LIPA Board and public on Task Force findings and recommendations for immediate and long-term corrective actions
- Oversee PSEG Long Island's implementation of corrective actions

SCOPE



Workstream 1: Customer Communications and Outage Management System

- Review the Customer Communication Systems
- Review PSEG Long Island's OMS
- End-to-end system and process review – From “outage report to service restoration”



Workstream 2: Emergency Response Planning

- Review if Isaias was managed in accordance with the emergency restoration plan
- Review PSEG Long Island's emergency response preparation policies and procedures
- Review contingency planning elements

SCOPE



Workstream 3: Storm Management and Restoration

- Outage Management/Service Restoration processes
- Foreign crew sourcing, training, deployment, and management
- Application of “Lessons Learned” from Isaias and previous storm experiences
- IT system reliability and stress-testing processes



Workstream 4: Storm Resiliency

- Review performance of previous storm resiliency investments
- Long-term approaches to increasing system reliability and performance
- Other effective ways to improve resiliency of LIPA’s T&D assets and storm restoration efforts

SUMMARY OF 30-DAY REPORT FINDINGS

1. Many calls to report outages or to get outage status were unsuccessful due to overloaded inbound voice (telephony) infrastructure during the first 3 days of the storm.
2. PSEG Long Island's OMS experienced multiple issues with the high volume of data, rendering it effectively non-functional at times, and negatively impacting all communication channels and efficiency of restoration efforts.
3. Failures of PSEG Long Island's OMS prevented some customer text messages from being processed, the Outage Map from refreshing in a timely manner, and the Municipal Portal became frequently ineffective.

SUMMARY OF 30-DAY REPORT FINDINGS

4. Failures of PSEG Long Island's OMS as well as overloading of the "My Account" website infrastructure prevented customers from communicating with PSEG Long Island through the PSEG Long Island "My Account" customer portal or through their mobile app during the initial 2 days of the storm.
5. PSEG Long Island provided ETRs to customers that was frequently stale or incorrect and customers received numerous ETR updates that did not convey useful or accurate information
6. The 8-day (99%) restoration time substantially exceeded both the initial ETRs of up to 48 hours. It also exceeded the revised goal of Saturday midnight (4 days). The OMS failure was a significant cause of the poor ETRs, as were certain operational decisions in how to employ ETRs.

SUMMARY OF 30-DAY REPORT FINDINGS

7. Due to a misconfiguration of the Advanced Metering Infrastructure (AMI) system some customer saw consumption during for the outage on their “My Account” portal. (This has been fixed.)

RECOMMENDATIONS FOR IMMEDIATE IMPLEMENTATION



1. Upgrade (increase capacity) and simplify the telephony network to ensure more reliable customer access to outage information and customer service representatives.
 - PSEG Long Island has begun making changes but must complete these short-term fixes as soon as possible



2. Continue to analyze data and retest OMS to better characterize OMS failure modes and root causes.

RECOMMENDATIONS FOR IMMEDIATE IMPLEMENTATION



3. In the meantime, reconfigure OMS and business processes to simplify OMS operation:
 - During the first 24-48 hours of a large storm PSEG Long Island should not provide specific ETRs to customers because too little information is generally available at this very early stage of a major storm to provide accurate ETRs. Instead, temporarily publish “Assessing damage, will update...” message for customers.
 - As more information becomes available update the ETR message initially with a “global” ETR and/or region-specific ETRs for customers.
 - Finally, with even more situational information, provide customers with specific ETRs calculated by the system.

RECOMMENDATIONS FOR IMMEDIATE IMPLEMENTATION



4. Due to a system defect it is evident that OMS cannot handle high volumes of SCADA events. Until this defect is fixed, implement manual work-around processes if SCADA reporting events at greater than 150 events/hour.



5. Monitor OMS system logs and interfaces to proactively identify any issues that arise.



6. Test and deploy the PSEG Long Island mobility app so foreign field crews or PSEG Long Island crew guides efficiently receive restoration work assignments and report the completion of restoration orders.

RECOMMENDATIONS FOR IMMEDIATE IMPLEMENTATION



7. Ensure that automated systems are designed with resiliency and redundancy. Develop contingency plans in case of unanticipated failures of IT systems.

NEXT STEPS

- Continue ITF analysis of root causes of the system and process failures of technical infrastructure
- Focused analysis on emergency planning, storm management, and system hardening issues
- Continue regular meetings with PSEG Long Island team to ensure implementation of all recommendations
- Regularly brief the Board of Trustees on progress made
- 90-Day ITF Report in November

QUESTIONS?

For the Long Island Power Authority Board of Trustees
Submitted by the Isaias Task Force



TROPICAL STORM ISAIAS 30-DAY REPORT

September 23, 2020

NOTE FROM THE CEO

Dear Customers and Stakeholders,

On August 5, 2020, the day after Tropical Storm Isaias made landfall on Long Island, LIPA formed an Isaias Task Force to undertake a comprehensive, independent investigation into the failure of PSEG Long Island's communications and service restoration systems during the storm.

The Task Force's review will determine the root causes of the technical and communication issues encountered by PSEG Long Island during Isaias, provide actionable recommendations to improve storm restoration, and oversee implementation to ensure that the investigation's findings lead to results for customers.

The Task Force will issue a series of reports to the LIPA Board of Trustees within 30, 90, and 180 days. To provide both transparency and accountability, LIPA will make both the interim and final reports available to the public. This is the first of those reports.

PSEG Long Island's response to Tropical Storm Isaias has undermined the many tangible achievements of the LIPA Reform Act of 2013, including:

- Increasing customer satisfaction by 34 percent;
- Improving system-wide reliability by 39 percent;
- Hardening 1,000 miles of Long Island's electric grid;
- Procuring over 1,000 megawatts of clean energy; and
- Achieving four upgrades of LIPA's credit ratings.

PSEG Long Island's failures during Isaias are inconsistent with these accomplishments and are simply unacceptable. Long Islanders deserve better, and LIPA is working to ensure that they get better.

I would like to thank the employees of both LIPA and PSEG Long Island who continue to work around the clock to address these issues expeditiously, as well as our colleagues at the Department of Public Service, who are both providing guidance to this review and also undertaking a separate, larger investigation of the storm response by all New York utilities during Isaias.

Thomas Falcone

September 23, 2020



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EXECUTIVE SUMMARY

On Tuesday, August 4, 2020, Tropical Storm Isaias landed on Long Island with rain and wind gusts of up to 70 mph. The resulting damage to the electrical system resulted in approximately 645,000¹ customer outages. Full restoration took eight days² and resulted in significant criticism of PSEG Long Island from customers and government officials. This criticism was especially vocal regarding the inability to reach the company across multiple communication channels, inaccurate estimates of restoration times, and the overall time required to complete the restoration.

Notably, on the afternoon of August 4, PSEG Long Island's inbound voice telephony infrastructure became overloaded and thousands of customers received busy signals when calling the utility to report an outage. PSEG Long Island's Outage Management System (OMS) and the related systems that are used to manage restoration efforts, estimate restoration times, and provide restoration information to customers, also began to fail.

On August 5, the Long Island Power Authority (LIPA) initiated an independent review of the circumstances and root causes that led to the lapses in PSEG Long Island's communications and restoration systems during the storm. LIPA appointed its Senior Operations Oversight and Information Technology executives to lead an Isaias Task Force (ITF or Task Force), together with the heads of the Offices of Investigations and Enforcement and Resilience and Emergency Preparedness at the New York State Department of Public Service (DPS). The Task Force is supported by a team of independent utility consultants experienced in management, operations, and technical design of utility systems, as well as by LIPA staff.

The Task Force is charged with both providing actionable recommendations and overseeing PSEG Long Island's remediation activities. LIPA committed to reporting the Task Force's findings, observations, and recommendations to the LIPA Board of Trustees and public in a 30-Day Report, 90-Day Report, and 180-Day Final Report.

The ITF is organizing its review around four workstreams, each led by a highly qualified and experienced Subject Matter Expert (SME), to help establish what happened and what needs to be improved upon. The four workstreams are:

- Customer Communication and Outage Management Systems
- Emergency Response Planning
- Storm Management and Restoration
- Storm Resiliency

The Customer Communication and Outage Management Systems workstream has been deemed the highest priority for the Task Force and is the primary focus of our preliminary findings in this 30-Day Report.

What really happened with customers' calls? Why were customers not able to reach PSEG Long Island through other communication channels like text messages and the customer portal? Why were Estimated Restoration Times (ETRs) incorrect and why did they change so frequently? This workstream has the highest potential to identify near-term improvements to restoration efforts.

¹ Total number of customer interruptions reported during the storm (data provided by PSEG Long Island to DPS). This count includes all outages reported and includes counts of multiple incidents reported by the same customer. LIPA is in the process of independently verifying this data and the results will be available in a future report.

² PSEG Long Island restored approximately 99 percent of the outages by August 12, 2020 (Source: PSEG Long Island OMS data)

PSEG Long Island has executed several corrective actions and continues to pursue its own analysis of root causes of the various system malfunctions. This 30-Day Report by the Task Force is intended to provide the LIPA Board of Trustees and other stakeholders with the preliminary results of the ITF inquiry into root causes, the state of PSEG Long Island's remediation activities, and an assessment of PSEG Long Island's preparedness for the remainder of the 2020 Atlantic hurricane season. Where possible at this point in the review, and where we believe it is necessary, the Task Force recommends courses of action. The 30-Day Report is preliminary in nature, and any findings and conclusions are tentative and subject to confirmation through further gathering of data and analyses.

The other workstreams — Emergency Response Planning, Storm Management and Restoration, and Storm Resiliency — will be addressed in more detail in the 90-Day and 180-Day Reports. The 90-Day and 180-Day Reports will also provide results from continuing investigations of the Customer Communication and Outage Management Systems workstream.

Summary of the Initial Findings

Based on the Task Force's work to date, we have identified causal factors that contributed to the inability of customers to reach PSEG Long Island to report an outage and the inability of customers to receive a timely and accurate ETR. While our investigation into the root causes is ongoing, the evidence clearly supports the following major findings:

Major finding 1: Many customer calls to report outages or to get outage status were unsuccessful due to overloaded inbound voice (telephony) infrastructure.

Major finding 2: The OMS experienced multiple issues with the high volume of data, rendering it effectively non-functional at times, and negatively impacting all communication channels and field management activities.

Major finding 3: Failures of the OMS prevented some customer text messages from being processed and the Outage Map from refreshing in a timely manner.

Major finding 4: The total restoration time of eight days substantially exceeded both the initial ETRs of up to 48 hours and the subsequently revised goal of Saturday midnight (four days). The failure of the OMS was a significant cause of the inaccurate ETRs, as were certain operational decisions in how to employ ETRs.

The Task Force recommends specific near-term actions be taken to address these major issues so that customer communications and outage restoration activities for the balance of the 2020 storm season will be improved. These near-term actions are:

1. Upgrade and streamline the telephony network to ensure customer access to outage information and customer service representatives. PSEG Long Island has already taken two steps to increase capacity and reduce the potential for blockages on the telecommunications path between its Long Island customers and their high-volume Interactive Voice Response (IVR) service. PSEG Long Island needs to complete these short-term actions by transferring the routing of outage and customer billing calls from Verizon Telephone (traditional telephone service) to Verizon Business (internet-based, dynamically routed calls).
2. Provide realistic communications to customers at the outset of the storm by implementing the “Null ETR” functionality for major storms, thereby enabling an “Assessing damage, will update expected restoration times in 24 hours” message to be communicated to customers at the outset of the storm. Codify this approach and the necessary supporting processes and responsibilities in the Emergency Restoration Plan (ERP). This should be followed by working with CGI to ensure that the “OMS Storm Mode” (as discussed in section 3.2.2) is functioning as designed. A functioning comprehensive OMS Storm Mode will extend the benefits of “NULL ETR” by also allowing OMS and CAD (Dispatching) to operate in a way that prevents OMS unresponsiveness from affecting field management activities.
3. Implement a manual work-around process to ensure that the current OMS performs at an acceptable level in future storms if transmission and distribution breaker and recloser operations exceed 150 per hour, and actively monitor OMS system logs and interfaces to proactively identify any issues that arise. Update the ERP to assign these responsibilities to specific members of the Incident Management team.
4. Rapidly test and deploy the mobility application to enable foreign field crews, or their PSEG Long Island crew guides, to receive restoration work assignments and report the completion of restoration orders electronically. Update the ERP to document the work processes required to dispatch work to foreign crews electronically, and train the involved staff in this updated work process.

For each of these near-term recommended actions, there are supporting findings and detailed discussion in the body of this report.

The Task Force recommends that PSEG Long Island complete the near-term actions to address the identified causal factors by October 15, 2020 and believes that the implementation of these actions will significantly improve service for customers, should another major storm occur in 2020.

Our investigation into the root causes of the failures during Isaias is ongoing. The ongoing investigation is a detailed, data driven analysis to understand each of the potential failure modes in the communications systems, service restoration systems, and storm management processes. Additional findings and recommendations will be forthcoming as the Task Force makes further progress.

SECTION 1

INTRODUCTION



1.1 About LIPA

LIPA was created by an Act of the New York State Legislature in 1986. LIPA became the retail supplier of electric service in the Counties of Nassau and Suffolk (with certain limited exceptions) and a portion of Queens County known as the Rockaways, on May 28, 1998, by acquiring the Transmission and Distribution (T&D) system of the Long Island Lighting Company (LILCO). LIPA provides electric delivery service in the Service Area, which includes approximately 1.1 million customers. The population of the Service Area is approximately 2.9 million.

LIPA utilizes a public-private partnership business model and contracts with PSEG Long Island, a subsidiary of Public Service Enterprise Group Incorporated, to operate LIPA's electric system under a 12-year Amended and Restated Operating Services Agreement (OSA) contract. LIPA's public-private business model delivers the advantages of public power to customers, including LIPA's not-for-profit status, access to low-cost financing and federal disaster relief grants, local control, and dedication to Long Island and the Rockaways.

1.2 LIPA and Department of Public Service Oversight Responsibilities

LIPA's contract with PSEG Long Island, as well as the LIPA Reform Act of 2013, provides PSEG Long Island broad control and responsibility for operating the utility, including storm preparedness, customer communication, and service restoration. LIPA owns the utility assets and, as the owner, exercises contractual and statutory oversight over PSEG Long Island's budget and operations.

LIPA at a Glance

Customers

Residential: 1,033,760
Commercial: 148,703

2019 Peak Demand

5,474 MW

Generating Capacity

5,762 MW

Energy Requirements

20,773,082 MWh

Transmission System

1,400 miles

Distribution System

9,000 miles overhead
5,000 miles underground
189,000 transformers

Substations

30 Transmission
152 Distribution

2020 Budget

Operating: \$3,753,951,000
Capital: \$820,363,000

Pursuant to its oversight responsibilities, LIPA annually reviews PSEG Long Island's budget requests and performance metrics. Additionally, LIPA independently reviews and audits PSEG Long Island's operations services, and independently reviews and monitors PSEG Long Island's storm preparation and response. LIPA reviews the cost substantiation for PSEG Long Island's storm response, and where possible, applies to the Federal Emergency Management Agency or FEMA for grants to reduce the cost of storms to customers.

The LIPA Reform Act provides the Department of Public Services (DPS) with oversight responsibilities of both LIPA and PSEG Long Island. LIPA's storm oversight activities are in addition to DPS' statutory role, and DPS' statutory role is the same for PSEG Long Island as it is for the state's other utilities. The DPS provides independent recommendations to the LIPA Board of Trustees and, to date, the Board has accepted every recommendation offered by the DPS.

Regarding oversight of storm preparedness and response, New York Public Service Law requires utilities to submit a comprehensive Emergency Restoration Plan (ERP) for review by the DPS each year. LIPA and DPS both review the ERP, and DPS provides independent recommendations for ERP modifications. PSEG Long Island has adopted all of the DPS' ERP recommendations each year.

DPS also has statutory authority to investigate PSEG Long Island's emergency preparedness and response. DPS has exercised that authority for Winter Storms Riley and Quinn in 2018, and in addition to its participation in this Task Force, is also conducting a separate review in conjunction with the New York State Department of Financial Services into the responses of several regional utilities to Tropical Storm Isaias.³

1.3 Tropical Storm Isaias

Tropical Storm Isaias was first identified by the National Hurricane Center on July 23, 2020 and originated from a vigorous tropical wave off the coast of Africa. On August 1, the storm made landfall on North Andros, The Bahamas, and subsequently proceeded up the East Coast of the United States then dissipated over Quebec, Canada on August 6. On Tuesday, August 4, 2020 Tropical Storm Isaias hit Long Island with sustained wind speeds of 45 to 50 mph and gusts of up to 70 mph.⁴ The storm left in its wake a long path of fallen trees and a trail of debris. Isaias brought only approximately 0.2" of rainfall across Long Island.

FIGURE 1:
Tropical Storm Isaias making landfall on Northeast



Source: National Oceanic and Atmospheric Administration

³ In the matter of DPS Investigation into the utilities' preparation and response to August 2020 Tropical Storm Isaias and resulting electric power outages, DPS matter no. 20-01633.

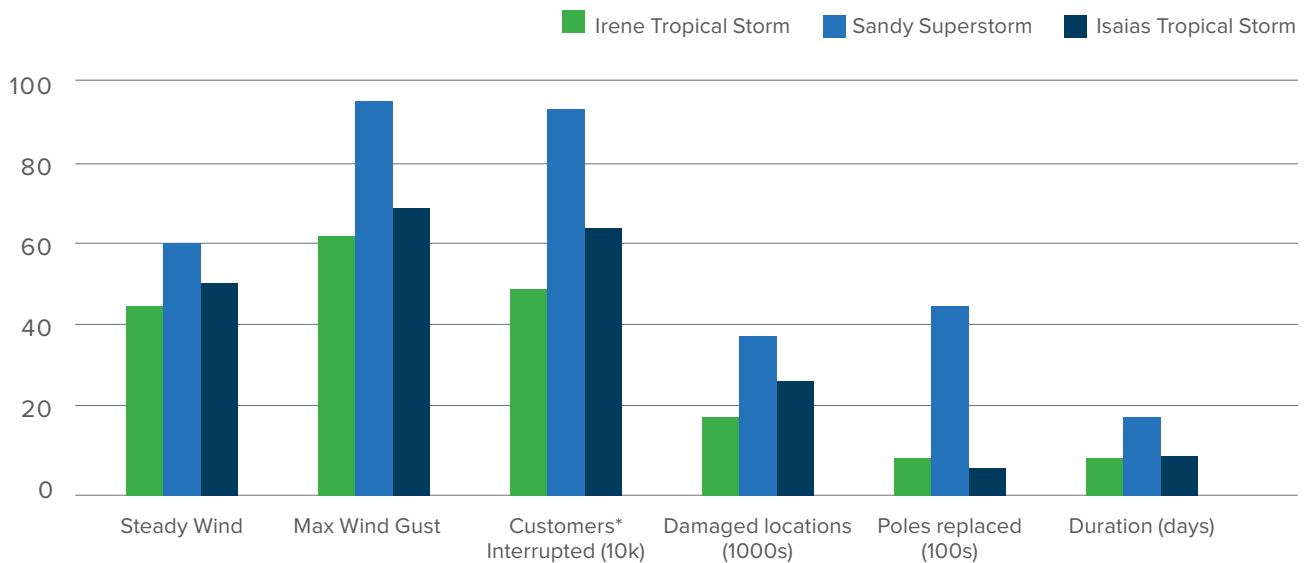
⁴ As measured at John F. Kennedy and Islip MacArthur Airports.

1.4 Damage from Isaias and Impact on Electric Service

As the powerful and destructive storm swept through New York, it downed hundreds of large trees, pulled down thousands of electric poles, and left more than 1.2 million across the state of New York without electricity.

Tropical Storm Isaias was one of the most damaging storms ever to hit Long Island's electric grid. In total, over 20,000 outage events were acted on in LIPA's service territory itself, and more than 645,000⁵ customers were impacted across the duration of the event. Figure 2 compares Isaias to other major storms.

FIGURE 2:
Comparison of Major Storms affecting Long Island in Recent History



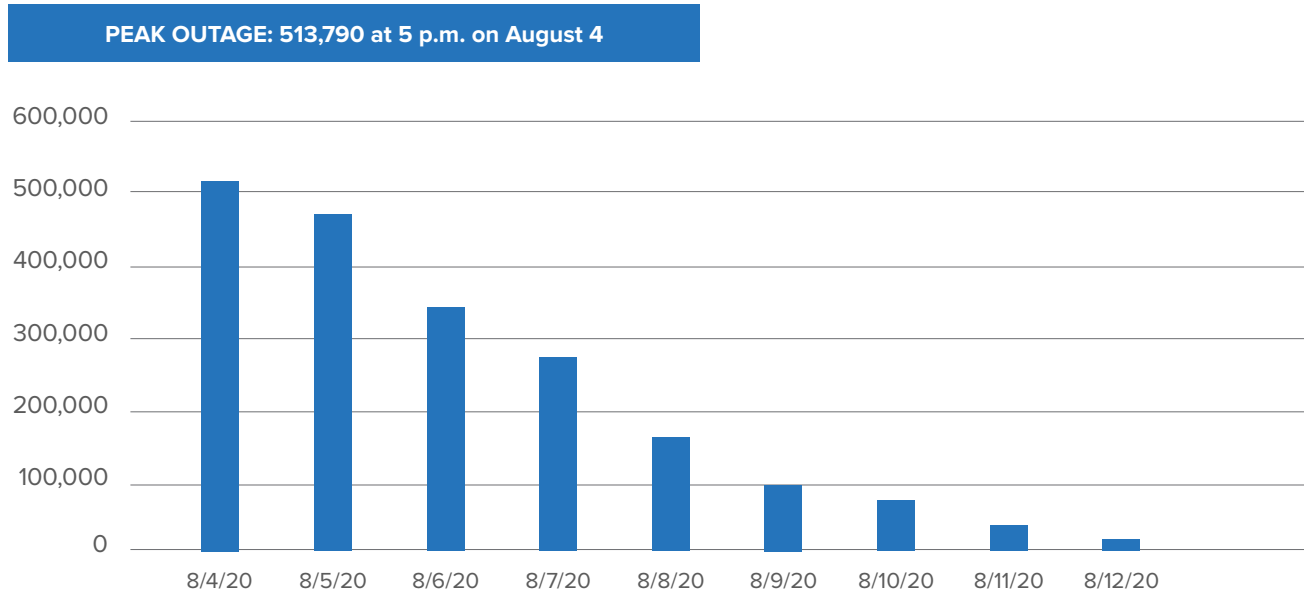
*For Superstorm Sandy, data reflects peak outages not total.

1.5 Additional Weather Events during Restoration Period

In the days after Tropical Storm Isaias, the electrical system sustained additional damage. The storm left LIPA's service territory in the early morning hours of Wednesday, August 5. The rest of the week's weather remained steady with the balance of Wednesday staying reasonably calm and scattered showers on Thursday and Friday. On Friday, August 7, five substations lost supply due to salt spray contamination issues. This coupled with transmission line contingency constraints caused an estimated 16,000 customers to lose power for more than five minutes. There was no significant widespread wind associated with the rain showers, but localized wind may have contributed to the salt spray. Figure 3 shows customers without power each day of the storm restoration period.

⁵ 645,000 customers is PSEG Long Island's current estimate, and subject to confirmation.

FIGURE 3:
Customers without power (8/4/2020 to 8/12/2020)



1.6 Customer Communication Failures after Isaias

Following Isaias, many customers were without power and unable to communicate with PSEG Long Island to report the outage or obtain information on when service would be restored. Customers who were able to communicate with PSEG Long Island reported that the ETRs that they were provided were incorrect and often changed. Customer outcry was intense and evident in the news articles, editorial pages, and the public statements of state and municipal government officials. On August 20, the New York State Legislature called a Joint Virtual Hearing to address the emergency storm response and customer communications by utilities located in New York City, Long Island, Westchester County, and the greater Hudson Valley.

Cold Spring Harbor Laboratory, a PSEG Long Island commercial customer, offered the following testimony for the Legislative Hearing: *“The limited, direct communication the Lab was actually able to have with PSEG Long Island resulted in the same responses from the company for six days straight – ‘power would be restored by tomorrow at noon’ or ‘tomorrow at midnight.’ At first, the Lab had great confidence in PSEG’s communications, but as the days passed it was clear that information, we were receiving from PSEG representatives was inaccurate.”* PSEG Long Island’s inability to communicate with customers and provide accurate and timely ETRs is unacceptable and must be corrected.

SECTION 2**ISAIAS TASK FORCE INDEPENDENT REVIEW****2.1 About the Isaias Task Force**

On August 5, 2020, the day after Tropical Storm Isaias, LIPA's CEO, Mr. Thomas Falcone, created the ITF, as it was evident that PSEG Long Island's customer-facing communications systems were not functioning effectively and PSEG Long Island's performance during the ongoing storm restoration was not responsive to customer expectations.

The Task Force is led by Mr. Rick Shansky, LIPA's Vice President of Operations Oversight; Mr. Mujib Lodhi, LIPA's Chief Information Officer; Mr. Kevin Wisely, DPS' Director of Office of Resilience and Emergency Preparedness; and Mr. Joseph Suich, DPS' Director of Office of Investigations and Enforcement.

The Task Force is supported by LIPA staff and a team of industry technical experts from four leading utility advisory firms: PA Consulting Group, an international firm specializing in Utility Transmission and Distribution operations; Utelligent, experts in Utility Customer Service and Customer Communications; and EnerNex, experts in Utility Automation and Smart Grid systems. TieBridge, a consulting firm with a long history of managing complex IT projects for large municipal utilities, is providing program management and quality assurance support to the team. Appendix 1 contains brief background information on the people who make up and support the Isaias Task Force.

2.2 Objectives and Structure of this 30-Day Report

This 30-Day Report is intended to provide the LIPA Board of Trustees and other stakeholders with the preliminary results of the Task Force's inquiry into root causes of issues during Isaias, the state of PSEG Long Island's remediation activities, and preparedness for the ongoing 2020 Atlantic hurricane season.

The first order of business for the Task Force was to quickly identify the most impactful failures during Isaias, investigate the root causes, and rapidly develop and implement corrective actions. As the technical systems failures were the primary cause of a number of cascading failures with a broader range of consequences, the Task Force has initially focused on the design, configuration, and operation of PSEG Long Island's Customer Communication and Outage Management Systems. The subsequent 90-Day and 180-Day Final Reports will address in detail the broader questions on PSEG Long Island's emergency planning, preparations, and storm management and restoration.

2.2 Objectives and Structure of this 30-Day Report

The ITF review includes four workstreams:

- Customer Communication and Outage Management Systems
- Emergency Response Planning
- Storm Management and Restoration
- Storm Resiliency

The review of the Customer Communication and Outage Management Systems starts with a detailed understanding of all PSEG Long Island systems that are a part of the “contact to service restoration” value chain. This includes the telecommunications systems, customer and municipal contact portals (including mobile applications and text messaging), customer notification systems, outage data collection systems, messaging middleware, and outage management systems. The scope also includes messaging interfaces with feeder systems such as Supervisory Control and Data Acquisition (SCADA), Geographical Information System (GIS), Distribution Management System (DMS), Advanced Metering Infrastructure (AMI), and other relevant data sources. The Task Force will also look at downstream systems such as Computer Aided Dispatching (CAD), mobile work management, and outage inspection systems.

The Task Force will also verify the data associated with the performance history of these systems, including system logs, transactional data, system configuration data, operational procedures and manuals, program outputs, etc., to establish baseline information on system characteristics and fault modes.

ITF will also review system test plans, test cases, and test results; undertake independent testing; and guide PSEG Long Island to develop appropriate testing strategies. On a parallel track, ITF is developing use cases for Fault Mode Effect Analysis (FMEA) modeling to aid in the “root cause analysis” of observed defects.

When the problems and the requirements are well understood, the Task Force plans to provide high-level oversight to PSEG Long Island’s system planning and development process, which includes infrastructure, system architecture, contingency planning, and quality assurance. The final goal is to have PSEG Long Island’s storm management network perform to benchmarks that are clearly understood and responsive to customer expectations.

On the Emergency Response Planning workstream, the Task Force will review PSEG Long Island’s current plans and procedures to identify their strengths and weaknesses, undertake an operational audit of their performance during Isaias, and make recommendations to strengthen the plans, policies, and procedures.

On the Storm Management and Restoration workstream, the Task Force will review the technical approaches to storm management around the entire network. This includes topics in emergency preparedness, situational awareness, training, incident command management, public information dissemination, and stakeholder management. The expected outcome from this workstream is an optimized process for the execution of the service restoration process that delivers faster restoration, safe and efficient resource deployment and management, and an informed and satisfied customer base.

On the Storm Resiliency workstream, the Task Force will review the effectiveness of LIPA’s prior investments in storm hardening and make recommendations for future investments.

2.3 Ongoing Activities of the Isaias Task Force

The Task Force is executing its oversight in several phases. In the initial phase, the Task Force is primarily focused on identifying the root causes and validating corrective actions for PSEG Long Island’s Customer Communication and Outage Management Systems, due to their primacy in causing challenges to the other workstreams of the Task Force’s review. The Task Force is undertaking formal discovery, interviews, data and forensics analysis, and internal modeling. Starting on August 10, the Task Force began engaging PSEG Long Island on many fronts, including:

- Formal “Information Requests” to PSEG Long Island on its Isaias storm response. LIPA sent approximately 150

information requests and responses are analyzed as they are received.

- Daily progress meetings with PSEG Long Island on its fact-finding and mitigation activities. This oversight activity provides transparency and accountability to the project.
- Weekly, multiple in-depth discussions with PSEG Long Island focusing on specific technical issues. These weekly meetings ensure that (a) the PSEG Long Island teams are working on the right problems and with the needed urgency, (b) the technical approach and analysis methodology is subject to critical review, (c) the resulting design and architecture decisions have been carefully considered, and (d) PSEG Long Island's service agreements demand appropriate accountability from vendors and third-party service providers.
- Root cause analysis. LIPA is reviewing PSEG Long Island's project documents, test plans, test execution results, project prioritizations, infrastructure designs, capacity planning decisions, system resilience and disaster recovery plans, and contingency planning efforts.
- Discussions with PSEG Long Island third-party service providers have been conducted to obtain independent reporting of the problems encountered in the storm as well as a clear understanding of the accountabilities of the engagements. LIPA has had separate interviews with Verizon (telecommunications provider), Intrado (provider of PSEG Long Island's contracted high-volume Interactive Voice Response), CGI (provider of PSEG Long Island's Outage Management System software), Kubra (cloud-based service provider for processing customer "text messages" and also maintaining the web-based "outage map" and the Municipal Portal), and Presidio (service provider responsible for maintaining PSEG Long Island's Customer Service Call Center solutions).
- Independent Failure Mode Effect Analysis modeling of the system is being investigated. This formal methodology will facilitate discovering potential failures that may exist within the design, configuration, implementation, or operation of these systems.
- Review of PSEG Long Island's planning and operations of its Information Technology assets to understand opportunities for improvement.

The progress of the Task Force in the first 30 days is summarized in the remaining chapters of this report.

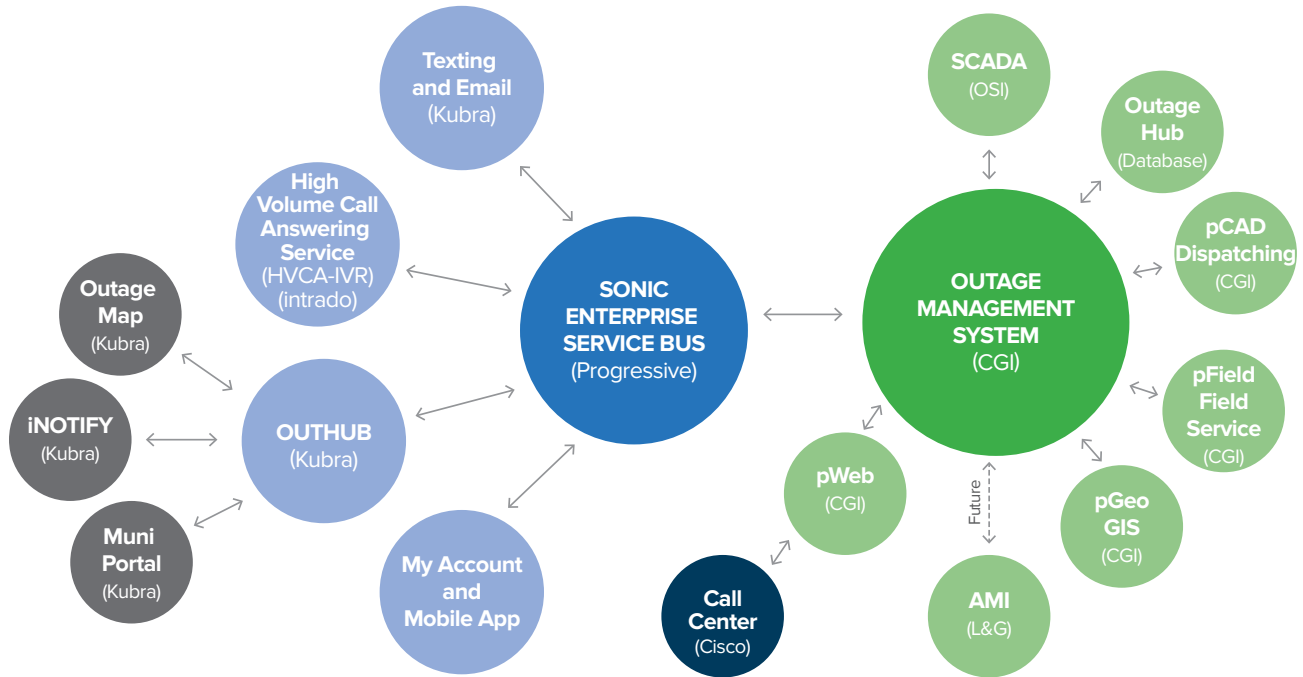
SECTION 3**CUSTOMER COMMUNICATION AND OUTAGE MANAGEMENT SYSTEMS****3.1 PSEG Long Island's Communications and Outage Management Systems**

PSEG Long Island provides multiple channels to customers and stakeholders for both routine and storm and outage related communications. Routine communications include account, billing, and energy usage information. Storm and outage communications include downed wire and outage reporting, customer status and estimated restoration times, overall system status and service restoration activities, and pre-storm notifications.

The service restoration process, whether for routine “blue sky” outages or in the aftermath of major storms, requires the coordinated action of numerous utility staff, relies on information from customers as well as multiple utility operating systems, and, when well executed, provides customers with useful expected restoration time information. At the center of the service restoration process is PSEG Long Island's Outage Management System or OMS. The OMS depends on timely and accurate information from several other systems, and in turn, is responsible for supplying data in real time to other “downstream” systems such as PSEG Long Island's Outage Map or its outbound Texting Service to ensure that customers receive prompt status notifications. Figure 4 shows PSEG Long Island's OMS and the ancillary systems that it connects to.

All customer communications related to outage and restoration reporting and status, regardless of the initiating channel, entail transmitting information to and receiving information from the OMS. The OMS is the central repository for inbound outage reports and the processing engine for the service restoration process. The OMS takes in data from customers reporting outages through any of the multi-channel customer communication options and integrates electrical system status information from SCADA devices that monitor the electrical network. The OMS analyzes and integrates the separately produced outage information and predicts the location of the failure. For each predicted failure, it then dispatches a crew Work Package to initiate the necessary repair, and the status and completion of this work is tracked through the OMS.

FIGURE 4:
Architecture of PSEG Long Island's Outage Management System



The OMS also uses all of its available information to calculate the estimated time of restoration (ETR) for each customer outage and updates these ETRs when new information from the dispatched repair crews becomes available. The OMS makes these ETRs available to all customer communications channels, including the outage map, text updates, and live agent calls.

While PSEG Long Island communicates with its customers through a wide variety of methods including phone, website, text, mobile devices, email and social media, the goal is for these different channels to work together to allow a customer to be served in the manner they prefer. During Isaias, however, customers encountered difficulties communicating through almost all of the channels.

3.2 Findings and Recommendations

As summarized above, the Isaias Task Force review is based on data and facts independently verified and reviewed. Its ultimate findings, conclusions, and recommendations for improvements will therefore be solely the product of the work of the members of the Task Force, LIPA staff, and the technical and forensic expertise of independent consultants who have been retained by LIPA specifically for this task. Theories offered by PSEG Long Island as to the causes of various lapses during and after the storm will be independently tested for corroboration in the raw data that the Task Force has and is continuing to collect, in conjunction with information gathered during daily meetings between the Task Force and PSEG Long Island personnel with direct knowledge of various systems, processes, and their functioning during Isaias. The central objective of the Task Force is to learn the truth of what happened and why it happened, and based on accurate assessments of the root causes, make recommendations geared to best avoid the same failures from happening again. While that work continues, our efforts thus far have led to certain preliminary findings as set forth below.

3.2.1 Voice Calls / Telephony Networks

Finding 1: Much of the inbound voice (telephony) infrastructure failed or was overloaded. Consequently, many customer calls to report outages or receive status updates were not successful in the first three days of the storm.

PSEG Long Island's customers can report outages by calling a designated toll-free number, 800-490-0075 (the Outage Line). During relatively calm periods, these calls are directed to the PSEG Long Island Call Center and are answered by a call center representative or the PSEG Long Island Interactive Voice Response (IVR) system. During storm/high volume periods, PSEG Long Island Call Center Management can elect to re-direct 25 percent, 50 percent, or 100 percent of incoming calls from the Outage Line to a self-service automated High Volume Call Answering (HVCA) IVR service provided by PSEG Long Island's vendor Intrado. The HVCA IVR provides customers with three options: (1) report outage, (2) check status of reported outage, and (3) report downed power line. The first two options are processed by the HVCA, and the third, reporting of downed wires, is re-directed to a live Call Center agent.

PSEG Long Island also has a second toll-free number 800-490-0025 for billing-related calls (the Billing Line). Calls are directed to the PSEG Long Island Call Center. There is no redirect process since the number is not intended for high volume call scenarios such as reporting outages during a storm.

The Call Center network is designed for a capacity of up to 575 simultaneous calls which are assigned to agent devices or to the Call Center IVR (Nuance). During the initial days of the storm, PSEG Long Island reports that the Call Center was staffed with approximately 250 agents.

Capacity for the Intrado HVCA is shared across all Intrado customers, but it was expected that PSEG Long Island would have capacity for a minimum of 2,600 simultaneous calls at any given time,⁶ for an estimated 78,000 calls per hour.

The Outage and Billing Lines are provided under contract with Verizon. At the time of Isaias, the redirecting of Outage Line calls to the HVCA required calls to be transferred from the Verizon network to an intermediate AT&T-managed number provided by Intrado, and then from AT&T to the HVCA.

There was a significant initial failure that prevented customers from reporting outages or hearing outage updates via phone. This was prevalent for the first 24 hours of the storm from August 4 at 12:00 p.m. until August 5 at 11:10 a.m. Because customers could not get through by phone, some turned to other methods of reporting outages such as text, website, and social media. However, many were not able to contact PSEG Long Island by any means because all channels were congested.

ITF's investigation concludes there was not enough capacity among the Verizon lines to move the Outage Line calls between the local Verizon network and the AT&T networks to the HVCA on the first day of the storm and part of the second day. This created a blockage and limited the ability for customers to take full advantage of the HVCA system by dialing the Outage Line. We estimate approximately 75 percent of the customer calls (potentially over 400,000 calls⁷) to PSEG Long Island's Outage Line did not go through on the first day of the storm (August 4).

⁶ While this was our initial understanding (and also the understanding of PSEG IT management), we were later advised that no such contractual commitment existed between Intrado and PSEG Long Island.

⁷ PSEG Long Island reports that over 400,000 calls were blocked on August 4 on this shared circuit. Verizon also estimates that as much as 10 percent of these calls may have been from sources other than PSEG Long Island. LIPA has not independently confirmed this number.

The inability of customers to report outages on the Outage Line led many to attempt to report outages through the Billing Line. The capacity limitations between Verizon and PSEG Long Island's Call Center caused approximately 60 percent of the customers who tried to report their outage through the Billing Line between August 4 and 6 to be blocked (approximately 542,000 calls over the three day period⁸).

Key issues and events during and after the storm include:

- Due to the limited number of telecommunication lines provisioned between the Verizon and AT&T networks, outage reporting calls to the Intrado HVCA became rapidly congested. Customer calls to the Outage Line started getting busy signals or call drops around 12:00 p.m. on August 4. As some customers who were unable to reach the Outage Line tried calling the Billing Line instead, the incoming call capacity at the Call Center was also overloaded, leading to busy signals/blocked calls on the Billing Line as well.
- In the afternoon of August 4, PSEG Long Island's Call Center managers realized that customers were receiving busy signals on the Outage Line and raised a high priority ticket to Verizon for investigation. The ticket was escalated after one hour. Meanwhile, Verizon central offices recorded that some call attempts were not getting through to AT&T, Intrado's interconnect provider. However, Verizon did not associate this issue with the problem that PSEG Long Island was having with calls not being completed. The capacity issue was identified 10 hours after PSEG Long Island raised the high priority ticket with Verizon.
- Once the issue was escalated and Verizon diagnosed that more capacity was needed, Verizon added additional lines to allow PSEG Long Island customers to reach the HVCA, eliminating the blocked calls at around 11:00 a.m. on August 5. It was approximately 20 hours from the time an initial request for help was made before consistent, reliable access to the HVCA system was provided. In those 20 hours, we estimate over 400,000 customer calls were dropped or received busy signals on their attempt to reach PSEG Long Island.
- Verizon also worked with PSEG Long Island to implement a Verizon IVR that intercepted calls to the Billing Line to redirect outage calls to the HVCA. Unlike the pre-existing Call Center IVR that was initially used to try to mitigate the Call Center overloading, the new IVR sits outside the Call Center and does not use its capacity. It was implemented on August 6.
- On August 24, PSEG Long Island, Verizon, and Intrado implemented a change that removes AT&T from the HVCA routing, eliminating one potential bottleneck. A permanent solution that ports the Outage Line from Verizon New York (the Local Exchange Carrier) to Verizon Business Network (a Division of Verizon Communications) is expected to be completed by October 15, 2020. This will further streamline the routing and eliminate the potential bottleneck between the local Verizon carrier switches and the Verizon Business network. Capacity testing of the interim change (elimination of AT&T handover) has been conducted, and end-to-end capacity testing for the Outage Line is planned once the in-progress design changes are implemented.

⁸ As reported by PSEG Long Island, based on source data from Verizon and subject to confirmation.

Recommendations

- PSEG Long Island should complete the implementation of the planned telecommunication design changes and conduct additional capacity testing as soon as possible. The Task Force will review the design and results of these capacity tests. PSEG Long Island should explore if there are ways to conduct the load tests so that the calls (a) originate in the service territory, and (b) consist of a representative mix of land line and mobile phones. We believe that it is prudent not to simply rely on Verizon Business's assurance that the new design will accommodate device and location diversity.
- Improve the pre-storm planning process and include specific communication, coordination, and escalation with the communication service carriers and the HVCA provider before and during the storm. PSEG Long Island must ensure that Verizon technical support is on stand-by during a storm and Verizon representatives are included in the storm management call bridge.
- The existing infrastructure for handling calls within the PSEG Long Island Call Center should be upgraded to a more recent version. PSEG Long Island should modernize its call center infrastructure to a technology that uses the newer "SIP Trunking" technology. Such technology will circumvent many of the current capacity limitations inherent in a traditional voice telephony (PBX) design, and will additionally make the system more scaleable and elastic for future expansions.⁹
- PSEG Long Island should redesign their communications system so that its Billing Line can also be used to receive outage calls in case of a storm emergency. PSEG Long Island has advised us that this recommendation has already been implemented. We will elaborate on this in the 90-Day Report after the ITF has had the opportunity to independently verify the deployment.
- PSEG Long Island should develop appropriate capacity monitoring and management processes to support evidence-based demand forecasting and capacity planning.
- PSEG Long Island should review the service operation process between PSEG Long Island and Verizon to understand how the major issues as identified are handled. A formal service level agreement (SLA) and performance-based stipulations in PSEG Long Island's contract with Verizon and other telecommunications carriers should appropriately reflect the importance of PSEG Long Island's communication needs to the community.

PSEG Long Island has been able to implement several corrective actions that promise to remediate some of the issues identified in this review. There are still several open items that need to be speedily resolved and tested. As a next step, PSEG Long Island should undertake a systematic planning exercise to determine the telecommunications capacity requirements based on lessons learned from this storm, prior storms such as Superstorm Sandy, and the possibility that weather events may get even worse as a consequence of climate change.

⁹ It is our understanding that the current infrastructure (Cisco) already supports "SIP Trunking." This recommendation speaks to PSEG Long Island implementing this technology to receive inbound voice calls to the Call Center.

3.2.2 Outage Management Systems

Finding 2: The OMS experienced multiple issues with the high volume of data, rendering it effectively non-functional at times, and negatively impacting all communication channels and field activities.

Outage Management System Overview

Primary Functions of the OMS:

- 1) Identifying problems on an electrical network based on incoming outage reports.
- 2) Locating the problem to a faulting piece of equipment.
- 3) Coordinating restoration activities.
- 4) Estimating restoration times.
- 5) Management activities details for customer communications and subsequent reporting.

Sources of Incoming Outage Reports to the OMS:

- 1) SCADA – the most reliable source of information for an OMS. SCADA is a protocol for communicating measurements and states from sensors attached to electrical equipment.
- 2) AMI – another reliable source of information for an OMS. AMI is currently used in the PSEG Long Island OMS in a limited manner.
- 3) Customer Reports – there are multiple channels available to customers to report outages. This source of information is less reliable than SCADA or AMI (future) because the report can be inaccurate (due to human error) or out of date.

As Isaias landed on Long Island, the OMS started to receive a very high volume of incoming transactions in a short amount of time. Almost immediately, performance started to degrade. PSEG Long Island began working with the OMS vendor, CGI, Inc., to troubleshoot and improve the performance of the system. Those efforts continued throughout the duration of the storm and restoration. While the implemented workarounds reportedly prevented the situation from becoming worse, the performance issues persisted throughout the storm restoration, with the system becoming effectively unresponsive and non-functional at times. The resulting issues cascaded through all related systems, causing significant negative impacts to both customers and field management activities. The OMS failure was the root cause of multiple subsequent failures in customer and field activities, including the customer communications issues discussed in this report, the ability to review and model system state, and the ability to assign work to and receive updates from field workers in a timely manner.

The root cause of the performance issues is still being investigated. Current indications are:

- SCADA alarms were not being processed at a rate fast enough to keep up with incoming reports.
- Customer reports were not being processed at a rate fast enough to keep up with incoming reports.
- Stale and repeated outage reports from the external HVCA IVR service were being submitted erroneously to the OMS when initial submission attempts timed out.

- Operators' use of the application was impaired because of OMS unresponsiveness, causing delays to PSEG Long Island employee work processes and lower quality of ETR information.

After the storm, PSEG abandoned the recently installed Version 6.7 of the OMS in favor of an older version, 5.5, on the premise that the older version could prove to be more stable. PSEG Long Island then conducted stress testing of the OMS Version 5.5 by simulating Isaias-level data volumes. This exercise was largely successful but also identified several issues within Version 5.5 of the OMS. Even though Version 6.7 of the OMS was in production during Tropical Storm Isaias, there are indications that there may be some commonality of the issues experienced by PSEG Long Island between the two versions. It is possible, but we have not yet verified, that some of these issues may be resolved with configuration changes, and some would require fixes from the vendor or an upgrade to a more current version of the OMS software. For instance, the post-storm testing and analysis has confirmed that when the volume of incoming SCADA events exceeds a certain threshold, the OMS performance degrades significantly. This is of concern as SCADA events are the most reliable source of information and should serve to relieve processing pressure on the OMS. Root cause analysis and stabilization efforts are continuing.

The extent and impact of the stale and repeated outage reports from the IVR requires further investigation. Stale and repeated reports increase the processing burden on the OMS as it re-processes outage reports in order to associate them accurately. Repeated submissions, when they occur at a large enough scale, cause the load on the OMS to be significantly higher than necessary as it reprocesses outages repeatedly.

Finally, and most significantly, PSEG Long Island's OMS was not able to enter a comprehensive "OMS storm mode" where:

- Users can control the frequency, accuracy, and content of ETR messages so that consistent customer communications can be achieved across all channels, including "null" ETRs that allow for messages like "We are currently assessing damage. PSEG Long Island will update expected restoration times in 24 hours."
- OMS and CAD can operate in a way that prevents OMS unresponsiveness from affecting field management activities.

Applying a comprehensive "OMS storm mode" of operation could have circumvented the complex problems of multisystem synchronization, over-stressed system processing requirements and inaccurate ETRs, and simplified the administration of the OMS. Implementation of a comprehensive OMS Storm Mode is the single-most important technology change that would have made a notable difference in the customer's experience and their trust in the information provided by PSEG Long Island.

Recommendations

- Complete the design, implementation, and testing of a comprehensive “OMS Storm Mode” of operation for OMS and CAD. Implementing the “Null ETR” functionality for major storms is a first step. Codify this approach and the necessary supporting processes and responsibilities in the Emergency Restoration Plan.
- Speedily complete the implementation and testing of “Null ETR” for PSEG Long Island’s OMS and connected systems (including HVCA, IVR, Kubra and My Account tools) to enable the use of a Null ETR.
- Work with the CGI to obtain and implement fixes for identified application defects, which could include upgrading to a more recent version of the OMS software.
- Automate monitoring of OMS and CAD performance at the application level to detect application failures and give administrators an opportunity to adjust the configuration settings that affect performance.
- Automate monitoring of the OMS and CAD at the infrastructure level to detect infrastructure failures and give administrators an opportunity to restore normal operating conditions.
- Automate monitoring of inbound SCADA events to the OMS, to be able to detect events or event volumes that cause unresponsiveness and allow operators to restart failed services.
- Automate monitoring of inbound outage reports to the OMS, to be able to detect and eliminate erroneous reports that may arrive from any source.
 - Irrespective of whether the failure mode is corrected within the IVR, the OMS should have automated monitoring of data quality arriving from IVR to detect potentially duplicate or otherwise bad information. This automation will allow administrators to remove faulty data and maintain normal operating conditions for the OMS.
- The IVR and OMS communication protocol should be reviewed in detail and redesigned so that all messages between the two components are agreed, understood, verified to be operational and tested against error conditions such as sending duplicate outage reports.

If another storm of the magnitude of Isaias were to land on Long Island today, PSEG Long Island’s OMS would likely function better due to the application of several configuration changes that have been implemented so far, and general awareness by the Information Technology and operational staff, but there is insufficient evidence that without implementing the above recommendations the OMS would function at an acceptable level.

3.2.3 Messaging, Outage Map, and Municipal Portal

Finding 3: Failures of PSEG Long Island's OMS prevented some customer text messages from being processed, the Outage Map from refreshing in a timely manner, and the Municipal Portal from being fully effective.

PSEG Long Island uses two-way text, outbound messaging, an Outage Map, and a Municipal Portal provided by a software company, Kubra, which provides similar capabilities for some of the largest utilities in North America. All of these systems are hosted by Kubra and use a common data source tied to the PSEG Long Island OMS.

The messaging services include two-way text messaging and outbound messaging:

- Two-way text messaging services allow a customer to report an outage (by texting OUT) or receive an on-demand outage status update (by texting STAT) via text. This option is convenient and allows customers to receive updates without having to call the Call Center. The “Status Check” function retrieves information about the outage time, condition/reason if known, and estimated restoration time from the OMS and provides it to the customer. The “Report Outage” function checks the OMS to see if the outage is known and if not, submits the relevant outage data to the OMS. The service is popular and in 2017, PSEG Long Island decided to enroll all customers who had a valid mobile phone number on file to participate in this service unless the customer did not want to do so. PSEG Long Island currently has 640,959 customers enrolled in the service.
- The outbound messaging service allows customers to receive proactive notifications (such as outage detection, update messages, and service restoration messages) from PSEG Long Island via their preferred channel, be it text, voice, or email.

The Outage Map provides a user-friendly view of information about general system conditions such as the total number of customers without power and a map with the locations of known outages. The map can be tailored to area or community specific views and can provide detailed information based on information reported by crews in the field. The outages can be selected to see specific information about the outage including the duration, cause, number of customers affected, and estimated restoration time. It is typically refreshed every 15 minutes. It is ordinarily user friendly and a common place for individual customers, local media and government officials to see a snapshot of the status of the electric distribution system. This data is principally provided by the OMS supplemented with commercially available weather and geographic information. It can include an alert banner when wide-spread conditions require general information. For this storm, PSEG Long Island recorded more than 6.3 million¹⁰ page views of the Outage Map.

The Municipal Portal's function is to provide an accessible site to select government stakeholders. Stakeholders can use the portal to report make safe to clear incidents such as trees or wires down, rank outages for priority restoration, sign up for notifications on outages, and access information on critical facilities such as pumping stations and hospitals. The portal is populated with data from and sends data to the OMS.

The Messaging services, Outage Map, and Municipal Portal rely on accurate and timely information from PSEG Long Island's OMS. In this storm, the OMS was not able to provide these updates in the expected time or with accurate data. During the storm, a large number of inbound and return messages were delivered, but for approximately 24 hours almost 300,000 attempted text messages failed and many customers received error messages when they texted PSEG Long Island with outage reports or status requests. The reliability and

¹⁰Based on PSEG Long Island estimate as of September 9, 2020 of an average of 629,000 views per day for the 10-day storm.

usefulness of the PSEG Long Island's customer-facing Outage Map and the Municipal Portal were also severely degraded.

Key issues and events during the storm related to Messaging, the Outage Map, and the Municipal Portal include:

- In normal situations, the OMS will update the messaging systems, Outage Map, and Municipal Portal every 15 minutes with any new or changed condition of an outage. The delivery of this data from the OMS degraded starting around 2:00 p.m. on August 4, which affected two-way text notifications, the Outage Map, and PSEG Long Island's Municipal Portal.
- The two-way text messaging application typically completes its interactions with the OMS in seconds. In this storm, PSEG Long Island observed that the heavy demand sometimes caused the text feature to fail because too much time elapsed trying to get information to or from the OMS. During the period from 5:00 p.m. on August 4 to 7 a.m. on August 5, more than 120,000 attempts to send or receive text messages failed and another substantial group of attempted texts failed on August 5 from 11:00 a.m. to 12 p.m.
- PSEG Long Island and the service provider, Kubra, detected the OMS problem quickly and initially increased the Outage Map data refresh rate from 15 minutes to 30 minutes and then to an hour to allow new data from the OMS to be received and processed.
- As performance of the OMS continued to degrade, a process was initiated on August 5 where data was entered manually by Kubra based on information received from the PSEG Long Island team. Intermittent problems continued over the following days, and additional changes and adjustments were made through August 8 to further mitigate OMS impacts and restore the messaging, Outage Map and Municipal Portal systems to a more normal operational state. While this did not impact PSEG Long Island employees' storm response, it was confusing to customers and public officials who could not see outage status changes for their community in a timely manner. For example, a newly reported outage might not appear on the Outage Map until up to 45 minutes after it was reported.
- Delays in outage status messages to customers and/or messages based on inaccurate restoration status records in the OMS caused customers to receive unreliable restoration estimates and updates, which then drove the customers to create additional outage record reports.
- In peak events with widespread damage, PSEG Long Island can modify the Outage Map by putting it into Storm Mode,¹¹ which bundles outages into broad geographic areas and gives restoration estimates by area, as calculated by PSEG Long Island staff, rather than estimates generated by the OMS. The OMS generated estimates during Isaias were inaccurate and changed frequently. PSEG Long Island did not activate the Storm Mode during the storm and relied on OMS generated ETRs but did use regional ETRs later in the storm for wide-spread email and text messages to customers.
- During this storm, PSEG Long Island took advantage of several wide-scale text message efforts to find people affected by isolated outages. In hindsight, this might have helped if it was used sooner.

¹¹ "Storm mode" is a feature of the Kubra system and is distinct from the "OMS Storm Mode" discussed earlier in the context of the OMS system.

Recommendations

- At the beginning of storm planning and throughout the storm, designate a system data administrator dedicated to monitor, on a continuous basis, the timeliness, accuracy, and integrity of the information coming from OMS to Kubra.
- If performance issues occur and cannot be promptly remediated, as part of contingency planning, institute the process of moving the lookup requests to an alternate data file to relieve congestion on the normal data transmission path.
- Empower the administrator to take measures to adjust the Outage Map if the timeliness and accuracy of data begins to be faulty due to file processing delays or inaccurate restoration times coming from OMS. This person should also monitor data timeout potentials. This will allow them to place the Outage Map into Storm Mode to lengthen the time between Outage Map updates to give the OMS and Kubra time to complete data uploads and reduce any data quality problems caused by data transfer delays.
- In cases where customers may need repairs to more than one type of equipment to be restored, continue to use a text option to ask “are you still out” to get confirmation.
- Assign a data administrator to work with Communications to use banner alerts and other widely applicable messages. When wide-scale text messages need to be sent because the restoration effort is not yet precise enough to give property-specific updates, include a periodic reminder text every few hours to let the community know when more precise estimates will be available instead of providing inaccurate OMS-generated ETRs.
- If OMS-generated ETRs are not accurate because there are extenuating circumstances in a particular area, the Outage Map data administrator should work with a restoration coordinator to override the information in the OMS.
- Finish testing and implementing Null ETRS in OMS and move to regional ETRs for large storms.

We have proposed several actions which will improve the robustness and resiliency of these systems. We should, however, note that the root causes of the failures of the text messaging, Outage Map, and Municipal Portal systems are attributable to failures of the PSEG Long Island’s OMS. After appropriate corrective actions are applied to the OMS, the functionality and performance of these customer-facing systems will have to be re-tested and re-verified.

3.2.4 Website and Mobile App

Finding 4: Failures of PSEG Long Island's OMS as well as overloading of the "My Account" website infrastructure prevented customers from communicating with PSEG Long Island through the PSEG Long Island "My Account" customer portal or through their mobile app during the initial 2 days of the storm.

In addition to the channels identified in the Customer Messaging section, PSEG Long Island also provides customers with access to the same outage reporting and outage information through the PSEG Long Island website and mobile apps. The website and apps, through the PSEG Long Island "My Account" tools, provide customers with the ability to manage their accounts, once authenticated, in addition to reporting and receiving outage information. The apps are available through Google Play and the Apple app store for Android and iPhone users respectively. The web and phone applications outage related functions redirect customer inquiries to the services maintained by Kubra, which in turn depend on information provided by PSEG Long Island's OMS.

Starting at around 12:00 p.m. on August 4, the "My Account" portal started experiencing slowness and performance degradation, which continued intermittently for the next several days. Many customers therefore had difficulty accessing the services during this time because the web and phone apps were unresponsive.

The website and mobile tools communicate with the OMS for outage related functions and experienced the same issues as other communication channels in completing these transactions in a timely manner. In addition, the website infrastructure hosting the "My Account" portal was initially overloaded as the volume of customer interactions surged to approximately 20 times the normal volume, and some presentation issues were identified with the apps. Remedying the performance bottlenecks within the apps would not have resolved the customer communication problems as customers would then have experienced the low-quality information being presented by the OMS at that time, as described in the Customer Messaging discussions.

Key issues and events during the storm include:

- The PSEG Long Island team detected slowness on the website at around 11:50 a.m. on August 4 and started working with the vendors (Microsoft and Sitecore) to troubleshoot. The team took a number of steps over the course of the day to improve the performance of the infrastructure, including disabling non-essential features, restarting services and components, and other adjustments. On the afternoon of August 5, additional servers were added.
- The infrastructure adjustments are believed to have improved the ability of the website to handle the high user volume. However, the performance issues of the OMS continued to cause slow responsiveness on the website. At 11:30 a.m. on August 5, the team removed some components from the main website dashboard that make calls to the OMS. Performance reportedly improved initially, then started to degrade again. The next day, the team removed some remaining components on the website that display data from the OMS.
- Starting 8 p.m. on August 6, the system was stable, and no further issues were reported.
- Additionally, some issues with the presentation of ETRs were identified in the apps, relating to formatting and display of expired ETRs. The issues were identified and resolved on August 8 and August 9, with the final adjustments made around 11:00 a.m. on August 9.

Recommendations

- Review the storm-oriented customer journey maps implemented within the mobile and web applications so that customer transactions are directed to the externally hosted infrastructure rapidly.
- Monitor system logs and health alerts to proactively detect incipient failures within the system or the infrastructure, especially during a storm.
- Introduce the capability to quickly decouple the web and mobile apps from the OMS, so that when unresponsiveness is detected, alternate messaging can be provided to the customer and the OMS can be relieved of incoming transactional pressure.
- Model storm scenarios and conduct thorough stress testing on the website for all customer journeys and ensure that the infrastructure has sufficient capacity for high activity periods.

PSEG Long Island's analysis of the root causes of website and mobile apps dysfunction is continuing. These systems were functioning properly prior to the storm but underperformed under stress. The 90-Day Report and the 180-Day Final Report will have more information on these issues.

3.2.5 Estimated Time of Restoration

Finding 5: Information presented through customer channels on ETRs was frequently stale or incorrect and customers received numerous ETR updates that did not convey useful or accurate information.

Reports by customers of inaccurate, inconsistent, and frequently changing ETRs were widespread. This perception is accurate and is the result of multiple problems with the OMS and communications systems (as discussed above), and with the storm restoration process design and storm restoration operating decisions. In addition to the negative impacts on customers, the inaccurate ETRs also likely exacerbated the OMS performance issues by causing increased customer contacts requesting updates and reporting outages that had not been restored by the previously provided ETR.

Calculating an ETR is always a challenge, and ETRs will almost always evolve over the course of an event, as the extent of required repairs becomes clearer and the workload is balanced against the available crew resources. In the context of a routine day or a minor storm event, PSEG Long Island uses some rules of thumb to initially set ETRs, and then works to update those as the event unfolds and more information is known. These blue sky rules of thumb are to provide a 2-hour ETR to a customer whose outage is caused by a feeder lockout and a 4-hour ETR to a customer whose outage is caused by a customer fuse or branch line outage.

To scale this ETR approach up for Isaias, PSEG Long Island used a 12 times multiplier to automatically lengthen the ETR for each outage, as described in the ERP, which means it will take 12 times longer than the blue sky rules of thumb, resulting in ETRs of 24 hours for a feeder lockout and 48 hours for a fuse or branch line outage. These ETRs were communicated to customers even before the extent of the damage from the storm was known. Alternatives to the multiplier approach are discussed below.

Operators attempted to use the ability to adjust ETRs during later stages of the storm response. However, the unresponsiveness of the OMS impaired operators' ability to adjust ETRs, and the OMS internal algorithm to calculate ETRs was also slow.

Alternate Approaches to Managing ETRs

In a large-scale event such as Isaias (over 20,000 damage locations and over 600,000 customers out of service), the first 24-48 hours after the storm should be spent assessing the damage and restoring transmission facilities and equipment (and thereby getting large groups of customers restored) before estimating individual ETRs. This is an industry best practice and results in customers not receiving individualized ETRs during that timeframe but instead a message saying, "We are currently assessing damage. PSEG Long Island will update expected restoration times in 24 hours."

The OMS has the ability to support this approach through setting of a null or blank ETR, however, it requires that PSEG Long Island undertake an effort to ensure that the null ETR is translated into effective and consistent messaging in all downstream communication channels and to provide training for customer representatives and community outreach to explain the approach to customers and stakeholders. PSEG Long Island had initiated this implementation project earlier in the year, but it has not been completed at this time.

Without this null ETR functionality, the only alternative to the multiplier ETR approach PSEG Long Island used at the outset of Isaias was to put out a global estimate for when all customers were to be restored (a “global ETR”). This global estimate would have been made while the storm was still ongoing, before damage assessment had begun, and would have been highly inaccurate for most of the customers, the majority of whom would be restored much faster than the global ETR. The ERP does not require a global ETR be issued until 24 hours from the start of the restoration.

A global ETR using available information on the number of customers out of power and the state of the electric grid would have been better than using the multiplier function in the OMS that was designed for smaller events. Using the multiplier undermined PSEG Long Islands credibility as one and two-day ETRs were subsequently revised to up to eight days. This is a design gap in the ETR system and in the process contemplated in the ERP.

Additionally, the multiplier ETR approach only indirectly considers the available restoration resources. PSEG Long Island makes a subjective assessment of the appropriate multiplier to choose (in this case, 12 times). Currently, the Task Force is reviewing the extent of the available OMS functionality to balance incidents (work) with resources (crews) for the calculation of ETRs using a more sophisticated approach than the multiplier approach currently employed. While we believe the null ETR function described above, if available, would have been more appropriate for Isaias, the industry experience of other utilities in using OMS functionality to make more sophisticated individualized ETR estimates indicates that it can improve ETR calculations under routine operations and in smaller storms. We will explore this further in our 90-Day Report.

Recommendations

- Review ETR strategy and revise it to allow for suspending ETRs while damage is being assessed and relevant information to estimate an ETR is still being gathered.
- Prioritize completion of the ‘null’ ETR implementation effort. In the absence of deploying this functionality, if a major storm event occurs, the ETR coordinator and leadership should set a global ETR at the storm outset rather than employ a multiplier approach. This is not optimal but for widespread outage predictions this is better than giving out inaccurate individualized ETRs, setting unrealistic expectation for customers, and undermining PSEG Long Island’s credibility, as occurred during Isaias.
- At the same time PSEG Long Island should also work to install end-to-end quality control measures for communication of ETRs. Consistency across communications channels is critical in developing confidence in the restoration effort.

Providing customers with the correct ETR and setting appropriate customer expectations of service restoration is a critical part of customer satisfaction. In a storm situation, communicating the right ETR consists of balancing many factors. The solution to storm ETRs lies in the blending of technology, business processes, and the judgment of utility staff. We expect that the implementation of these recommendations will help regain the confidence of PSEG Long Island customers.

3.2.6 Social Media Communication

Finding 6: PSEG Long Island's social media support is designed and staffed to provide consistent and professional service. They integrate social media requests and contacts with other customer relationship management records. The difficulty in this storm is the Social Media staff were hampered by the same lack of timely and accurate information from the OMS as the other communication channels. The Social Media channels themselves did not fail and there were no perceived technology issues.

Social media as a communication tool, both inbound and outbound, plays an increasingly important role in utilities. For PSEG Long Island, social media refers to Facebook, Twitter, Instagram, and banner alerts on PSEG Long Island's website and YouTube. Facebook, Twitter, and Instagram are used as two-way tools, while the website and YouTube are outbound communication. PSEG Long Island also includes LinkedIn under the banner of social media but it is not a communication tool used during outages. The PSEG Long Island ERP allows for website and social media specialists who are charged with maintaining around the clock availability of the website and social media response during an electrical emergency. Information to be provided includes safety tips, press releases and updates, storm center updates, procedural guidance and entering service orders for customers.

Social media is used as more than an outbound information tool. Customer inquiries are handled by a dedicated social media team that can serve customers on Facebook, Instagram, and Twitter. Facebook and Twitter are the most active platforms used by PSEG Long Island's customers with 67,000 and 15,000 followers respectively. While Instagram can be used to interact with customers, it currently only has approximately 1,000 followers. PSEG Long Island also maintains informational videos on their website and on their YouTube channel, and used the YouTube channel for replaying media briefings during the storm.

Our observation about the design of the social media response from a technology and staffing perspective is that PSEG Long Island has the appropriate combination of support, customer service training, operating hours and types of platforms supported to deliver valuable information through these channels to individual customers and to give information valuable to community-wide concerns. The social media group also has the capability to create trouble tickets using customer provided data.

PSEG Long Island maintains a repository of social media interactions and as part of our 90-Day review we will include an assessment of specific postings.

Recommendations

No Recommendations (at this time).

3.2.7 Field Mobility Application

Finding 7: Communication of work orders with foreign crew is currently a paper-based function which lends itself to errors and inefficiencies.

The integration of foreign crews with the OMS system is an opportunity to gain efficiencies in the storm restoration operation. PSEG Long Island has been testing an easily downloadable smartphone application called Field Mobility that allows external field-personnel to remotely receive, update, and close-out work orders. We believe that deploying this application to foreign crew will generate considerable efficiencies in foreign crew management.

Recommendations

- Test and deploy the mobility application to enable foreign field crews, or their PSEG Long Island crew guides, to receive restoration work assignments and report the completion of restoration orders electronically. Update the ERP to document the work processes required to dispatch work to foreign crews electronically and train the involved staff in this updated work process.

3.2.8 AMI Usage Data in “My Account” during and after Isaias

Finding 8: A misconfiguration of the Advanced Metering Infrastructure (AMI) system led to temporary reporting of estimated consumption in “My Account” customer portal for some customers.

The My Account tools allow customers with AMI smart meters to view their energy usage data. In normal circumstances, when a customer visits the My Account website, the website backend system accesses the Meter Data Management System (MDMS) to get the customer’s latest AMI meter readings and presents 15-minute interval meter readings to the customer.

In the normal operation of the AMI infrastructure, there can be periods when individual customer meter reading data fails to transmit back to the MDMS for a short period. The MDMS is configured to show an estimate on the customer portal during these periods. When communication is restored, the estimates are overwritten by the actual meter readings. The estimates used for the customer portal are not used for billing the customer.

When an AMI meter loses power, it sends a “last gasp” power outage notification, which is recorded in the MDMS. If the MDMS is aware that the meter has lost power (as opposed to a temporary communications disruption), the MDMS shows zero power usage to the customer on the My Account portal. During Isaias, however, not all “last gasp” power outage notifications were received by the MDMS, and the MDMS continued to show estimated usage for some customers.

Key issues related to usage data shown in the My Account customer portal during Isaias include:

- The MDMS was configured to present estimated usage to the My Account website if the MDMS had not received a power outage message from the meter. Customers with AMI meters whose outage message had not been received by the MDMS who visited the My Account website were shown estimated energy usage instead of zero usage for the time intervals for which no data was recorded. The My Account website did not notify the customer that the presented data was an estimate, leading to customer confusion and a loss of confidence in the AMI meter.
- During power restoration after Isaias, the MDMS validation and estimation functions became backlogged with large amounts of meter data, and the nightly data replication to the My Account system continued to include estimated data for up to 72 hours after an AMI meter had been restored and communicated the actual customer usage. As a result, for up to three days after having power restored, some customers continued to see estimated usage for the time period when they were without power. These estimates were eventually overwritten by actual usage data and were not used for billing purposes.
- After power was restored and AMI meters communicated their actual usage to the MDMS, the MDMS incorrectly assigned the usage from the last, incomplete interval reading (when the customer had power) by spreading the usage across the rest of the hours in the day. Customers were expecting to see the correct zero usage for the intervals on August 4 when they were without power, and instead the MDMS and My Account showed small amounts of power used.

Recommendations

- PSEG Long Island reconfigured the MDMS to present zero usage to customers through the My Account website when there is missing data. This will be done regardless of the MDMS awareness of the meter's power status. This change was implemented on September 11, 2020.
- PSEG Long Island is evaluating turning off some MDMS data processing sub-functions during recovery from a large storm to improve data processing capacity and reduce or eliminate the delay in updating the My Account system.
- PSEG Long Island is evaluating having the MDMS incorporate time stamped meter event messages for power off and power on when performing data validation to correctly assign usage to the actual interval.

The above corrective actions should resolve the issue experienced by customers of seeing estimated usage data on My Account while their power is out. Customers were not improperly billed for usage. The issue was limited to the My Account portal.

SECTION 4**EMERGENCY RESPONSE PLANNING, STORM MANAGEMENT, AND STORM RESTORATION****4.1 Scope of Emergency Response Planning and Storm Restoration Review**

Successful storm restoration results from having a well-designed, trained, and exercised ERP combined with strong execution of that plan through an effective incident command system. As the technology failures during Isaias were of the highest priority for the Task Force, a detailed investigation into emergency response planning and preparation, and storm management and restoration will be covered in greater detail in the 90-Day and 180-Day Reports.

The following areas have been identified for review by the Task Force.

Emergency Response Planning and Preparation

- Emergency Response Plan
- Incident Command Structure
- Weather Tracking
- Damage Prediction and Resource Planning
- Pre-Event External Communications

Storm Management and Restoration

- Mobilization and Deployment Process
- Command Center Operation
- Damage Assessment

- Field Restoration
- ETR Philosophy and Management
- After-Action Critique and Follow-Up Process

For the 90-Day Report and the 180-Day Final Report, the Task Force plans to review PSEG Long Island's ERP and its execution during Isaias. Our present understanding is that, despite operational preparedness, the difficulties in using the OMS impaired the execution of aspects of the ERP. During the next phase of our review, we will be examining PSEG Long Island's chronology of events, the resilience and the deficiencies of the defined processes, and other ERP components with the goal of improving the ERP particularly with respect to systems monitoring, preparedness for potential system failure, and contingency planning.

Below, we address specific aspects of communications related to Life Support Equipment customers.

4.2 Outreach to Life Support Equipment Customers

A Life Support Equipment (LSE) customer is a PSEG Long Island customer who requires electrically operated machinery to sustain basic life functions. PSEG Long Island's ERP spells out the procedures for contacting LSE customers in the wake of an emergency and the policies for responding to these customers' needs for electric service.

Examples of qualified LSE include:

- Apnea Monitor (Infant Monitor)
- Respirator/Ventilator
- Cuirass Respirator
- Hemodialysis Machine
- Positive Pressure Respirator
- Rocking Bed Respirator
- Suction Machine
- Oxygen Concentrator
- Intravenous Feeding Machine
- Intravenous Medical Infusion Machine
- Tank Type Respirator
- Other devices as certified as LSE by a medical professional

Customers who rely on LSE are required to re-certify their needs annually, and removal of the LSE designation requires substantiating documentation and DPS approval.

PSEG Long Island has procedures in place to reach out to LSE customers before, during, and after a large-scale storm when outages are expected to last more than 48 hours.

During non-storm conditions, PSEG Long Island's policy is to reach out to LSE customers on a semi-annual basis in order to advise them of the potential for power outages that would affect the supply to their medical equipment, options to help prepare for their own safety and security, and emergency services that are available in the event of a loss of power. Customers are also informed that the designation as an LSE customer is not a restoration priority and that electric service will be restored as quickly and safely as possible following normal prioritization and safety guidelines.

Before and during a storm, PSEG Long Island's procedures are designed to comply with the requirements of 16 NYCRR Part 105, including:

- Establishing and maintaining contact with LSE customers prior to, during, and after an event to ensure that the customer is apprised of the most current restoration information.
- Automated outbound calling campaigns to contact LSE customers within 24 hours of the expected start of any forecasted large-scale event.
- Confirming the wellness status of LSE customers affected by power outages.
- Meeting the DPS Emergency Response Performance Measures, including:
 - o Ensuring staffing, automation, and operating procedures are in effect to contact 80 percent of the LSE customers affected by outages within 12 hours from the start of the storm restoration.
 - o Tracking whether 100 percent of affected LSE customers were contacted or referred to an emergency service within 24 hours.
 - o Ensuring that at least one additional contact attempt is made within the same 12-hour period to contact any LSE customer who was not contacted on the first attempt.
 - o Ensuring that within 24 hours of the start of the event, LSE customers that have lost power have been either:
 - Directly contacted by speaking with an agent of the utility
 - Visited by a PSEG Long Island Community Outreach Liaison
 - Referred to an emergency services agency (e.g. police or fire department, county OEM or NYC EOC, or other human services or volunteer agency) for further direct contact attempts
 - Restored within that time limit

During an event, PSEG Long Island representatives make a minimum of two call attempts to reach LSE customers within the first 12 hours after storm restoration begins to confirm if the:

- Customer is safe and well
- Customer has arranged for any assistance required to stay in their home
- Customer had to evacuate their home

The representative will also provide the following information to the LSE customer:

- Call 911, in case of an emergency
- ETR, if available
- Information regarding the PSEG Long Island Critical Facilities hotline
- In the event the customer expresses a need for assistance related to their health or safety, the representative will refer the customer to an appropriate response agency.

This process continues each day for LSE customers that are identified as an outage in OMS. The LSE team tracks all contact and wellness visits and a detailed report of all activity at the individual customer level is provided to DPS on a daily basis.

4.2.1 Life Support Equipment (LSE) Customer Outreach During Isaias

During Tropical Storm Isaias, PSEG Long Island reports completing its customer outreach protocols for LSE customers and filing the required daily reports on LSE customer outreach with the DPS. In the 90-Day and 180-Day reports, the Task Force will review records to independently verify that outreach activities followed the procedures and processes established in PSEG Long Island's ERP.

An area that has been reported as a weakness is in maintaining the LSE customer list. For example, at the New York State Legislature's Joint Virtual Hearing on the emergency response to Isaias, Lisa Black, Chief Deputy County Executive of Suffolk County, offered the following testimony:

"The utility asked us to outreach to customers from their Life Support Equipment list. Within 24 hours of the storm, FRES first utilized our RAVE Program to send an electronic welfare call to applicable customers and reached more than 1,100 individuals in 15 minutes. Employees then called through more than 800 LSE customers to identify those in need of assistance. Finally, the SCPD performed physical welfare checks on over 200 customers, while PSEG [Long Island] outreached to County residents who reside outside our police district in the five eastern Towns.

Ultimately through this communication and outreach to critical care patients, we discovered that lists provided by PSEG [Long Island] were outdated and inaccurate. For example, County employees who made LSE calls reported that several individuals did not in fact have life support equipment or life-threatening conditions associated with a power outage. Unfortunately, they also found that many of the customers they called had deceased prior to the weather event. Moving forward, this is something that should be further evaluated as we prepare for future storms to ensure critical care patients remain a priority."

4.2.2 LIPA Audit of Life Support Equipment (LSE) Customer Process

LIPA previously found that there were significant weaknesses in PSEG Long Island's process for maintaining the LSE customer list. A December 2018 audit of PSEG Long Island's processes noted that PSEG Long Island reported roughly the same number of LSE customers as Con Edison, which has roughly three times the number of electric customers.

The audit found that PSEG Long Island's process for maintaining the LSE customer list at that time consisted of a single letter sent annually, with only a 43 percent response rate. Best practice among New York utilities is to make multiple attempts to reach LSE customers, reconfirming their continuing use of LSE each year, as well as

updating their contact information. The audit noted that “during a storm event, unnecessary calls and field visits may be made to LSE accounts, where the LSE customer may not qualify for an LSE designation, thereby risking the LSE customer that may truly require help and may not be reached.”

In response to the audit, PSEG Long Island established a management action plan to implement process changes and improvements. PSEG Long Island reports that since the December 2018 audit they have staffed a dedicated team to support maintaining the LSE customer list and that over 1,158 customers have been removed from the LSE customer list because they no longer require life supporting equipment. PSEG Long Island further reports that after Isaias, 86 customers were removed from the LSE list and documentation has been submitted to DPS to remove another 138 customers that no longer require LSE designation. These figures are out of approximately 6,400 customers.

LIPA's 2020 Internal Audit plan had previously scheduled a re-audit of the process to maintain the LSE customer lists to begin in the fourth quarter of 2020. Following reports of outdated LSE customer list during Isaias, LIPA's re-audit has been accelerated and began in September 2020. The re-audit will be further addressed in the 90-Day and 180-Day Task Force reports.

SECTION 5

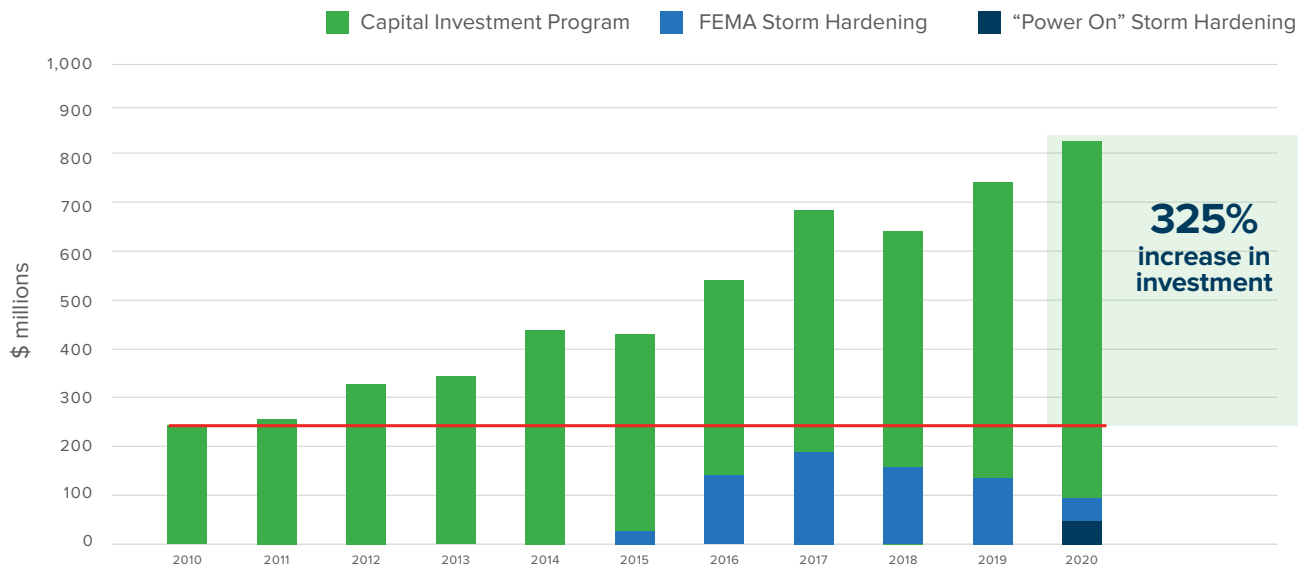
STORM RESILIENCY

5.1 Investment in Reliability and Resiliency Since 2016

Long Island’s electric grid consists of 15,000 miles of transmission and distribution (T&D) lines. The T&D system is approximately two-thirds overhead and one-third underground, with 5,000 miles of underground distribution circuits.

Beginning in 2016, LIPA and PSEG Long Island began a significant program to strengthen the reliability and resiliency of the electric grid, with over \$3.4 billion invested in capital assets since that time. In fact, LIPA’s annual spending on infrastructure has more than tripled, reaching \$820 million for 2020, which is up from \$249 million a decade ago, as shown in Figure 5.

FIGURE 5:
LIPA Capital Budget: 10-Year History of Investment in Long Island Electric Grid
 LIPA Invested Record Levels in Electric Grid Reliability and Resiliency



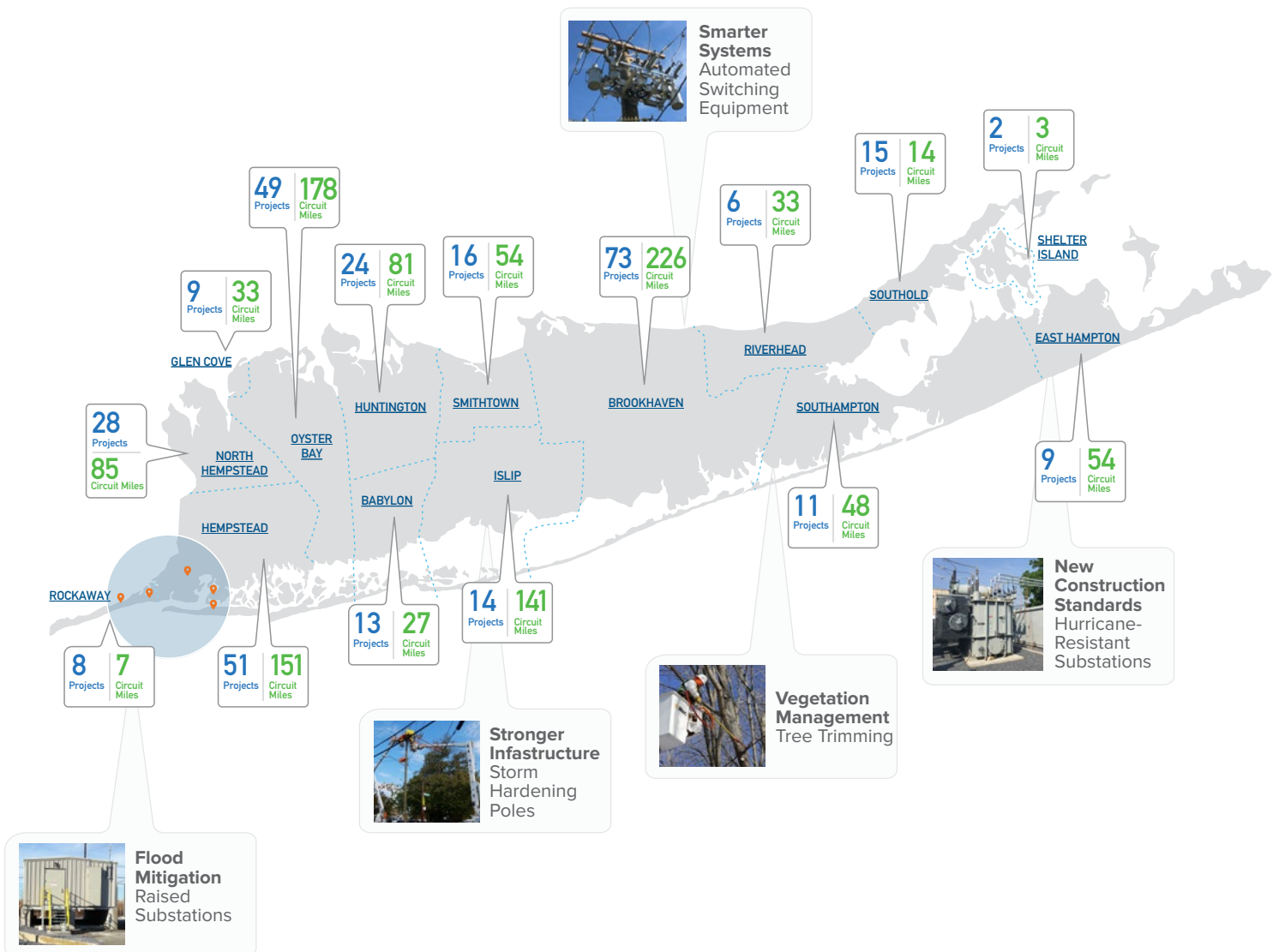
LIPA’s 2020 Budget alone includes \$264 million to replace aging poles, wire, and underground cable on circuits that provide poor reliability. The single largest cause of power outages is downed trees and tree limbs. In addition to these capital investments, the LIPA Board of Trustees has funded an expanded tree-trimming program with a four-year cycle, which has reduced the incidence of tree-related outages by 35 percent since 2016.

Most notably, following Superstorm Sandy, LIPA secured a federal grant to fund 90 percent of a \$730 million

storm hardening program. As a not-for-profit public power utility, LIPA is eligible for such federal grants for investments that would otherwise have to be funded at customer expense.

The Federal Emergency Management Agency (FEMA) funded storm hardening program enhanced the resiliency of 1,025 miles of overhead mainline distribution circuits, installed 894 smart switching devices to re-route power around damage locations, upgraded five major transmission crossings, and elevated eight of the system’s substations along the South Shore that were at risk for flooding, as shown in Figure 6. Outages on the transmission system and mainline distribution circuits account for the majority of customers who lose power during a storm. The FEMA program hardened approximately one-third of these mainline distribution circuits but that is only about 10 percent of the overall overhead transmission and distribution system.

FIGURE 6:
LIPA’s \$730 Million Storm Hardening Investment Since 2016



The mainline circuits that were hardened by the FEMA program were selected from a ranked list of the worst performing circuits based on past reliability data. The storm hardening techniques used for each circuit were selected based on an engineering evaluation of the circuit and included stronger poles and wire, selective undergrounding, and smart devices.

The FEMA program was a major five-year undertaking involving an average of approximately 200 lineworkers working six-days per week. The program was substantially completed in March 2020, with only the installation of monopoles for the smart switches remaining, which is expected to be completed in early 2021.

Based on the improved performance of the FEMA-hardened circuits, PSEG Long Island recommended, and the LIPA Board approved, a continuation of the storm hardening program in LIPA's 2020 Budget for an additional four years at an estimated cost to customers of \$200 million. This program, referred to as "Power On," continues to prioritize primary mainline distribution circuits and some primary branch line distribution circuits based on the historically worst performing circuits. The program is expected to harden an additional 240 miles of the electric grid using customer funds.

5.2 Improvements in Everyday Reliability from Past Investments

LIPA's investments in reliability and resiliency since 2016 have resulted in notable improvements to the everyday reliability of the Long Island electric grid, as shown in the table below. Customers with power outages are down 39 percent, while customers with multiple outages (greater than four per year) are down 79 percent. Momentary "flicker" outages have also improved by 39 percent and Long Island electric grid reliability is among the top 25 percent in the nation, with plans to further improve over the next five years.

FIGURE 7:

LIPA's \$3.4 billion Investment in Long Island's Electric Grid is Showing Results for Customer 2016 TO 2019 YEAR-TO-DATE

Customers with Power Outages:	↓ 39%
Customers with >4 Outages Per Year:	↓ 79%
Customers with Momentary Interruptions:	↓ 39%
National Utilities Ranking for Reliability:	Top 25%
Diamond-level Reliable Public Power Provider	

5.3 Resiliency During Tropical Storm Isaias

PSEG Long Island has prepared a preliminary evaluation of the performance of the FEMA-storm hardened circuits during Isaias and has concluded that the hardened sections of each circuit experienced 44 percent fewer damage locations per mile, thereby reducing the number of outages and the restoration time in those areas. This is estimated to have reduced total customer outages during the storm by 41,000 customers.

LIPA has requested detailed data from PSEG Long Island to independently validate these analyses in the 90-Day Report.

5.4 Recommendations for Future Storm Resiliency Investments

Multi-day electrical outages are a significant cost and inconvenience for customers and in certain circumstances can endanger the health and safety of residents. With ever greater reliance on electronic devices, homes and businesses simply require an increasingly reliable electric supply.

The effects of climate change are also apparent, with stronger and more frequent storms. Any resiliency strategy requires both significantly reducing carbon emissions across the global economy and hardening electrical infrastructure against the effects of a warming climate. The trend is also clear – the carbon-free electric grid envisioned in New York’s Climate Leadership and Community Protection Act will play a larger role in supplying energy for transportation, heating and cooking in the future, further increasing customers’ reliance on the electric grid for the necessities of life.

LIPA and PSEG Long Island are also reviewing additional storm hardening investments for overhead transmission and distribution circuits. To put the undertaking into perspective, PSEG Long Island estimates that an expanded program of circuit hardening could cost billions of dollars and take several decades to complete, as illustrated in Figure 8. There are also limitations on the trained resources available to construct a storm hardened system. As such, any practical program requires setting priorities and balancing costs and benefits.

FIGURE 8:
Estimated Cost and Construction Time of Storm Hardening Investments

Source: PSEG Long Island estimate

Program Size	Approach	Isaias Duration (Days)	Revised Isaias (Days)	Duration Reduction (Days)	Cost (\$Mill)	Construction at FEMA Funding Levels (Years)	Construction at FEMA x2 Funding Levels (Years)
Small	25% of primary circuits hardened	8	7.6	0.6	1,601	11	5
Medium	50% of primary circuits hardened	8	6.9	1.1	4,531	30	15
Large	100% of primary circuits hardened	8	5.6	2.4	10,391	69	35

For example, hardening 25 percent of Long Island’s approximately 8,800 miles of primary distribution circuits (i.e. those that bring electricity to the distribution transformer) using the techniques employed in the FEMA storm hardening program would cost an estimated \$1.6 billion and take between 5 and 11 years, depending on the availability of lineworkers and the level of annual investment (and resulting customer rate impact). Hardening 100 percent of the primary circuits would require an estimate \$10 billion and take between 35 and 69 years.

While hardening the primary circuits that bring electric to the distribution transformers can reduce the number of customers affected by a major storm and speed the restoration of those circuits, PSEG Long Island estimates it would not have significantly reduced the duration of the Isaias storm restoration. That is because the majority of restoration jobs are on the secondary low voltage system (i.e. from the transformer to the end customer)

and affect very few customers. In fact, during Isaias, PSEG Long Island reports that while damage to the secondary low voltage distribution system (transformers and secondary service lines) accounted for 63 percent of restoration jobs, these jobs were only four percent of customer outages. The majority of PSEG Long Island's storm restoration jobs restored just four percent of the customers affected by the storm.

Further reducing storm restoration duration through a storm hardening effort requires broadening the storm hardening program beyond the transmission and mainline distribution circuits that impact the majority of customers in a storm and even beyond the approximately 8,800 miles of the primary distribution system. This can be challenging from a cost effectiveness perspective, as larger and larger storm hardening expenditures result in rapidly declining resiliency benefit to customers.

Other initiatives PSEG Long Island is considering that could improve system resiliency and shorten restoration time include:

- Selective undergrounding of main or branch lines in areas with difficult access;
- Accelerating the deployment of smart meters and the full integration of smart meters with the OMS so that outage reports will be available more rapidly and embedded outages (i.e., small-scale outages downstream of larger-scale outages) will be more readily identified, thus enhancing the efficiency of job dispatch;
- Investigating the use of electricians for low-voltage secondary service restoration;
- Increasing the utilization of local National Grid gas and generation system employees for damage assessment and wire down repairs;
- Revisions to the current vegetation management program to shorten the 4-year cycle across the system or in selected areas with denser vegetation; and
- Increased use of drones and other technologies to improve damage assessment.

The Task Force is working with PSEG Long Island to further refine and review the assessment of these proposals.

5.5 Balancing Cost to Customers of Additional Resiliency Investment

The LIPA Board of Trustees has invested record amounts in reliability and resiliency, as described above. In doing so, customers demand that the Board strike a balance between clean, reliable, and reasonably-priced electricity for Long Island. While the storm hardening investments of the past five years were a large undertaking in terms of both staffing and dollars, they hardened only approximately 10 percent of Long Island's overhead electric grid.

Using the information available from Isaias, the Task Force aims to provide the LIPA Board of Trustees with actionable recommendations related to ongoing storm hardening investments and new cost-effective resiliency measures by its 90-Day Report, so that such recommendations can be incorporated into the Board's consideration of LIPA's 2021 Budget in December 2020.

LIPA has also identified an opportunity to refinance certain outstanding Utility Debt Securitization Authority (UDSA) bonds in the current low interest rate environment. Such savings could provide several hundred million dollars towards additional resiliency investment without additional cost to customers. This refinancing would require additional statutory authorization to refinance UDSA bonds for savings, as well as to fund incremental storm hardening investment. LIPA will consult with members of the Legislative and Executive branches on the proposal.

SECTION 6**CONCLUSION**

This 30-Day Report presents some of the preliminary findings and recommendations of the Isaias Task Force. The Task Force has worked diligently with PSEG Long Island management and technology experts during the last 30 days and investigated about a dozen different systems in place at PSEG Long Island. We explored complex connectivity issues to multi-vendor telecom networks, internal systems that have difficulty communicating with each other during heavy load, outside vendors contracted to provide service with poorly defined service quality assurances, and other problematic management control issues that coincided to deliver a “perfect storm” of unsatisfactory customer experience.

Could this have been avoided? Isaias handed a severe blow to Long Island. Hindsight is 20/20, but we believe that with better planning and sufficient management controls, the risks could have been mitigated at least to some extent. The lapses in customer communication and estimated restoration times should never be repeated.

The Task Force continues to work with PSEG Long Island every day to gather information, review findings, critique and guide remedial actions, and provide transparency and accountability to our customers. We have just begun this task, and we will be providing 90-Day and 180-Day Reports with more in-depth analysis, recommendations, and ultimately reassurance to LIPA’s customers.

APPENDIX

Appendix 1

Isaias Task Force Team Bios

LIPA

Mujib Lodhi* is LIPA's *Chief Information Officer*. Mr. Lodhi is responsible for managing LIPA's information security and technology, including business applications, computing infrastructure, networks, and cybersecurity, as well as oversight of PSEG Long Island's information technology platforms. Mr. Lodhi joined LIPA in October 2018 and previously served as Interim Chief Financial Officer. Prior to LIPA, Mr. Lodhi spent over two decades as a Chief Information Officer for large utilities across the United States, including Riverside Public Utilities, Washington Suburban Sanitary Commission, and DC Water. Throughout his career, Mr. Lodhi has earned over a dozen CIO awards for leveraging technology and improving business performance.

Rick Shansky* is LIPA's *Senior Vice President of Operations Oversight* and directs LIPA's oversight of its primary contractor PSEG Long Island, as well as its contractor engaged in power and fuel procurement. Mr. Shansky also manages LIPA's participation in wholesale power markets. Mr. Shansky has over 35 years of electric utility experience and has held a number of management positions since joining LIPA in 2008. Previously, Mr. Shansky held positions at Consolidated Edison Company of New York and the Long Island Lighting Company in the areas of energy management, resource planning, fuel and purchased power, and generation planning. Mr. Shansky is also a licensed Professional Engineer in the State of New York.

Kenneth Kane is LIPA's *Senior Advisor for Oversight* and leads LIPA's implementation of a new oversight framework for its service providers, including Chairing LIPA's management committee for Oversight and Metrics. Mr. Kane joined LIPA in 1999 as Director of Financial Reporting and previously served as Controller, Managing Director of Finance, Vice President of Financial Oversight, and most recently as Interim Chief Financial Officer. Mr. Kane has 36 years of experience in the electric utility industry, beginning in 1984 with Ernst & Young's utility practice. Mr. Kane joined the Long Island Lighting Company in 1988. Mr. Kane is a Certified Public Accountant in the State of New York.

Michael Deering is LIPA's *Vice President of External Affairs*. Mr. Deering joined LIPA in 2007 with over 25 years of environmental and energy experience having worked in both the private and public sector. Mr. Deering is responsible for LIPA's oversight of PSEG Long Island's customer service, energy efficiency, renewable energy and environmental programs.

James Miskiewicz is LIPA's *Special Counsel for Ethics, Risk and Compliance*. He joined LIPA in January 2016 after being appointed by Governor Cuomo as part of a state-wide initiative to encourage best practices for such functions across state agencies. At LIPA, Mr. Miskiewicz is responsible for managing legal and regulatory compliance, training, and reporting requirements under State law as well as LIPA's Code of Ethics and Conduct. He oversees LIPA's procurement department, including compliance with State vendor diversity programs for women, minority and service-disabled veteran-owned businesses. Before joining LIPA, Mr. Miskiewicz was a federal prosecutor in the Eastern District of New York. Winner of several awards, he investigated and led trials against corporate fraud, public corruption, international narcotics trafficking, homicide, and racketeering.

* Member of the ITF Steering Committee

He served as Deputy Chief of the Long Island Criminal Division and acting chief of the Organized Crime and Racketeering Section. Mr. Miskiewicz joined the Department as a Trial Attorney in the Environmental Crimes Section in Washington, D.C., where he litigated Clean Water Act, Clean Air Act and RCRA cases throughout the country.

NYS Department of Public Service

Joseph Suich* is the NYS *DPS Director of the Office of Investigations & Enforcement (OIE)*. The OIE conducts investigations and enforces against violations of the Public Service Law and its associated regulations and orders on behalf of the Public Service Commission. Mr. Suich joined DPS in 2020. Prior to joining DPS, Mr. Suich worked at General Electric from 2005-2019 in various US and international roles such as Global Chief Compliance Officer, General Counsel and other legal positions in the energy, water, nuclear, renewables and oil and gas sectors, including oversight of investigations. Mr. Suich also worked in Albany and Syracuse, New York as an energy and environmental lawyer from 1997 to 2005.

Kevin E. Wisely* is the NYS *DPS Director Office of Resilience and Emergency Preparedness* and is responsible for the oversight of DPS and Utility resilience, emergency preparedness and utility security (including physical and cyber) programs and initiatives. Mr. Wisely joined DPS in April 2019 and previously served the State of New York as the Director Office of Emergency Management. Prior to NYS, Mr. Wisely spent over twenty years with Niagara Mohawk (National Grid) in various nuclear, electric and gas roles, including system dispatch and control center operations.

PA Consulting Group

Derek Hasbrouck – *Engagement Director*

Derek advises senior utility industry clients on topics ranging from corporate strategy to operations improvement. He is an expert in benchmarking electric and gas utility businesses, utility regulation, network reliability, and customer service. He has benchmarked electric reliability and improvement programs for 30 years. He is the creator of PA's ReliabilityOne™ program, which annually certifies and recognizes the most reliable electric utilities nationwide. Derek has worked with both LIPA and PSEG Long Island on electric reliability issues, having led PA's 2017 review of the reliability performance metrics.

Mike Sullivan – *OMS and Storm Response*

Mike has over 35 years of broad utility leadership experience first as a Senior executive for Pepco Holdings Inc (now part of Exelon) and then as a management consultant with PA. At PA he has worked on several strategic and operational consulting engagements including an assessment of the Puerto Rican electric system following hurricane Marie and smart grid technology assessments. At PHI (Pepco, Delmarva Power, and Atlantic City electric, he was responsible for all aspects of designing, testing, and executing the Incident Command System (ICS). He was the PHI Incident Commander for more than 15 years.

Stephen Kerr – *Technology and Data*

Stephen specializes in analytics and internet of things technologies to improve and modernize electric utilities'

* Member of the ITF Steering Committee

grids, helping clients manage their portfolio, innovate, architect, and deliver solutions. He is a seasoned project leader, frequently called upon to organize large programs and turn around underperforming ones. Stephen is a Chartered Engineer and is a leader within our Delivery Assurance service. His technical expertise is in enterprise architecture, analytics, data management and integration with 20+ years of experience across the system lifecycle. His experience covers research and development, infrastructure, smart devices, enterprise packages, integration, utility operational systems and multiple frameworks and standards. His utility clients include the New York Power Authority and National Grid.

May Li -*Telephony and IT*

May Li has over 25 years of experience in Information and Communication technologies, and have worked with some top communication companies, service providers, transport organization, government, and regulators in various global locations. Specialized in network architecture design, technology strategy advisory, network assurance, digital services enablement, and ICT solution implementation. May studied powerline line communication and did her internship with one of China national grid regional offices before she started working as a network integration and troubleshooting engineer for a major telecommunication equipment providers, her career developed to holding board-level responsibility for managing and delivering major ICT transformation programs in both communication and enterprise network.

Olu Adebo – *Quality Assurance, IT*

Olu has over 25 years of accounting, financial and risk management consulting experience, including 13 years as Chief Financial Officer and Controller for the largest water and sewer utility on the east coast, the District of Columbia Water and Sewer Authority (DC Water). In this capacity, Mr. Adebo managed the utility's annual operating budget that exceeded \$450 million, and its \$3.8 billion 10-year capital improvement budget.

Mark Fowler – *Customer Communications*

Mark has over 35 years of utility consulting experience. In New York he has worked on assignments for the DPS regarding National Grid, LIPA, Central Hudson, and Consolidated Edison. Additionally, he has experience in other states with storm restorations involving National Grid, Unitil, Ameren, New Hampshire Electric Cooperative, Guam Power and Public Service of New Hampshire. He has also worked in the customer communications arena in water, gas and telephony industries.

Walt Drabinski – *Quality Assurance*

Walt has 25 years of consulting experience and another ten years with Niagara Mohawk as an Operations Project Engineer, Electrical Maintenance Supervisor, and as a Director of Training for all fossil and nuclear technical groups. Walt has managed 100-plus consulting engagements related to finance, power plant operations, fuel procurement, risk management, system and environmental modeling, and IRP development. He continues to provide long-term, direct consulting services to many senior utility managers.

EnerNex, a CeSI company

Ben Rankin – *SmartGrid and Customer Communications*

Ben specializes in smart grid systems and advanced metering infrastructure (AMI) including the integration of meter data management systems, advanced distribution management systems including outage management, and distributed energy resource management systems. Ben was a member of the team that developed the

advanced metering use cases and architecture for Southern California Edison in 2006 which have been foundational documents used by many other utilities for their own smart metering projects. Ben has worked with many other utilities and vendors on advanced metering projects including planning, integration, and communications. In addition to smart metering, Ben has been involved as a facilitator on two state utility commission sponsored stakeholder collaboratives for smart grids and advanced meter planning.

Uelligent

Lauren Preston – *Customer Communications*

Lauren has more than 25 years of experience leading consumption to cash and customer care call center functions for natural gas, electric and water utilities at both investor owned and municipal organizations. Her experience includes leading people and customer services through significant changes of systems, customer expectations, regulations and vendor relationships. She has more than 15 years experience leading electric and gas utilities in storm-prone service areas through major outages. She served as the customer service committee chairman for the American Gas Association and as an advisor to industry peers throughout the US. She has an MBA from Boston College and is a Certified Internal Auditor.

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Osman Ahmad – *Program Management and IV&V*

Osman is a senior utility IT professional with a successful track record of advising utilities on their IT turnaround strategies. Osman has authored IT strategic plans for water and electric utilities and has provided program management support to ensure their proper implementation. Mr. Ahmad has over 35 years of information technology and business management experience, including 20 years in senior IT technical leadership roles. He was the Chief Information Officer for District of Columbia Water and Sewer Authority and the Chief Business Officer for the Transportation Technology Center in Pueblo, Colorado. Osman has a BA in Chemistry and an MBA in Corporate Finance both from the University of Chicago.

Shonali Wadhvani – *Program Management and IV&V*

Shonali is a Project Manager and Senior Consultant at tieBridge. She has more than 25 years of technology analysis, project management, and software life cycle experience; and combines project management skills with strong functional and technical understanding to design and deliver solutions focused on meeting business needs, system optimization and process improvement. Shonali has a B.A. in Mathematics from Smith College and an active PMP.



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