State of New Jersey

New Jersey Board of Public Utilities

Staff Report and Recommendations
on Utility Response and Restoration to Power Outages
During the Winter Storms of March 2018

Prepared by
Division of Reliability and Security
Jim Giuliano, Director

July 12, 2018

Acknowledgements:

Principal authors:
Joseph Costa, Division of Reliability and Security
Lynn P. Costantini, Division of Reliability and Security

Contributors:

Division of Energy
Division of Customer Assistance
Office of Cable Television and Telecommunications

Table of Contents

Executive Summary 1

1. The Weather Events of March 2018 7

1.1 Winter Storm Riley 7

1.2 Winter Storm Quinn 9

1.3 Winter Storm Toby 10

2. Pre-Storm Preparations: Winter Storms Riley and Quinn 12

2.1. Overview and Profile of New Jersey's Electric Distribution Companies 12

2.1.1. ACE 13

2.1.2. JCP&L 13

2.1.3. PSE&G 15

2.1.4. RECO 15

2.2. Weather Forecasting and Outage Predictions 16

2.2.1. ACE 17

2.2.2. JCP&L 18

2.2.3. PSE&G 18

2.2.4. RECO 19

2.3. Pre-Storm Acquisition of Resources: Process and Considerations 20

2.4. EDC Pre-storm Acquisition of Resources 23

2.4.1. ACE 23

2.4.2. JCP&L 24

2.4.3. PSE&G 24

2.4.4. RECO 25

2.5. Findings and Recommendations 25

2.5.1. Weather Forecasting 25

2.5.2. Event Level Classification and Outage Prediction Modeling 26

2.5.3. Pre-Storm Resource Acquisition and Mutual Assistance 28

3. Restoration of Service ____ 30

3.1. Damage Assessment 30

3.2. Restoration Priorities 31

3.3. Workforce Deployment 32

3.3.1. ACE 34

3.3.2. JCP&L 34

3.3.3. PSE&G 34

3.3.4. RECO 35

3.4. Storm Impact, Outage Response and Restoration Timeline 35

3.4.1. ACE 36

3.4.2. JCP&L 37

3.4.3. PSE&G 38

3.4.4. RECO 39

3.5. Findings and Recommendations 40

3.5.1. Damage Assessment 40

3.5.2. Restoration Priorities 41

3.5.3. Workforce Deployment 42

3.5.4. Storm Impact, Outage Response and Restoration Timeline 43

Undergrounding 47

Advanced Metering 49

4. Communication and Outreach: Winter Storms Riley and Quinn ____ 52

4.1. Pre-Storm Notification 52

4.2. Customer Outreach 53

4.3. Customer Call Center Performance 53

4.3.1. ACE 54

4.3.2. JCP&L 54

4.3.3. PSE&G 54

4.3.4. RECO 55

4.4. Estimated Time of Restoration 55

4.5. Communication with Local Officials and the BPU 56

4.6. Findings and Recommendations 57

4.6.1. Pre-Storm Notification and Customer Outreach 57

4.6.2. Customer Call Center Performance 58

4.6.3. Estimated Time of Restoration 59

5. The EDCs' Response to Winter Storm Toby 61

5.1. ACE 61

- Pre-Storm Preparations 61
- Restoration of Service 61
- Communication and Outreach 62

5.2. JCP&L 63

- Pre-Storm Preparations 63
- Restoration of Service 63
- Communication and Outreach 64

5.3. Findings and Recommendations 65

6. Compliance with Board Orders 66

Executive Summary

During March 2018, New Jersey was struck by a series of severe weather events that impacted more than 1.2 million electric utility customers, leaving some without power for up to 11 days, and causing millions of dollars in property damage. Damaging weather events are not without precedent in New Jersey; however, the combination of three nearly back-to-back late-season nor'easters, each carrying heavy wet snow and intense wind gusts, and saturated soil due to a warm, wet winter was unusual. These conditions presented storm response and recovery challenges to each electric distribution company (EDC) in the state: Atlantic City Electric (ACE), Jersey Central Power and Light (JCP&L), Public Service Electric & Gas (PSE&G), and Rockland Electric Company (RECO).

Winter Storm Riley, the first of the three nor'easters, arrived on March 2, 2018. The storm was forecasted to be a rain event accompanied by high winds. As it approached New Jersey, however, Riley intensified into a powerful nor'easter with heavy wet snow and wind gusts reaching 50 to 70 mph. By 9:00 p.m. on March 2, electric customer outages peaked at more than 230,000, most of which were due to downed power lines from tree damage. Customers in all of New Jersey's 21 counties experienced power outages. On March 7, just five days after Riley had left the region, a second nor'easter named Winter Storm Quinn hit New Jersey. Compared to Riley, Quinn brought heavier snow and high winds to South Jersey with significant accumulating snow just west and northwest of Philadelphia and east along Interstate 95 up into the New York City area. On the evening of March 7, approximately 29000 remained without power from Riley. Outages from Quinn brought the total number of customers without power to 342,000 at peak. As a result of the severe damage to electricity infrastructure, mostly from toppled trees and falling tree branches caused by severe winds and heavy snow, power restoration was not completed until the afternoon of March 13, 2018; a full 11 days from the time Winter Storm Riley arrived on March 2, 2108.

On March 21, 2018, New Jersey and much of the northeast was hit by another nor'easter, Winter Storm Toby. This nor'easter brought heavy snow, high winds and coastal flooding, primarily to central and southern New Jersey. Compared to Riley and Quinn, damage to these areas was not as severe, owing largely to the differences in terrain and vegetation coverage within the affected areas. Nevertheless, peak outages reached a high of approximately 87,000 on the morning of March 22, with some customers out of service for up to four and one half days.

Given the magnitude of damage to electric utility infrastructure within the state and the lengthy restoration period that ensued, Governor Murphy directed the Board to initiate a review of actions and activities undertaken by each EDC before, during, and after each nor'easter. The purpose of this review is to identify areas for improvement so that the impacts of future storms are minimized and restorations are conducted with the utmost efficiency and effectiveness. To this end, Staff reviewed Major Event Reports, Emergency Management Plans, and other documentation provided to the Board by the EDCs as required. The Board also held 5 public hearings to gather information concerning EDC responsiveness from local officials and the public at large. Lastly, Staff examined each EDC's performance for compliance with requirements and directives issued by the Board following Hurricane Irene and Superstorm Sandy. This report is the culmination of Staff's review. It presents a detailed description of the March 2018 nor'easters and their impacts as well as Staff findings and recommendations to the Board for subsequent action. The body of this report explains in detail the basis for Staff's findings and recommendations. A synopsis of findings and recommendations follows.

Staff began its review by examining each EDC's pre-storm preparations, including its weather forecasting and outage prediction modeling. Effectiveness in these areas is vital because subsequent decisions depend on it. This is especially true for those decisions involving estimates of the number of potential resources needed to assist in restoration efforts as well as the timing related to acquiring those resources. Trained personnel who are able to mobilize quickly and work efficiently are the key to effective post-storm restoration.

When storm damage is expected to be significant, EDCs augment their employees with external resources including contractors, employees of affiliated or "sister" utilities, and mutual aid from other non-affiliated utilities in the region. The earlier in the process these external resources are acquired the faster EDCs can begin restoration efforts, safety permitting. Staff found that the rapidly changing nature of Winter Storm Riley led the EDCs initially to classify Winter Storm Riley as a low impact event, which, in turn, led to underestimates of potential damage and the number of external resources that might be needed to effect restoration. Once the true nature of the storm revealed itself, external resources were in limited supply across the Northeast. This situation was most challenging for JCP&L as storm damage in its Northern Region was much more substantial than predicted and customer outages were more than 10 times higher than initially anticipated.

The inability to acquire external resources before and during the early stages of recovery from Winter Storm Quinn affected restoration. Again, JCP&L suffered as it was still working to restore 29.000 customer outages remaining from Riley. Nor did RECO appear to have enough resources working in New Jersey to effect a timely restoration. Staff also found that because of the widespread damage from Riley and Quinn, the Regional Mutual Assistance Group (RMAG) was of limited value to New Jersey's EDCs early in storm restoration. Although members of this group commit to share employees and contractors with other utilities in need, these utilities also were planning for and recovering from the nor'easters and could not send resources into New Jersey immediately. This also reflects a tendency for utilities to keep personnel in place until the potential or actual effects of a major weather event in their service territories are better understood.

> *Based on these findings, Staff recommends the Board direct EDCs to improve their outage prediction modeling, develop and implement an Intrastate Resource Sharing Alliance to ensure resources are shared within the state should RMAG resources be scarce, and, participate with Staff and the National Weather Service in an initiative to improve weather-related information sharing. Moreover, the Board should direct JCP&L to make improvements to its outage prediction model to factor in the challenging physical environment of its Northern Region as well as the age, type and vulnerability of its aerial infrastructure*.

Staff also assessed the effectiveness of the EDCs' post-storm restoration efforts. Whereas ACE and PSE&G recovered within 3 and 4 days following Riley, respectively, JCP&L and RECO had yet to complete restoration when Quinn arrived. ACE completed restoration from Quinn on March 10, while JCP&L, PSE&G and RECO did not complete restoration until March 13. This reflects in part, the differences in regional impacts of these storms as more snow and higher winds were seen in JCP&L's and RECO's service territories during these storms. PSE&G also saw significant snow and high winds during Quinn. ACE and JCP&L's Central division were hardest hit by Toby, the March 21st nor'easter. Heavy snow and high winds caused extensive utility infrastructure damage caused by uprooted trees and falling tree limbs, which contributed to restoration delays.

Other contributing factors were identified. First, ACE, JCP&L and RECO relied upon contractors to perform damage assessment. This step is critical to the restoration process because the faster damage assessors can be mobilized and sent into the field, the faster restoration can commence. Employing significant numbers of contractors for this purpose appears necessary for ACE, JCP&L, and RECO but time lags may result. Similarly, contractors typically do not have direct access to these EDCs' Outage Management Systems (OMS), which may introduce delays in work order processing. Second, the EDC's ability to manage the influx of large numbers of external resources in the aftermath of a severe storm may be stretched to the limit. Efficiency may suffer as a result, which, in turn, affects timeliness of restoration. JCP&L's experience underscores this span-of-control concern. Between March 5 and March 12 JCP&L more than doubled its force, yet its restoration was the longest at 11 days. In Staff's view, this delay owes in part to inadequate levels of managerial and logistical oversight of an overwhelming number of external resources that quickly ramp up. RECO experienced a similarly long restoration period; however, contributing factors are hard to identify because restoration-related data is combined with its parent, Orange and Rockland Utilities, Inc. (ORU). Disaggregating RECO data from ORU data is absolutely necessary to gain appropriate levels of transparency into future recovery efforts from major weather events within New Jersey's borders. Finally, it is clear that telecommunications providers also have a role in infrastructure restoration. They own or co-own poles that must be replaced before fallen wires and cables can be replaced. Sustained communication and effective coordination with EDCs and telecommunications providers during a storm restoration is essential.

To ensure efficient and effective storm restoration, Staff recommends the Board direct JCP&L improve its span of control capabilities and hire or contract additional skilled personnel for this purpose. Staff also recommends that, to improve transparency, the Board direct RECO to provide New Jersey-specific storm restoration data, including resource acquisitions and deployments. Staff also recommends that the Board direct EDCs to work with telecommunications providers to develop and implement a formal joint-use storm coordination plan.

Given the extent of damage to EDC infrastructure during the March nor'easters, Staff also assessed potential root causes that perpetuate the likelihood of severe damage to utility infrastructure during weather-related events. During Winter Storms Riley and Quinn, nearly 100 miles of overhead wires and cables were knocked down by fallen trees and tree limbs — levels of damage not seen since Superstorm Sandy. The Board's Vegetation Management rules require EDCs to trim trees within their rights of way, but damage during severe storms such as Riley and Quinn typically were caused by trees outside those areas. In addition to wires and cables down, approximately 2,000 utility poles were broken or damaged, including poles owned by Verizon and Century Link. While EDCs must adhere to National Electrical Safety Code (NESC) standards when installing or replacing poles, it is unclear to what extent Verizon and Century Link take these strength and loading standards into consideration when replacing poles. This could be a factor in pole line susceptibility to storm damage.

> *To address these root cause issues, Staff recommends that revisions to the Board's Vegetation Management rules be considered that emphasize a targeted, risk-based tree trimming and removal program that includes tree branches beyond the distribution lock out zone. Staff also urges the consideration of more permanent legislative solutions to reduce potential infrastructure damage from trees outside of utilities' rights of way*.

> *Additionally, Staff recommends that the Board direct all pole-owning utilities in the State to conduct a pole safety audit to ensure adherence with NESC requirements.*

Staff also considered the viability of undergrounding as a means of protecting infrastructure in areas particularly susceptible to storm damage. There is no industry consensus on this practice. Studies conducted since the early 2000s typically found that protection benefits are outweighed by the costs of burying electric cables – as much as $3 million per mile — as well as additional costs related to maintenance and repair.

Finally, Staff reviewed EDCs' communications with their customers and with local officials about storm restoration progress following Winter Storms Riley, Quinn and Toby. This entailed examining the EDCs development and communication of Estimated Times of Restoration (ETRs), the performance of their customer call centers, and contact with their registered critical care customers. Of these topics, developing reasonably accurate ETRs proved the most challenging for EDCs, particularly after Riley and Quinn.

The development and communication of ETRs was mandated by the Board following Hurricane Irene. First, EDCs must post a Global ETR within 24 hours after a weather event leaves the region. This value indicates the best estimate from an EDC as to when system repairs will be completed in their entirety and power restored to all affected customers. The Global ETR provides decision-making insights for public safety officials regarding community needs such as sheltering, traffic management and life safety matters. It also provides customers their first indication of when they can expect power to be restored, which allows them to make sheltering decisions. As EDCs conduct damage assessment and their situational awareness improves, EDCs are required to post updates to their Global ETRs and begin posting more localized ETRs as well. As restoration continues, EDCs also must begin posting ETRs for individual customers. The EDCs also revise these second and third tier ETRs as damage assessment and restoration efforts continue.

Staff's review shows that EDCs posted Global, local, and individual ETRs as directed by the Board. However, as found after reviews of other storm restorations, confusion remains as to the intent and purpose of these estimates. Although EDCs develop these values based upon the best information they have at the time, customers continue to express frustration and confusion over the posting of multiple ETRs and the reasons for myriad revisions during the restoration process. Customers and local officials were particularly critical of JCP&L and RECO in this regard. For some JCP&L customers, confusion and frustration over ETRs was exacerbated when JCP&L failed to recognize early in the restoration process that its interactive voice response (IVR) system was providing inaccurate restoration information. Staff also found that, unlike JCP&L, PSE&G and ACE appear to interpret Global ETR to apply at the operating district level rather than to the entirety of their systems. It also appears that their more refined ETRs proved more achievable than JCP&L's system-wide Global ETR.

Based on these findings, Staff recommends for major storms affecting customers in multiple operating districts that the Board direct EDCs to post a global ETR applicable to the entirety of each operating district. These estimates should be posted within 24 hours of a storm's departure from its service territory. EDCs should clearly define the differences between these estimates.

Staff's review also found deficiencies in the performance of RECO's customer call center, which is provided by ORU. These findings are based in large part on customer complaints received by the Board, particularly during its April 16, 2018 public hearing in Mahwah, NJ. Many customers in attendance expressed frustration over the lack of New Jersey specific restoration information provided by the ORU call center and complained about a perceived indifference shown by ORU call center representatives toward New Jersey residents. Staff also found that information posted on social media by ORU typically did not reference the status of ongoing repairs in RECO's service territory.

Based on this finding, Staff recommends the Board direct ORU, on behalf of RECO, to improve its customer call center performance. Information specific to storm restoration progress in RECO's service territory must be readily available. Additionally, ORU should improve its training program for customer call center representatives to ensure RECO customers receive the New Jersey specific information they seek in an expeditious, professional manner.

Staff also recommends the Board direct the following improvements to EDCs communications with their critical care customers:

Each EDC should make phone calls to critical care customers before, during, and after any outage event. In the event an EDC cannot reach the critical care customer within a 24-hour period, the EDC should make referrals to local or county Emergency Operations Centers, first responders or other health and human service organization to make contact.

Lastly, as evidenced during restorations from major storms such as Hurricane Irene and Superstorm Sandy, improving restoration effectiveness requires EDCs to rapidly identify damage locations and prioritize repairs. This is especially challenging during the tail end of the restoration process when work turns to repairs to single homes or small groups of customers. Oftentimes, this work uncovers additional damage, or “nested” outages, which slows the pace of restoration. Moreover, EDCs must confirm successful restorations at this level directly with the customer, which also slows the efficiency of the restoration process. Improvements can be achieved by enhancing the visibility of assets closer to customer premises. As suggested by ACE, advanced metering infrastructure (AMI) offers a potential solution. Because efficiency is instrumental to effective storm restorations, Staff believes a closer review of this technology is warranted at this time. As such, Staff recommends the Board direct the following:

> *JCP&L, PSE&G and ACE each submit to the Board a feasibility study for AMI implementation, including a detailed cost-benefit analysis, for the purposes of reducing customer outages and improving EDC’s capabilities to effect timely system restoration following major weather events*.

Ultimately, the purpose of this report is to identify ways and means for EDCs to improve the effectiveness of their post-storm system restoration efforts. Despite the fact that weather can be unpredictable, as evidenced by the March 2018 nor’easters that impacted New Jersey, Staff’s review found room for improvement exists in several key areas especially pre-storm planning and post-storm restoration. Staff’s detailed recommendations contained within the body of this report, address these areas.

1. The Weather Events of March 2018

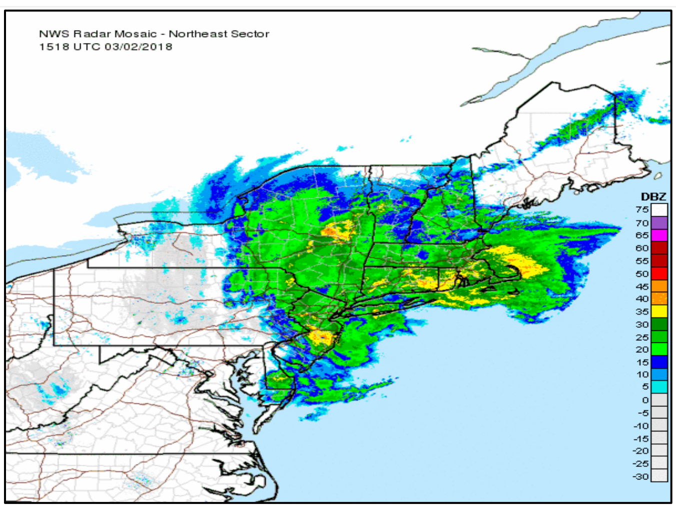
During March 2018, New Jersey was struck by a series of severe weather events that left more than 1.2 million people electric utility customers without power for up to 11 days and caused millions of dollars in property damage. Although these weather events were not without precedent— the Northeast region has experienced comparable storms in recent years[1]—the combination of three nearly back-to-back late-season nor'easters, each carrying heavy wet snow and intense wind gusts, and saturated soil due to a warm, wet winter was unusual.

1.1 Winter Storm Riley

Winter Storm Riley, the first of the three nor'easters to hit New Jersey, arrived on March 2, 2018. It began as a low-pressure system in the eastern Great Lakes. On February 26, the National Weather Service characterized the approaching storm as a hazardous "summer-like" rain event that could cause flooding throughout New Jersey. Up to three inches of rain along with 45 mph wind gusts were forecasted. Coastal flooding was of paramount concern. Snow was deemed possible but not probable as temperatures were expected to climb into the 40s and 50s across most of the state.

By March 1, a mix of rain, snow and high winds engulfed the northeast region. Riley had grown quickly into a powerful nor'easter with strong wind gusts reaching 50 mph. The intense weather was strengthened by a phenomenon known as "bombogenesis," which describes a rapidly strengthening storm caused by a drop in atmospheric pressure of at least 24 millibars in a 24 hour period[2].

Figure 1. Winter Storm Riley: Radar Image of Precipitation on March 2, 2018



Source: National Weather Service (NWS)

[1] Examples include the Derecho thunderstorm in June 2012, the bow echo storm in June 2015 and Winter Storm Jonas in January 2016.

[2] https://oceanservice.noaa.gov/facts/bombogenesis.html.

In New Jersey, rain became heavy early in the morning of March 2. The National Weather Service predicted up to 1.5" of precipitation in the northeast part of the state. Precipitation in the central and southern regions was forecasted to be between 0.5" to 1.0" and 0.25" to 0.5", respectively. Wind gusts over 50 mph were possible.

Rather than rising as forecasted, temperatures began falling. Precipitation turned to snow in the north, and to a mix of rain, sleet, and snow in central and southern areas of the state. Hunterdon, Bergen and Monmouth counties saw the highest precipitation. The heaviest snowfall was confined to higher elevations, with the highest total (16.5") in Sussex County. Weather monitoring stations recorded winds gusts between 40–49 mph in some parts of the state and more than 50 mph in others.

Figure 2. Relief Map of New Jersey

Source: www.maphill.com

By 9:00 p.m. on March 2, a statewide peak of 230,000 electric utility customers without power was reached, mostly due to downed power lines from tree damage caused by high winds. All of New Jersey's twenty-one (21) counties experienced power outages. Morris, Hunterdon and Sussex counties, areas of heavy tree canopy, experienced the heaviest concentration of outages. The wind abated somewhat on March 3, 2018, but wind gusts of 45 mph still occurred along the coast in central and southern parts of the state.

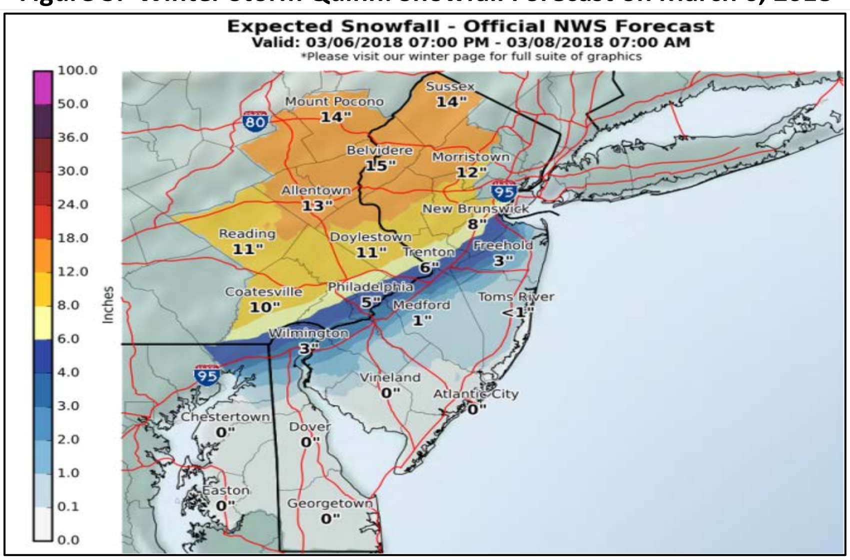
1.2 Winter Storm Quinn

Winter Storm Quinn arrived in New Jersey on March 7, 2018, just five days after Winter Storm Riley. According to the National Weather Service, Quinn developed in late February on the west coast and traveled over the Rockies on a multi-day voyage eastward. Compared to Riley, Quinn brought heavier snow farther south and east along Interstate 95 with significant accumulating snow just west and northwest of Philadelphia and into the New York City area.

In New Jersey, as with the previous storm, Quinn began as rain during the late evening of March 6. By dawn on March 7, rain began mixing with snow in northern and central regions of New Jersey. Snowfall amounts picked up during the afternoon and evening. Lightning and thunder were reported across central and southern areas of the state.

Weather monitoring stations recorded 10” or more of snow in eleven counties and 5” to 9” inches in seven others. The deepest snow fell at higher elevations. Montville in Morris County and Oakland in Bergen County reported the most snowfall at 26.8” and 26”, respectively. Snow extended as far south as Burlington County, with a rather sharp cutoff in snowfall into the eastern part of New Jersey. Coastal areas received less than 2.0 inches of snow.

Figure 3. Winter Storm Quinn: Snowfall Forecast on March 6, 2018



Source: National Weather Service (NWS)

As snow began to fall on March 7, approximately 29,000 customers remained without power due to Winter Storm Riley, mostly in Jersey Central Power & Light’s (JCP&L) Northern Region. Quinn’s high winds and significant wet snowfall caused additional outages across northern parts of the state. Customer power outages, including those leftover from Riley, peaked at 342,000 during the evening of March 7.

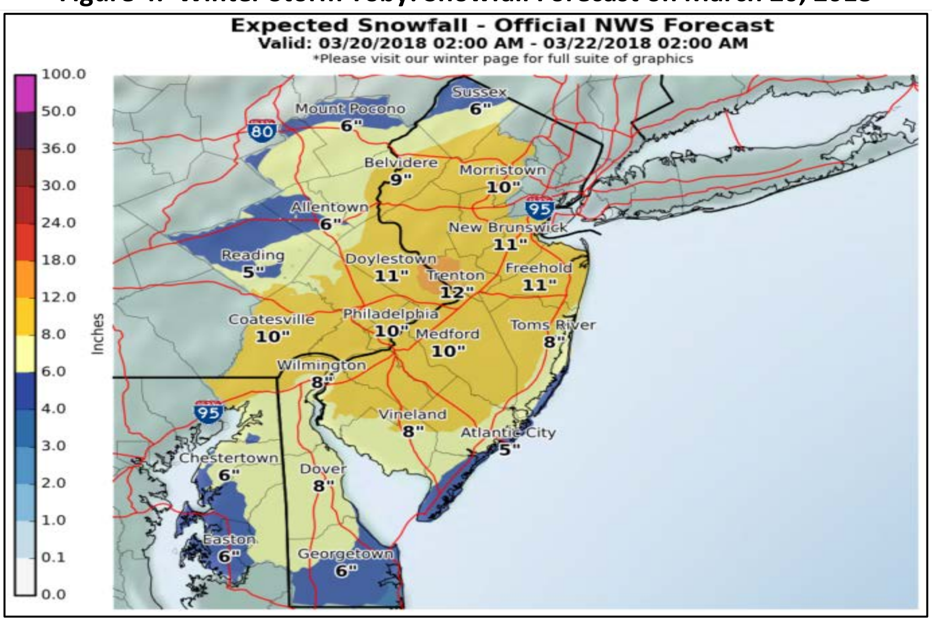
1.3 Winter Storm Toby

The final March nor'easter, Winter Storm Toby, arrived in New Jersey on March 20, 2018 with a mix of rain, sleet, and snow falling mainly in the southern half of the state. The National Weather Service forecasted wet snow, likely "to collect on trees and wires," would spread from the northwest to the southeast at rates of 1"-3" per hour during the day on March 21.

During the night of March 20 and into the morning of March 21, snow began to fall in southwestern sections of the state. Snow began to fall more heavily that afternoon, as the storm extended southeasterly. The storm finally tapered off early on March 22.

By the time Toby was over, locations in ten counties had received 10" of snow or more. Some areas in Camden and Burlington counties received 8" to 12" of snow. Lacey Township, located in southeasterly Ocean County, reported the highest snowfall at 15". High wind gusts also were reported with minor to moderate coastal flooding. Gusts reached 47 mph at Atlantic City Marina on March 20 and March 21. Wind gusts of 48 mph were recorded in Harvey Cedars on March 21.

Figure 4. Winter Storm Toby: Snowfall Forecast on March 20, 2018



Source: National Weather Service (NWS)

The heavy wet snow and high winds that accompanied Winter Storm Toby caused significant tree-related damage to the electric infrastructure of Atlantic City Electric (ACE) and JCP&L's Central Region. Approximately 87,000 customers in central and southern New Jersey lost power.

Because Winter Storm Toby arrived well after the restoration from Winter Storms Riley and Quinn was completed, discussion of this storm's impact on electric distribution companies (EDCs) and their restoration efforts is contained in Section 5.

2. Pre-Storm Preparations: Winter Storms Riley and Quinn

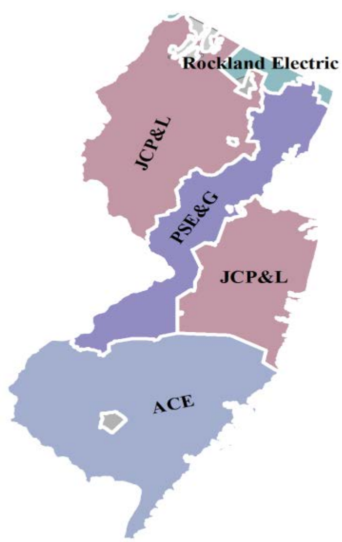
This section examines the pre-storm activities undertaken by each of New Jersey's EDCs in anticipation of Winter Storms Riley and Quinn.[3] These activities include weather forecasting and outage prediction modeling as well as the acquisition of trained personnel—employees, employees of affiliated or "sister" utilities, contractors, and mutual aid from other non-affiliated utilities—that might be needed to effect post-storm restoration. The purpose of this examination is to understand the extent of the EDC's preparations and to identify areas for improvement.

To fully understand the effectiveness of the EDCs during storm preparation and restoration efforts, it is first necessary to understand their service territories, corporate management structures, and operations within the state.

2.1. Overview and Profile of New Jersey's Electric Distribution Companies

Four investor-owned utilities, also referred to as electric distribution companies or EDCs, provide electric utility service to almost 4 million customers in New Jersey. They are Atlantic City Electric (ACE), Jersey Central Power & Light (JCP&L), Public Service Electric & Gas (PSE&G) and Rockland Electric Company (RECO). Together, these companies provide service to more than 98% of electricity customers in the state (the remainder is split between nine public entities and one cooperative utility). Each of the four EDCs has a defined service territory that is geographically distinct. All are subject to regulation by the Board.

Figure 5. New Jersey's EDCs



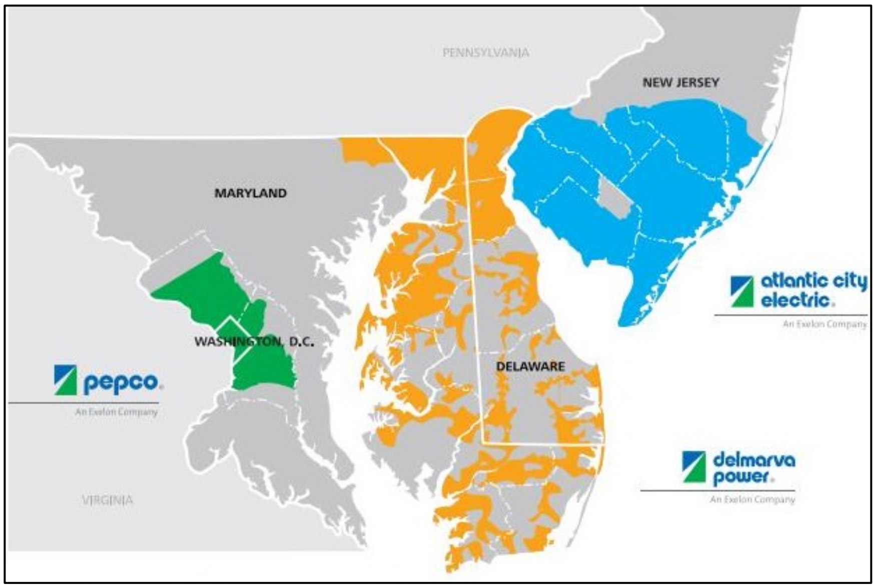
[3] The analysis of EDC performance during Winter Storm Toby is shown in Section 5 of this report.

2.1.1. ACE

ACE provides electricity to approximately 537,000 customers in 125 municipalities in southern New Jersey. Its service territory comprises all or parts of Ocean, Atlantic, Salem, Camden, Cumberland, Burlington, Gloucester and Cape May counties, encompassing nearly 3,000 square miles. It includes large parts of New Jersey's southern coastline, where communities are vulnerable to coastal flooding from severe storms such as hurricanes and tropical storms. ACE has divided its service territory into four operating districts: Cape May, Glassboro, Pleasantville and Winslow.

ACE is a wholly owned subsidiary of Pepco Holdings, Inc. (PHI), which also owns Potomac Electric Power Co. (Pepco) and Delmarva Power. Combined, PHI serves approximately 2 million customers in New Jersey, Delaware, Maryland and Washington, D.C.

Figure 6. PHI-Affiliated EDCs



In 2016, Exelon Corporation, a Fortune 100 energy company, acquired PHI through a merger agreement. As a result, PHI became a wholly owned subsidiary of Exelon. The merger of PHI and Exelon expanded the Exelon footprint but retained the PHI structure of affiliate utilities.[4]

2.1.2. JCP&L

JCP&L provides electricity to more than 1.1 million customers in 236 municipalities in New Jersey. Its service territory consists of 2 non-contiguous regions that total more than 3,100 square miles. Its Northern Region, headquartered in Morristown, serves all or parts of Essex,

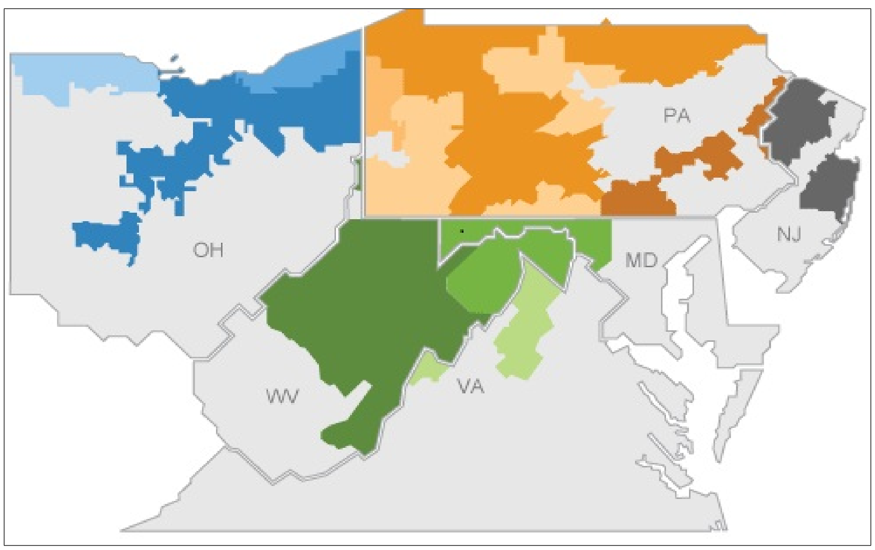
[4] In total, Exelon operates six regulated utilities, Commonwealth Edison (Illinois), PECO Energy Company (Pennsylvania), Baltimore Gas and Electric (Maryland), Delmarva Power & Light (Delaware and Maryland), Atlantic City Electric (New Jersey), and Potomac Electric Power Company (Washington, DC and Maryland).

Hunterdon, Mercer, Morris, Passaic, Somerset, Sussex, Union and Warren counties. The Central Region, headquartered in Holmdel, serves all or parts of Burlington, Mercer, Middlesex, Monmouth and Ocean counties.

JCP&L's two service territories are vastly different in terms of topography, home density and climate zones.[5] Its Northern Region is mostly rural with pockets of densely populated areas. It sits within some of the highest topological elevations and most dense vegetation in New Jersey. As such, this part of New Jersey is susceptible to significant snowfall and high winds during certain times of the year. On the other hand, JCP&L's Central Region includes a large swath of densely populated communities along the New Jersey coastline, which is susceptible to flooding from hurricanes, tropical storms, and similar weather events.

JCP&L is a wholly owned subsidiary of FirstEnergy Corporation (FE), an energy company with subsidiaries and affiliates involved in the distribution, transmission and generation of electricity. FE operates ten regulated utilities in parts of Ohio, Pennsylvania, West Virginia, Maryland, New Jersey and New York. Combined, these utilities serve more than 6 million customers.[6]

Figure 7. FirstEnergy Affiliated EDCs



[5] New Jersey has five distinct climate regions with prevailing atmospheric flow patterns that produce distinct variations in the daily weather between each region. The five regions include Northern, Central, Pine Barrens, Southwest, and Coastal. (Rutgers University Office of New Jersey Climatologist, *New Jersey Climate Zones*, climate.rutgers.edu/stateclim_v1/njclimoverview.html). JCPL's service territory encompasses three of the five climate zones.

[6] FE affiliated companies include the following:
Ohio: Ohio Edison, The Illuminating Company, Toledo Edison;
Pennsylvania: Met-Ed, Penelec, Penn Power, West Penn Power;
New Jersey: Jersey Central Power & Light
West Virginia/Maryland: Mon Power, Potomac Edison

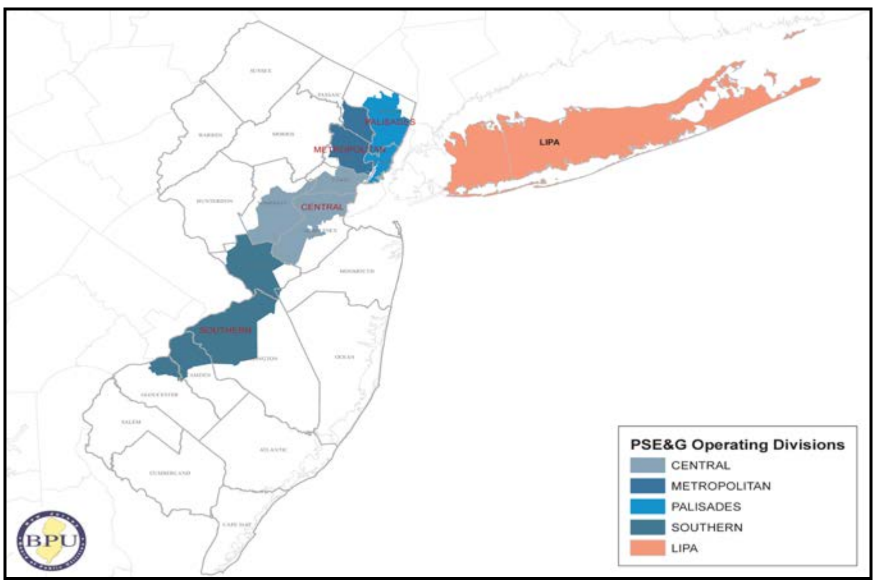
2.1.3. PSE&G

PSE&G is New Jersey's oldest and largest investor-owned utility in terms of total customers, serving more than 2.2 million electric utility customers in 23 municipalities. PSE&G's electric service territory covers approximately 1,400 square miles along a heavily populated, commercialized and industrialized corridor between Bergen County in the northeast and Gloucester County in the southwest. PSE&G is divided into four operating divisions: Central, Metropolitan, Palisades, and Southern.

In addition to serving the most electric customers in the state, PSE&G also provides natural gas service to approximately 1.8 million gas customers. Combined, the overlapping electric and natural gas service territory covers approximately 2,600 square miles in an area that extends from the New Jersey side of the Hudson River in Bergen County, southwest to the Delaware River and south to Camden County.

PSE&G is a subsidiary of the Public Service Enterprise Group (PSEG), a publicly traded energy company headquartered in Newark, New Jersey. In 2014, PSEG, through its subsidiary, PSEG Long Island LLC, was awarded a 10-year contract to manage Long Island Power Authority (LIPA). PSEG Long Island manages, but does not own, LIPA's electric transmission and distribution system.

Figure 8. Public Service Enterprise Group (PSEG) Affiliated EDCs



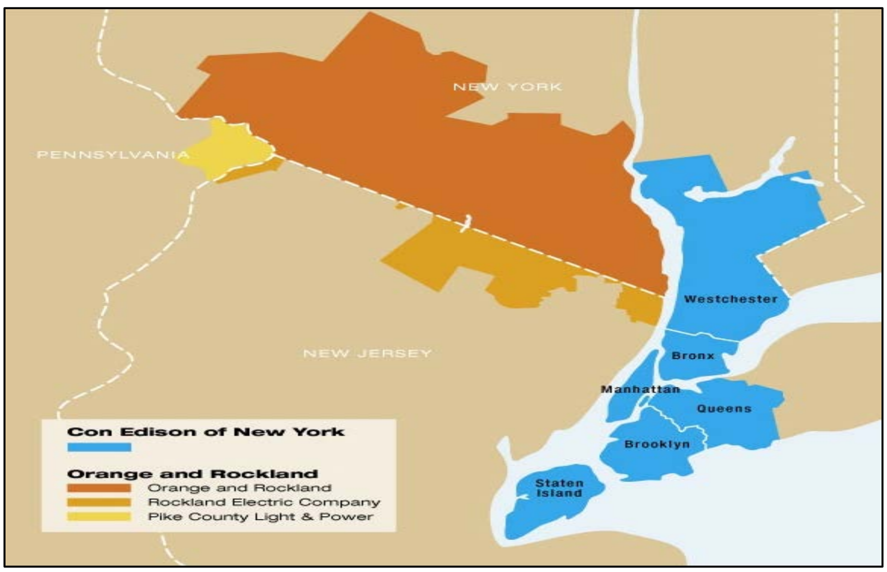
2.1.4. RECO

RECO is an investor-owned utility that serves approximately 72,000 electricity customers in 25 municipalities in New Jersey. Its territory covers approximately 200 square miles in parts of Bergen, Passaic and Sussex counties that border New York State. Similar to JCP&L's Northern Region, RECO's service territory is in the higher topological elevations of New Jersey, which are susceptible to significant snowfall and high winds during certain times of the year. It is not densely populated although pockets of densely populated areas exist.

RECO is a wholly owned subsidiary of Orange and Rockland Utilities, Inc. (ORU), a New York corporation, which in turn is a wholly owned subsidiary of Consolidated Edison, Inc. (ConEd). ORU provides service to electric and gas customers in all or parts of New York's Rockland, Orange, and Sullivan counties. ORU has three operating divisions: East, Central, and Western.

RECO has no employees. Its parent, ORU, provides all of RECO's administrative needs, operating services, and workforce. ORU charges RECO pursuant to cost allocation procedures approved by the Board. In New Jersey, ORU's East Division covers Bergen County, its Central Division covers Passaic County, and its Western Division covers Sussex County.

Figure 9. Consolidated Edison Affiliated EDCs



2.2. Weather Forecasting and Outage Predictions

Monitoring and forecasting events that could potentially disrupt service to customers allows EDCs time to plan for and mobilize resources that may be needed to effect restoration. At the first sign of an impending event with potentially damaging storm conditions, EDCs begin to collect and analyze critical information about the storm's possible impact to their systems. This includes information that helps to facilitate pre-storm planning, to accelerate resource mobilization, and to proactively alert critical needs customers of the possible loss of power.

In addition to public weather forecasts such as those provided by the National Weather Service, each of New Jersey's four EDCs uses its own internal or contracted meteorologists or weather services, often in combination. Current weather forecasts from these sources are compared to historical data to identify areas most likely to be impacted by the weather event. Based on this analysis, the EDC assigns a storm impact classification to the event, and predicts potential levels of customer outages that may result.

Each EDC uses a form of a matrix to classify storm impacts, as documented in its emergency management plans. The matrix is divided into levels, or classifications, each identified by a number (e.g., 1 through 5) or a letter (e.g., A through E), or a combination thereof. Each level corresponds to a given range of weather variables such as wind and precipitation. For individual weather events, the classification matrix serves as a pre-planning tool to help identify the resources that will likely be needed for storm response and recovery.

2.2.1. ACE

ACE relied on the weather service StormGeo[7] for forecasts related to the March 2018 weather events. ACE's first forecasts related to Winter Storm Riley were issued on February 26 and 27. These forecasts described an approaching storm, expected to arrive on March 2, consisting of rain and wind gusts of 30-35 mph inland and 40-45 mph on the coast. On February 28, the forecast was upgraded to wind gusts of 35-45 mph inland and 45-55 mph on the coast. In response ACE issued a high wind watch for its service territory. The forecast issued on March 1 called for sustained winds of 30 mph and gusts of 45-55 mph with a possibility of 60 mph winds with rain and trace amounts of snow. In response, ACE issued a high wind warning for its service territory and noted the potential for trees and poles to be blown over due to saturated soil conditions. On March 2, as Winter Storm Riley arrived, the forecast changed again to reflect expected wind gusts of 50-60 mph and a rain/snow mix with trace amounts of snow accumulation.

To determine pre-storm resource and mobilization needs, ACE assigns "Event Level" classifications to storms[8]. ACE uses a classification matrix based on numerical ranges from 1-6. Event Level 1 represents the least impact while Event Level 6 - Catastrophic Incident represents the most severe impact. Leading up to the arrival of Winter Storm Riley, ACE classified the storm as an Event Level 4.

Before Winter Storm Riley had left the region, weather forecasts began calling for the possibility of a rain and snow event for March 6-7. On March 4, Storm Geo's forecasts for ACE called for moderate to heavy snowfall and gusty winds. The forecast on March 5 predicted 2-6 inches of snow and winds gusting 25-30 mph inland and 35-45 mph on the coast. The snow totals were increased on March 6 to 3-8 inches inland and 2-4 inches along the coast with winds of 35-45 mph inland and 40-50 mph on the coast. ACE's final forecast on March 7, just before Winter Storm Quinn arrived, called for snow totals of 4-8 inches inland and 1-3 inches along the

[7] StormGeo is one of the largest privately held weather services in the world and provides meteorological services to energy, shipping, corporate enterprise and media industries. http://www.stormgeo.com/

[8] ACE's Event Level classification matrix was developed by its parent company PHI and is described in the company's Emergency Operation Plan.

coast with winds of 30-35 mph inland and 45-50 along the coast. Based on its forecasting and outage prediction modeling, ACE classified this storm as an Event Level 4.

2.2.2. JCP&L

JCP&L used FirstEnergy Meteorological Services for its weather forecasting before and throughout each of the March 2018 storms. The initial February 28 forecast predicted a storm, expected to arrive on March 2, with wind gusts of 40-45 mph with isolated gusts up to 50 mph for the majority of JCP&L's two service territories. No snow was expected. JCP&L's March 1 forecast called for similar wind gusts but added 3-5 inches of wet snow for the JCP&L Northern Region and 6-9 inches in an isolated pocket to the extreme northwest. The next two forecasts, both issued on the morning of March 2, were consistent with the previous day's forecast. During the afternoon of March 2 JCP&L updated its snow totals forecast to 6-9 inches in the Central Region and 10-14 or more inches across its Northern Region. Forty mph winds were forecast for March 3.

The first indication of the approach of the March 7 storm (Winter Storm Quinn) was on March 4. That forecast predicted up to 6-9 inches of wet snow in the Northern Region. Subsequent forecasts on March 5 and March 6 increased snow totals to 10-16 inches of wet snow in the Northern Region and between 3-6 inches and 6-9 inches in the Central Region with 35 to 40 mph winds along the coast. The final forecast on March 7 increased the possibility of up to 18 inches of wet snow in isolated portions of JCP&L's Northern Region.

JCP&L uses an event classification matrix developed by its parent company, FirstEnergy Corporation. Classification levels are designated by Roman numerals I to V where V represents the most catastrophic event. On March 1, the day before Winter Storm Riley arrived, JCP&L's weather analysis lead to the classification of Winter Storm Riley as a Level I- Low Impact storm. Its outage prediction model estimated 13,900 electric utility customers would likely be impacted. Winter Storm Quinn was classified as a Level IV storm and outage modeling estimated 100,000 or more electric utility customers would likely be impacted.

2.2.3. PSE&G

PSE&G uses StormGeo for its weather forecasting and storm monitoring and DTN[9] weather service for its storm impact analysis. Initial forecasts beginning on February 25 for PSE&G indicated the possibility of high winds for March 2-3 and for rain and small amounts of wet snow. On March 1, PSE&G's forecast continued to indicate that wind gusts of 50-55 mph were possible with 2-4 inches of wet snow in the northern portions of its system and diminishing through the southern portion. The snowfall amount was not deemed to be hazardous. The forecasts on March 2 continued to reflect an elevated risk of wind damage throughout the entire system, but non-hazardous snow accumulations.

[9] DTN provides products and services to the agriculture, oil & gas, trading, and weather-sensitive industries. For utilities, DTN provides localized weather information to help minimize risk and aid decision making.

On March 3-4, as Winter Storm Riley left the region, forecasts were issued for wet snow on March 7 with accumulations of 4-7 inches in the northern half of PSE&G's service territory and 2-5 inches elsewhere. In the afternoon on March 5, forecast snow accumulations were increased to 5-8 inches with isolated areas of 10 inches in the Metropolitan and Palisades Divisions, 3-6 inches with isolated areas of 8 inches in the Central Division and 3-5 inches in the Southern Division.

On March 6, the day before Winter Storm Quinn arrived, snow totals were again increased to 8-12 inches with isolated areas of 14 inches in the Metropolitan and Palisades Divisions, 6-10 inches with isolated areas of 12 inches in the Central Division, and 5-8 inches with isolated areas of 10 inches in the Southern Division. These snowfall amounts were classified as hazardous snow conditions in the forecast. Weather updates issued in the morning and afternoon of March 7 increased the snow totals again to 12-15 inches, with local amounts up to 18 inches, in the Metropolitan and Palisades Division, 8-12 inches with local amounts up to 14 inches in the Central and parts of the Southern Division, and 5-8 inches with local amounts up to 10 inches for the rest of the Southern Division.

For planning purposes, PSE&G uses a Storm Severity Matrix, which contains five classification designations, where 5 is most severe. PSE&G initially classified Winter Storm Riley as a Level 2 storm and anticipated between 15,000 and 40,000 customer interruptions. As the weather forecast changed, PSE&G reclassified the storm as a Level 3 and increased its outage predications up to 200,000 potential interruptions. PSE&G also classified Winter Storm Quinn as a Level 3.

2.2.4. RECO

Weather forecasts for RECO and ORU were provided by ConEd, DTN, and the National Weather Service. On February 26, the forecast for RECO included predicted winds of 25 mph and gusts from 30-45 mph for March 2. On February 27, the forecast called for 1-2 inches of rain with the possibility of wet snow and winds from 10-20 mph and gusts of 30-40 mph. The February 28 forecast upgraded the storm predictions to 1-2.5 inches of rain changing over to less than 6 inches of wet snow and 15-25 mph winds gusting to 35-45 mph. The forecasts on March 1 and March 2 increased the snow totals to greater than 6 inches of snow and wind gusts from 35-50 mph.

The first forecast for the March 7 storm (Winter Storm Quinn) was issued on March 3. It indicated a possibility of accumulating snow and winds of 10-20 mph with gusts up to 25-35 mph. The forecast on March 4 included snowfall amounts of greater than 6 inches of wet snow. On March 5, snow totals were increased again to 6-14 inches with winds of 10-25 mph and gusts of up to 30-40 mph. On March 6 and March 7, snow totals of 10-15 inches were issued with similar wind conditions.

RECO uses ORU's "Storm Classification and Staffing Matrix" to classify storm impacts. Similar to ACE, JCP&L and PSE&G, the ORU matrix assigns a severity level to determine likely customer outages and resource needs. ORU uses a combination number and/letter classification identifier. The matrix includes 12 classifications in 6 categories. The storm classification for Riley initially began as an “Upgraded level” (Category 1). As the weather forecast changed, the classification was changed to a “Serious” (Category 3) classification 3B level. Both Riley and Quinn ultimately were classified as “Serious” (Category 3) classification 3B events.

2.3. Pre-Storm Acquisition of Resources: Process and Considerations

Under normal conditions, EDCs are supposed to be adequately staffed to meet their routine day-to-day operational needs, including system failures, accidents and low impact weather events that cause outages. However, when confronted with potentially widespread infrastructure damage from weather-related events, each EDC supplements its workforce with additional personnel and equipment from a variety of sources to expedite post-storm restoration.

The decision to request additional resources is dependent in part on the classification that EDCs assign to an impending weather event. As described in Section 2.2, event classifications are determined based on internal and external weather forecasting data, outage prediction models, and the companies’ own past experiences. To supplement their internal workforces during an anticipated major restoration event, EDCs turn to the following: (1) local contractors under contract with the company or who have worked with the company in the past; (2) out-of-state electric utility crews from affiliated, or “sister”, utilities; (3) out-of-state contractors that work for other utilities; and, (4) local or out-of-state unaffiliated electric utility crews. Out of state contractors working for other utilities and local or out-of-state unaffiliated electric utility crews are acquired through Regional Mutual Assistance Groups (RMAG).

When acquiring additional resources, EDCs usually look first to their local contractors. These contractors are either under contract with the EDC or independent contractors who have worked with the EDC in the past. Local contractors are often the most expedient option for an EDC looking to supplement its workforce pre-storm because they can be on property very early in the restoration process. However, the number of available contractors may be limited during a major weather event such as the March 2018 nor’easters because of the high demand for them.

As described in Section 2.1, the corporate structures of JCP&L, ACE and RECO have expanded these utilities’ access to personnel and resources through their corporate affiliations with EDCs in other states. In theory, utility affiliates would provide a large pool of resources should they be needed to help restore service to customers in New Jersey who have been impacted by a major weather event. In practice, however, the availability of these affiliated utility resources has proven somewhat limited. When major storms impact more than one state, as the March 2018 nor’easters did, resources to share become scarce. For instance, Winter Storm Riley caused damage from Ohio across Pennsylvania to New York northward to Massachusetts and southward towards Washington DC. Utility affiliates of JCP&L, RECO and ACE were also battling storm-related outages affecting thousands of their own customers[10]. Consequently, crews from JCP&L affiliates in Ohio, RECO affiliates in New York and ACE affiliates in Maryland and Delaware were not immediately available to assist with storm restoration in New Jersey.

When the need arises for assistance over and above employees, contractors, and affiliated utility crews, EDCs look to one of seven Regional Mutual Assistance Groups (RMAGs) for help. RMAGs work on the principle of "strength in numbers," where EDCs pool resources and then draw from the pool during an emergency based upon shared need. Although participation is voluntary, each utility in an RMAG is committed to sending restoration workers where they are needed as they become available.

To effectively meet participants' needs in a timely manner, RMAGs are organized geographically. Table 1 lists RMAG membership by EDCs operating in New Jersey. As shown, all four EDCs belong to the North Atlantic Mutual Assistance Group (NAMA).

Table 1. Regional Mutual Assistance Group Participation by EDC

NJ EDC	Regional Mutual Assistance Groups (RMAGs)*		
	North Atlantic Mutual Assistance Group (NAMAG)	Southeastern Electric Exchange Mutual Assistance Committee (SEEMAC)	Great Lakes Mutual Assistance Group (GLMA)
PSE&G	•		
JCP&L/FE	•	•	•
ACE/PHI	•	•	
RECO/ConEd	•		

* Requests for mutual assistance for consolidated utilities such as ACE, JCP&L and RECO are made by the parent company.

As a supplemental workforce option, RMAGs play a vital role in the storm restoration process; however, members are not guaranteed they will receive assistance when they most need it or that they will receive a sufficient number of resources to meet their restoration timelines. Allocation of mutual assistance crews to a requesting EDC takes into account several factors, including greatest need, amount and resource type, requested arrival date and time and expected release date and time. In addition to meeting the qualifying factors for immediate need, RMAG members face the same resource availability problem as affiliated EDCs who lack

[10] News article posted on-line March 3, 2018 reports that as of Friday evening 20,000 FirstEnergy customers in Ohio were still without power (www.cleveland19.com/story/37632466/more-than-25000-people-without-power-in-northeast-ohio-outages-could-last-until-sunday). U.S. News article posted on-line March 3, 2018 reports ConEd has 59,200 customers in Westchester County and another 10,000 customers in New York City without power as of Saturday (www.usnews.com/news/best-states/new-york/articles/2018-03-03/westchester-county-exec-slams-utilitys-storm-response). News article posted on-line March 2, 2018 reports PEPCO had 215,844 customers in Maryland and Northern Virginia without power (patch.com/maryland/annapolis/maryland-noreaster-80-mph-winds-power-outages-storm-prep-tips).

sufficient resources to help one another when multiple states are impacted by a major weather event. Before the arrival of Winter Storm Riley, even some early requests for assistance were not able to be met due to storm-related conditions and consequent utility need for resources in other states.

As competition for skilled workers available to carry out major storm restoration increases and the pool of available resources shrinks, EDCs may reach beyond their regional group into other RMAG regions to request resources they anticipate needing to restore service to their customers. When deciding to go beyond state or regional borders for additional resources, however, limiting factors must be considered. These factors include the travel time that is required for out-of-state resources to arrive as well as mandated rest requirements that these crews need upon their arrival. Crews with trucks and equipment cannot be flown into storm damaged areas. Rather, remote line crews travel in bucket trucks loaded with special equipment that typically average 500 miles of travel per day (see Figure 10).

Figure 10. Travel Distance for RMAG Utility Crews to Reach New Jersey

Notwithstanding the challenges around the acquisition of supplemental resources in anticipation of a major storm, a utility's decision to acquire additional resources is further complicated by the uncertainty of storm tracks. Weather events are far less predictable 48 to 72 hours out than 12 to 24 hours before they arrive. Hence, the decision making for EDCs is marked by uncertainty as well. Making resource acquisition decisions too early, say two or three days in advance of unpredictable storms and uncertain forecasts, can have costly consequences for the company and ultimately the utility customers should they not be used.[11]

2.4. EDC Pre-storm Acquisition of Resources

When the potential impact of an anticipated storm exceeds an EDC's current full time workforce capabilities, additional resources are acquired according to the general process and considerations described in Section 2.3. In this section, the EDCs efforts to acquire resources in advance of Winter Storms Riley and Quinn to assist with predicted levels of outages are described. References to post-storm acquisition efforts are included here and detailed in Section 3.3.

2.4.1. ACE

Before the arrival of Winter Storm Riley, ACE followed its pre-storm emergency management plan and took steps to meet the anticipated resource needs as determined by the company's storm classification. On the morning of March 2, ACE's parent company PHI requested assistance, on behalf of ACE and PEPCO, from Exelon, PHI's parent company. Exelon mobilized 316 contractors from another of its utilities, Commonwealth Edison (ComEd), but those resources were directed to other Exelon utilities; none were dispatched to PHI. At the same time, PHI requested 400 line FTEs[12] from the NAMAG, but did not receive any. PHI also went to the SEE RMAG to request 400 line FTEs. This request was partially met, but those resources were sent to other PHI affiliates not to ACE. Later in the day on March 2, PHI made another request to the NAMAG for 1000 line FTE's, but again the request was not met.

Although ACE was not able to secure mutual assistance from RMAG member utilities or its PHI affiliates prior to the arrival of Winter Storm Riley, it was able to secure known independent contractors at other work sites outside of the ACE territory. ACE secured support from eight different contractors, some of whom arrived by noon on March 2, just as the storm started to intensify.

For Winter Storm Quinn, ACE received substantially more pre-storm assistance. On the morning of March 7, just before the storm arrived, Exelon released 218 affiliated line contractors to ACE. An additional 68 line FTEs came from ACE's sister utility, Delmarva Power. The independent contractors acquired for Winter Storm Riley restoration were on hand as well.

---

[11] In October 2015, JCP&L spent approximately $12 million for pre-storm resource mobilization in anticipation of Hurricane Joaquin, a Category 3 hurricane that devastated the Bahamas. Hurricane Joaquin was expected to make landfall on the East Coast but instead veered out to sea. The resources acquired during the pre-storm planning phase were never used.

[12] An FTE is equivalent to one employee working full-time (www.businessdictionary.com/definition/full-time-equivalent-FTE.html)

2.4.2. JCP&L

JCP&L implemented its pre-storm protocols, as defined in its Emergency Plan for Service Restoration, based on its pre-March 2 event classification of Winter Storm Riley as a Level 1– Low Impact Storm. On that basis, JCP&L determined that it likely would require only internal resources and on premise contractors to address any impacts of the approaching storm. FirstEnergy participated in RMAG conference calls but did not request resources on JCP&L's behalf until the severity of Winter Storm Riley was realized. Once the storm arrived on March 2, the escalating outages and the severity of the storm prompted JCP&L to seek 800 FTEs from contractors, FirstEnergy affiliates, and the RMAGs. JCP&L made this same request every day from March 2 through March 10.

On March 2, JCP&L secured 225 Line FTEs through the Great Lakes Mutual Assistance Group and 15 line contractors. By March 3, an additional 214 FTEs were secured through SEEMAC and 22 contractors directly or through FE affiliates. Through the RMAG process, an additional 131 line FTE contractors were secured on March 4; another 331 line FTEs on March 5 and 336 additional FTE contractors on March 6. JCP&L acquired an additional 882 line FTEs through contractors and affiliates on March 8.

As Winter Storm Quinn approached on March 7, JCP&L still had approximately 29,000 customers out of power from damage caused by Winter Storm Riley. In addition to the resources acquired during Riley, JCP&L received 320 line FTEs from SEEMAC on March 9 and an additional 318 contractor line FTEs on March 10. By March 5, JCP&L had approximately 220 forestry contractor FTEs. This number more than doubled to 591 FTEs on March 5 and increased steadily until a peak of 884 forestry contractors FTEs was reached on March 11.

2.4.3. PSE&G

Beginning February 28 and throughout the storm restoration process, PSE&G participated in multiple NAMAG conference calls to discuss resource availability. On the afternoon of March 1, PSE&G held an internal conference call to establish a firm staffing schedule for the late afternoon and overnight shifts, ensuring that at least four line crews and appropriate tree crews for each of PSE&G's four operating divisions were available. After closely monitoring the weather forecast and flood predictions, PSE&G made the decision, prior to the arrival of Winter Storm Riley, that mutual assistance would not be needed. Instead, PSE&G relied on its internal workforce and the approximately 132 contractors already on property.

In preparation for Winter Storm Quinn, PSE&G continued to participate in NAMAG conference calls. On March 6, PSE&G requested 500 FTEs. This request went unfilled and a second request was made on March 7 for the same number of FTEs. This request also went unfilled. On March 8, after Winter Storm Quinn had left the area, PSE&G's secured 141 FTEs through NAMAG. On March 9, another 472 FTEs were provided through NAMAG.

2.4.4. RECO

Prior to the arrival of Winter Storm Riley, RECO, through ORU, began to take pre-storm preparation measures in accordance with ORU's Emergency Response Plan. On February 28, ORU acquired 40 FTEs through the NAMAG member utilities. On March 1, ORU requested an additional 100 FTEs, of which 50 were acquired. Another request for 100 FTEs was made on March 2, but not filled. Allocations of resources intended for work in New Jersey were not specified.

For Winter Storm Quinn, ORU continued to add to an already existing workforce that was completing the restoration of service to customers impacted by Winter Storm Riley. On March 5, ORU secured an additional 25 line FTEs, 19 tree trimming FTEs and 48 service repair contractors, all of which arrived between March 6 and 7, just before the arrival of Winter Storm Quinn. Once Quinn's full impact was assessed, ORU continued to bring in additional resources. On March 9, ORU requested and received 500 FTEs from NAMAG. However, ORU reduced its request to 309 line FTEs later that day. Once again, the allocation of ORU resources to effect repairs in RECO's New Jersey service territory was not specified.

2.5. Findings and Recommendations

For EDCs, the days immediately preceding a major weather event are a critical decision-making period. The actions a company takes with respect to monitoring weather forecasts for an upcoming storm, predicting damage from that storm, and obtaining the resources that are expected to be necessary to recover from the storm all determine how quickly and effectively a utility can respond to customer outages when a storm impacts the area.

2.5.1. Weather Forecasting

For utility companies, monitoring the weather is a constant and ongoing part of their operations. As detailed in Section 2.2, all four EDCs were tracking the approaching storms of March 2018 for as much as four to five days before their arrival. They did so using a combination of publicly available information, third-party services, and their own in-house meteorologists.

Nevertheless, nor'easters are hard to predict. This was especially evident during Winter Storm Riley. Although there was advance notice of high wind gusts, precipitation, and track, the sudden, drastic change in atmospheric pressure just before the storm's arrival strengthened the storm, which brought higher-than-forecasted winds and largely unexpected amounts of heavy, wet snow. The rapidly changing storm conditions gave EDCs little time to react and ramp-up their pre-storm preparations.

Conversely, Winter Storms Quinn and Toby arrived much as they were forecasted in the days leading up to the actual events. This predictability is reflected in the EDCs pre-storm preparations. Each had a longer span of time to make critical, more accurate planning decisions regarding these storms than they did for Winter Storm Riley.

<u>Recommendation # 1 (ACE, JCP&L, PSE&G, RECO)</u>

<u>RQ-EDC-1:</u> EDCs should participate in the Board's collaborative initiative with the National Weather Service for the purpose of exchanging information about storm prediction modeling and weather impacts on electric infrastructure with the goal of refining EDCs' outage prediction modeling capabilities.

2.5.2. Event Level Classification and Outage Prediction Modeling

Prior to weather events, all four EDCs assign a level of severity to the storms using either a numerical or letter grade or a combination of both. Their classification matrices (also referred to as storm severity matrix or event level classification matrix) correlates expected storm severity with potential number of outages, which is then used to help EDCs determine their pre-storm resource needs. The use of a storm damage and outage prediction tool akin to these matrices was ordered by the Board following Hurricane Irene in 2013 for the purpose of expediting pre-storm resource acquisition. The Board also ordered EDCs to incorporate the full spectrum of environmental variables, such as geography, tree canopy, and population density, into those prediction models to ensure they reflected real-world conditions.[13] As discussed in Section 2.2, however, each EDC underestimated the severity of Winter Storm Riley. This was due largely to the rapidly changing nature of the storm as it approached New Jersey. Nevertheless, these errors led to underestimates of storm damage and potential outages, which, in turn, affected pre-storm resource planning decisions.

JCP&L's post-Riley restoration exemplifies the effects of a severe miscalculation so early in the storm planning process. JCP&L classified Winter Storm Riley as a low impact storm. On February 28, its outage prediction model estimated just 7,770 outages were likely to occur. A subsequent model created on March 1 predicted 13,950 potential outages, almost twice the initial number. The actual number of outages peaked at approximately 150,000 during the storm — almost 20 times more than predicted on February 28 and more than 10 times the number of outages predicted immediately before the storm's arrival. The highest number of those outages occurred in its Northern Region. Because of these severe underestimates, JCP&L did not call for additional resources via the RMAG process in anticipation of Winter Storm Riley's arrival.

ACE, PSE&G and RECO also assigned event level classifications on the lower storm-severity end of their matrices. Their outage predictions, however, were much closer to the actual number of outages they experienced from Winter Storm Riley than JCP&L.

During its evaluation of EDCs' pre-storm preparations, Staff reviewed each EDC's storm classification matrix and associated outage predictions. From its review, Staff was unable to

[13] In the Matter of the Board's Initiative to Revise Reporting and Improve Reliability Programs By Electric Distribution Companies Operating in New Jersey, BPU Docket No. EO11090543, Board Order dated January 23, 2013, ("Irene Order").

determine the extent to which EDCs have incorporated lessons learned from actual storms into their outage prediction modeling. Doing so should be a routine and valuable undertaking that serves to add more precision to outage predictions. Each storm provides an EDC with a trove of experiential data at the local and regional levels that will benefit future storm-related outage predictions.

As evidenced by the high degree of inaccuracy of its outage predictions for Winter Storm Riley, JCP&L's outage prediction modeling is deficient. It is clear that the physical environment in JCPL's Northern Region makes the infrastructure highly susceptible to storm-related damage. However, based on JCP&L's outage predictions for Winter Storm Riley, it does not appear that local and regional environmental variables are properly weighted in its models. Ample evidence from Winter Storms Riley and Quinn suggests that those same variables present a challenging environment for outage recovery as well, thereby underscoring the need for highly effective pre-storm planning. To this end, accuracy depends on appropriately accounting for differences in local and regional conditions in its outage prediction modeling.

Recommendation # 2 (ACE, JCP&L, PSE&G, RECO)

RQ-EDC-2: Staff recommends that the Board direct all EDCs to update their event level classification matrices to reflect data points and insights gained from all weather-related events for which a Major Storm Report was required by the Board since Hurricane Sandy in 2012, including the most recent March 2018 nor'easters. The updated matrices should explicitly account for locational differences such as tree canopy, surface terrain, and elevation. EDCs should revise their Emergency Operations Plans (EOPs) to include these updated matrices. Revised plans should be filed with the Board within 45 days. Each EDC also should submit to the Board a description of the process it will follow to ensure storm-specific pre-storm planning and post-storm recovery lessons learned are routinely incorporated into these matrices going forward.

Recommendation # 3 (JCP&L)

RQ-JCP&L-1: Staff recommends that the Board direct JCP&L to refine its outage prediction model to account for local, regional and division level differences. Specifically, JCP&L's prediction model should account for variations in weather patterns across its service territory as dictated by geographic locale. It also should include situational and locational variables that, at a minimum, include: (1) type and density of existing tree canopy; (2) the underlying soil conditions in heavily treed areas; (3) topology; (4) coastal and shoreline flooding and wind conditions; (5) distribution infrastructure configuration and resiliency; and (6) age and structural integrity of the overhead pole-line distribution system. JCP&L should detail its revised outage prediction modeling process including the specific inputs and outputs in a report to the Board within sixty days.

2.5.3. Pre-Storm Resource Acquisition and Mutual Assistance

When considering additional resource needs, the decision to request mutual assistance is often influenced by many factors, most of which are tied to the severity and size of the emergency or weather event. While it may be argued that some EDCs do not acquire enough additional resources to supplement their internal crews in advance of an approaching storm, in many cases those resources simply do not exist.

As discussed in Section 2.3, a constraint for EDCs during their pre-storm planning is the availability of resources from outside their operating areas. Competition for these outside resources is high, especially before and during large scale weather events. This reality was brought to light during the EDCs' response to and recovery from Hurricane Irene and Superstorm Sandy. As the EDC's responses to Winter Storms Riley and Quinn have demonstrated, this challenge has not abated.

Although events such as localized, damaging thunderstorms or impactful coastal storms typically do not hinder access to outside resources through the RMAG process, experience shows that storms forecasted to have widespread regional impacts or for which there is great forecast uncertainty do present acquisition challenges. These challenges were evident during Winter Storm Riley. First, under the RMAG agreement, requesting utilities must meet a "need" threshold. As seen during Winter Storm Riley, early weather forecasts and the EDC's own minimal storm impact classifications did not appear to support a needs-based case for RMAG members to send resources into New Jersey in advance. Second, as local resources are committed, EDCs are forced to seek resources from farther away. Yet the greater the distance that outside utility crews and contractors must travel, the further in advance EDCs must request them. For planning purposes, EDC's must consider travel time and required rest periods. They also must consider that crews traveling through storm conditions elsewhere in the region may arrive later than anticipated. Finally, EDCs must build time into their plans for outside crews to become familiar with the electrical system they will be working to restore. From the EDCs' planning perspective, early forecasts for Winter Storm Riley did not appear to warrant a significant mobilization of out-of-state resources. However, as the storm approached New Jersey, Riley's rapidly changing nature drastically shortened the timeline EDCs had to acquire out-of-state resources and have them in place early enough to enable a timely restoration.

As noted, resource availability was also a planning constraint. Prior to Winter Storm Riley's arrival, each EDC participated in RMAG conference calls. ORU and PHI requested resources early on but none were available. This intimates that utilities in nearby states were holding onto their crews because of the variability in weather forecasts leading up to the storm's arrival in the region. As described in Section 1, Winter Storm Riley did, in fact, impact utilities across a wide geographic area. Significant amounts of mutual assistance from RMAG member utilities began to arrive in New Jersey several days into the restoration process, only after their home-state restoration work was nearing completion.

Although the RMAG process can be a useful resource that EDCs can turn to under certain conditions, it is not necessarily the timeliest option. The EDCs performance leading up to and during Winter Storms Riley and Quinn demonstrates this point. Foreign crews were in limited supply to begin with and once available to help EDCs in New Jersey, they did not arrive until well in to the restoration. In circumstances such as these, it is appropriate and necessary for EDCs to plan for and to rely upon local contractors for assistance during the early stages of a restoration.

Because timeliness with respect to acquiring resources correlates in part to timely restoration, it also may be necessary to formally establish an intermediate resource sharing step between New Jersey's four EDCs. Such sharing of employees and contractors is common among the EDCs and, as described in Section 3.3, did occur during the restoration process from Winter Storms Riley and Quinn. Formalizing this practice may serve to reduce the resource acquisition planning horizon and to enhance the likelihood that resources will be available in a timely fashion. However, it is critical that an intrastate resource sharing model respect the RMAG process. Taking a purely New Jersey centric approach to mutual assistance may hinder the EDC's ability to acquire resources through this regional mechanism in the future. It also could have unintended consequences for other RMAG participants. Just as New Jersey's EDCs have relied upon RMAG members for resources, these members also rely on resources from New Jersey's EDCs when needed. It is important for New Jersey's EDCs to continue to provide assistance through the RMAG process when they are in a position to do so. Nevertheless, it is reasonable to expect New Jersey's EDCs to share resources in an effort to restore power to citizens across the state as quickly as possible.

Recommendation # 4 (ACE, JCP&L, PSE&G, and RECO)

RQ-EDC-3 Staff recommends that the Board direct New Jersey's four EDCs to work together to create an Intra-state Mutual Assistance Agreement that reflects a commitment to share internal company employees and contractors when out-of-state resources are likely to be unavailable through the RMAG process or when significant numbers of outages are predicted to affect New Jersey residents across the state. The EDCs also should seek participation from the state's nine municipal utilities and one cooperative utility and include those utilities in the development and implementation of the Intrastate Mutual Assistance Agreement. EDCs should submit the plan for Staff review within 60 days.

3. Restoration of Service

Restoring power after a major storm is a complex, labor intensive and time consuming process. When damage to the electric utility system is severe and widespread, company personnel cannot respond to every outage at once. The overarching goal, however, is the same for all EDCs: to complete restoration in the least amount of time as safely as possible.

This section describes the restoration process. It also details the actions taken by EDCs during and after Winter Storms Riley and Quinn to restore power to affected customers within their service territories.

3.1. Damage Assessment

For EDCs, damage assessment is the critical first step in event restoration. It is performed by trained employees or contractors sent to damage locations to evaluate the extent of damage and to identify the repairs that must be made at each location. These details are sent back to the EDC via laptop, tablet or phone and entered into the Outage Management System (OMS)[14] Within the OMS, information from damage assessors is integrated with other relevant information to determine service restoration priorities, define the scope of work required to effect each damage repair, and prepare work orders for line crews and other service repair personnel.

In response to major events, EDCs typically supplement trained damage assessors with other personnel on hand, such as supervisors and employees working in non-operational roles. These personnel conduct preliminary damage assessments for triage purposes. Damage assessments may also be augmented by remote instrumentation along with reports from customers, local police and firefighters, and municipal and county emergency managers. As conditions warrant, aerial patrols by fixed wing aircraft, helicopters, or drones also aid in the collection and reporting of damage information.

In addition to facilitating crew deployments, the information contained in an EDC's OMS is used to produce global, then local Estimated Times of Restoration (ETR). As the name suggests, ETRs are estimates and become more accurate as damage assessment activities proceed. ETRs also may change as the result of ongoing repairs that uncover additional damage. A detailed discussion of ETRs is included in Section 4.

Damage assessment also provides for the rapid identification of hazardous situations that affect public safety, such as live wires on the ground. It is imperative that affected areas be made safe as quickly as possible. Until repair crews can arrive or other corrective action taken, utility personnel called hazard responders are dispatched to safeguard these locations. Hazard responders remain in place until a public protector, such as local police arrive, or they are

[14] An OMS is the central collection point of all damage reports and customer trouble calls. OMS provides outage input, assessment, assignment, tracking, and data storage. The OMS also groups customer calls into orders which can be sorted for the purpose of restoration management.

relieved by other hazard responders. During a major weather event, EDCs often turn to contractors to supplement their cadre of hazard responders.

During the March 2 and March 7 nor'easters and throughout the restoration period from them, more than 1,400 damage assessors and hazard responders were deployed throughout the state. As in Superstorm Sandy and other past major weather events, contractors constituted a large part of this workforce. For example, JCP&L reported the deployment of more than 900 damage assessors and hazard responders during the restoration process; of these, approximately 70% were contractors. ACE and RECO also relied on contractors to supplement their damage assessment personnel, although to a lesser percent than JCP&L.

Conversely, PSE&G employed more than 360 damage assessors, all of which were company employees. These personnel came from various departments within the company who receive storm response training. During major storm restorations such as those following Winter Storms Riley and Quinn, PSE&G also has the advantage of being able to leverage personnel from its Gas Division to conduct power system damage assessment and to serve as hazard responders.

3.2. Restoration Priorities

As noted, the overarching goal for EDCs after an event is to restore power as quickly and as safely as possible. To accomplish this goal, each EDC has developed emergency plans that define a restoration hierarchy. Although there are some variations, all EDCs follow the same basic principles of priority restoration, as shown in Figure 11. These classifications are not exclusive, meaning that repair efforts in lower priority levels often commence while work is still underway in higher priority categories. Without exception, safety of the public and those working to restore service is always the highest priority throughout a restoration effort.

Figure 11. Priorities During Restoration

Immediate Life Threatening Situations (Live primary wires down), Hazards (Make Safe) and Vital Roadway Clearing	Note: Order of Restoration Often Overlaps Restoration may be interrupted to repair Transmission –related outages
Public Health and Safety (Hospitals, EOCs, 911 Centers, Critical Water Supply, etc.)	
Priority Customers (Shelters, Assisted Living, Nursing Homes, etc.)	
Community needs (Schools, Supermarkets, Roadways, etc.)	
Distribution (Wires, Poles, Transformers, etc.)	
Individual Premise Services/Nested Outages	

During a restoration, the first priority for an EDC is to address immediate public safety hazards, such as downed wires or fires caused by live wires. The next restoration priority is given to public health and safety facilities including hospitals and other critical care facilities, clearing vital roadways of hazards and addressing other life-threatening situations identified by emergency first responders. Once these situations are in hand, the EDC can turn its attention to community-level infrastructure such as public schools, supermarkets, and similar services that support the normal functioning of communities. Repairs that result in restoration to the largest blocks of customers at a time come next, followed by individual premise restoration. This final level of restoration is time-consuming and labor-intensive. As a result, these customers may experience the longest-duration outages. This is especially true in the case of customers in lightly populated and densely forested communities where significant electricity infrastructure damage due to falling trees has occurred. Nonetheless, it is important to note that the order of restoration is not rigid, meaning that work in each of these priority areas often overlaps.

Although EDCs strive to follow established priorities, real-time conditions during a restoration may require an EDC to divert repair crews to address emerging hazards or situations involving public health and safety that require immediate attention. These diversions arise frequently, especially during a multi-day restoration following a destructive weather event such as Winter Storms Riley and Quinn, and serve to disrupt the orderly restoration by priority levels. These diversions also tend to be sources of frustration for individual homeowners because the arrival of repair crews to their locations may be delayed.

The intensity, duration, and impacts of Winter Storms Riley and Quinn were greater than predicted. All across New Jersey, high sustained winds, heavy wet snow, and saturated ground combined to cause mature trees to fall and countless tree limbs to break, which in turn caused widespread damage to overhead facilities and utility poles. During the first 24 to 48 hours following the nor'easters, all EDCs dedicated considerable resources to clearing roads of downed wires. They coordinated with New Jersey's Department of Transportation as well as local officials to identify high-priority roadways and to expedite hazard removal.[15]

In the first 48 hours following Winter Storm Riley, JCP&L had cleared wires from more than 720 roadways and restored power to nearly 100 schools. PSE&G, ACE and RECO had similar issues with blocked roads and downed wires.

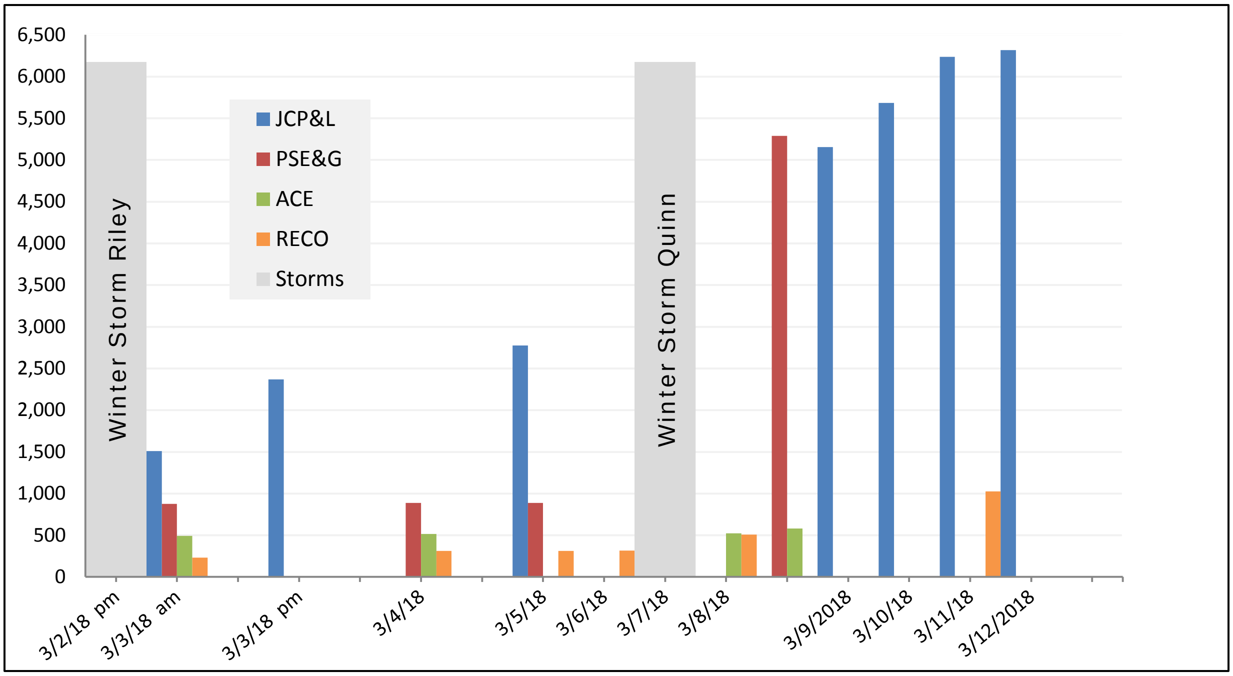
3.3. Workforce Deployment

As discussed in Section 2.4, each EDC made staffing decisions and resource acquisitions during its pre-storm preparations that were based on its weather forecasts and consequent storm damage assessment. On March 2, as Winter Storm Riley began to intensify with higher-than-expected winds and unexpected snowfall, JCP&L, ACE and RECO began to ramp up its workforce by requesting additional resources. By the morning of March 3, approximately 24 hours after the storm first arrived in the area, the combined workforce for all

[15] The need to expedite the clearing of vital roadways was a lesson learned from Hurricane Irene and Superstorm Sandy. The value and effectiveness of coordinating with state and local officials were also lessons learned from these storms, and resulted in the Board's requirements that EDCs do so.

four EDCs increased to approximately 3,100 FTEs.[16] Over the next 8-10 days, as the EDCs continued to add resources to recover from both nor'easters, the combined workforce taking part in restoration activities increased to more than 13,000 FTEs, representing the largest utility workforce in New Jersey since Superstorm Sandy (see Figure 12).

Figure 12. FTE Workforce Deployed In Response to Winter Storms Riley and Quinn



Between the morning of March 2 and the evening of March 13, crews worked in shifts around the clock to restore service to more than 1.2 million electric utility customers.[17] As the restoration progressed, EDCs re-deployed its crews between their own divisions or districts as necessary to accomplish repairs in a timely manner. As PSE&G and ACE completed their restorations, they sent personnel and contractors crews to JCP&L. On March 5 and March 6, PSE&G supplied 120 line FTEs and 132 contractors to JCP&L. Between March 6 and March 10 ACE released FTEs it had acquired from its Exelon sisters to JCP&L. In some instances, this sharing of resources occurred at the behest of the Board. As recommended in Section 2.5, EDCs should formalize this practice.

[16] For the purpose of this discussion, FTEs include all resource types dedicated to storm restoration activities including: company and contracted line workers, service repair personnel, and damage assessors; affiliated utility personnel and contractors; and, RMAG member utility personnel and contractors.

[17] As a safety precaution, JCP&L halted work overnight on March 2 and overnight on March 7. See Section 3.4.2.

3.3.1. ACE

Before Winter Storm Riley's arrival, ACE shifted its internal workforce into its divisions where the most damage was anticipated. It also supplemented its internal workforce with local contractors, particularly tree trimmers. Before and during storm restoration, ACE requested, through its parent company PHI, assistance from RMAG member utilities but none was received. At the height of restoration activities on March 4-5, most of ACE's workforce—both internal crews and contractors—was working in the Glassboro Division. They remained there until restoration was completed on March 6.

For ACE, Winter Storm Quinn caused less system-wide damage than Riley. ACE relied on its own internal crews, independent local contractors and resources acquired from PHI and Exelon to complete the restoration. PHI provided crews from sister utility Delmarva Power. Exelon affiliates BGE and Pepco also provided contractors. Once again, mutual assistance was requested but not received through the RMAG process.

Most of the damage from Quinn was within ACE's Winslow Division. Throughout the restoration nearly 60% of ACE's internal and acquired resources were working in that area. They remained there until service restoration was completed on March 9.

3.3.2. JCP&L

Before the arrival of Winter Storm Riley, JCP&L's initial workforce deployment strategy was to rely on internal line crews supplemented with contractors who were already working for JCP&L. During its pre-storm planning, JCP&L did not request assistance from RMAG member utilities. However, as Riley intensified during the morning of March 2, JCP&L began taking steps to ramp up its workforce by requesting line FTEs through the RMAG process. Meanwhile, it began moving internal line crews from its Central Region into its Northern Region where significant damage was beginning to occur. By March 3, approximately 24 hours after the arrival of Winter Storm Riley, JCP&L had more than 1,500 FTEs working to restore power across its service territory. By March 5, JCP&L's workforce grew to more than 2,700 FTEs, most of which were deployed in the Northern Region, specifically in hard hit Morris, Hunterdon and Sussex counties.

When Winter Storm Quinn arrived on March 7, JCP&L was still working to complete its restoration from Riley. By the time Quinn left the area, the number of customers without power peaked at 342,000. JCP&L continued to add substantially to its workforce throughout the subsequent restoration process. By March 9, more than 5100 FTEs were working to restore customers affected by Riley and Quinn, with the former given priority to the extent possible. By March 12 the number of FTEs swelled to 6,300. To support this additional workforce, JCP&L opened 4 staging sites and 3 additional parking areas to handle the overflow of incoming trucks and equipment.

3.3.3. PSE&G

Based on its pre-storm forecasting, PSE&G opted to rely on its internal workforce and the approximately 132 contractors on site to undertake restoration from Winter Storm Riley.

Although PSE&G participated in several pre-storm RMAG calls, it did not request additional resources. Beginning on the morning of March 2 and continuing through the evening of March 5, PSE&G moved much of its workforce into its Central and Southern Divisions, where most of the damage within its service territory was occurring. Restoration from Riley was completed by the evening of March 5.

During Winter Storm Quinn, PSE&G employed the same workforce strategy of moving resources from the least impacted operating divisions into the most impacted operating divisions. However, due to its outage predictions, PSE&G also made the decision to request mutual assistance. Between March 8-10, PSE&G received 613 line FTEs and 357 tree trimming FTEs, most of whom were sent to its Metropolitan Division. To support these external resources, PSE&G opened 3 staging areas to more effectively deploy and manage the additional workforce throughout the duration of the restoration process. Staging sites were opened at the former Hoffman La Roche site in Clifton, Rutgers Livingston Campus in Piscataway, and Moorestown Mall in Moorestown.

3.3.4. RECO

As described in Section 2.1.4, RECO is the only EDC without its own employees. All work activities in the RECO service territory are performed by ORU. Although RECO has three business offices located in New Jersey—West Milford, Wyckoff and Harrington Park—decisions regarding workforce deployment for storm restoration are made by ORU's corporate office in New York. All information provided to the Board post storm regarding workforce deployments and restoration activities are aggregated for ORU and RECO.

After initially acquiring 40 line FTEs on February 28 through RMAG member utilities, ORU continued to add to its workforce throughout the restoration from Winter Storm Riley.

On March 6, just before Winter Storm Quinn arrived, ORU had more than 390 FTEs dedicated to its storm restoration effort. By March 11 that number grew to more than 1,000 FTEs. While the increase in workforce appears to be timed with the restoration needs of RECO customers as the restoration process unfolded, it is unclear from RECO's Major Event Report, and subsequent information provided, how these additional external resources were deployed throughout the RECO service territory. Restoration from Winter Storm Quinn was completed on March 13.

3.4. Storm Impact, Outage Response and Restoration Timeline

Since Hurricane Irene in 2011, there have been other severe weather events[18] that have struck New Jersey, including the three March nor'easters. Although each storm was different in terms of its defining characteristics and intensity, they all caused extensive damage to utility infrastructure, especially to poles, overhead wires and cables. This section describes the

[18] Examples include "Snowtober" in 2011, Superstorm Sandy in 2012 and Winter Storm Jonas in 2016.

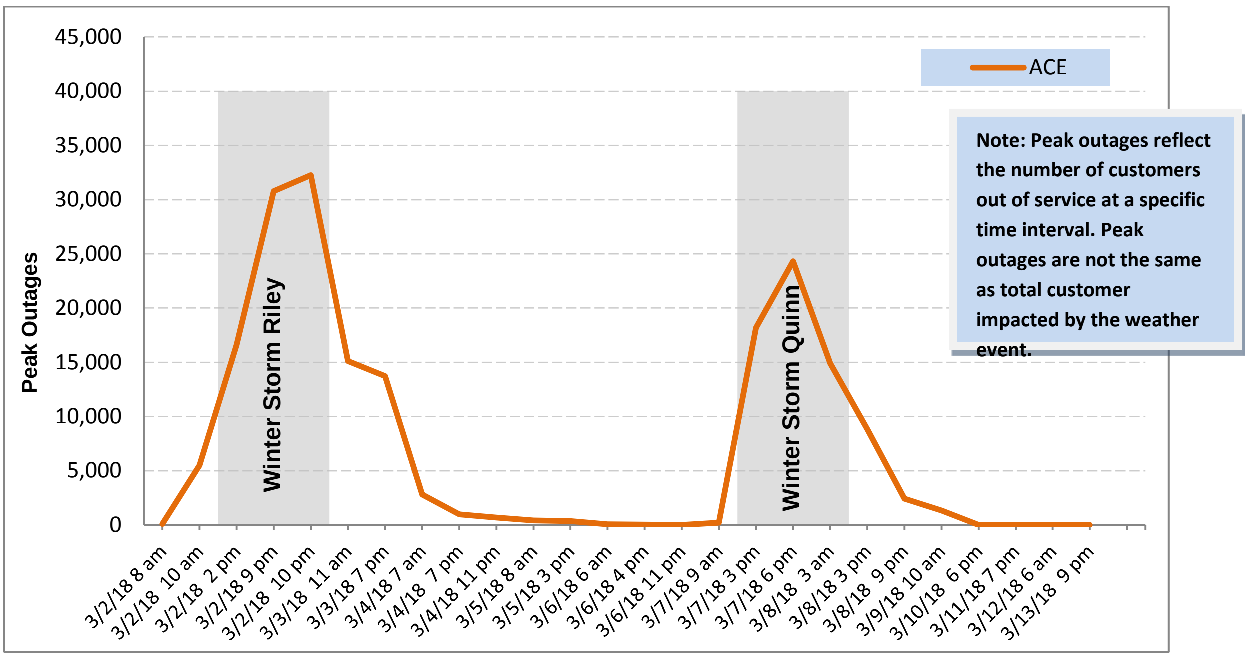
damage impacts to each EDC from Winter Storms Riley and Quinn,[19] along with the EDC's response and restoration timeline.

3.4.1. ACE

Winter Storms Riley and Quinn both nor'easters, struck the ACE service territory with heavy winds causing pole and overhead wire damage. In total, 116 poles were damaged from high wind gusts and from downed trees due to high winds. ACE also had to replace more than 20 miles of primary and secondary wire on its distribution system and more than 40 pole mounted transformers.

Over the course of the restoration, ACE responded to more than 2,300 trouble locations. Of those, approximately 40% were categorized as single customer outages. This high number of single customer outages is significant because it directly affected the overall restoration timeline. Generally, as fewer customers are restored per line repair, the longer restoration takes.

Figure 13. ACE Customer Outages During Winter Storms Riley and Quinn



More than 129,000 ACE customers were impacted by the two storms. Figure 13 shows the number of customer outages over time. It also depicts peak outages—the point in time when the highest number of simultaneous customer outages was reached during each nor'easter. The reduction in customer outages post-peak reflects ACE's restoration activities.

---

[19] All EDCs experienced storm damage from each of the three March nor'easters, however, because Winter Storm Toby arrived later in the month of March after utility crews had demobilized from the previous two storms, Toby's impact is discussed separately in this report.

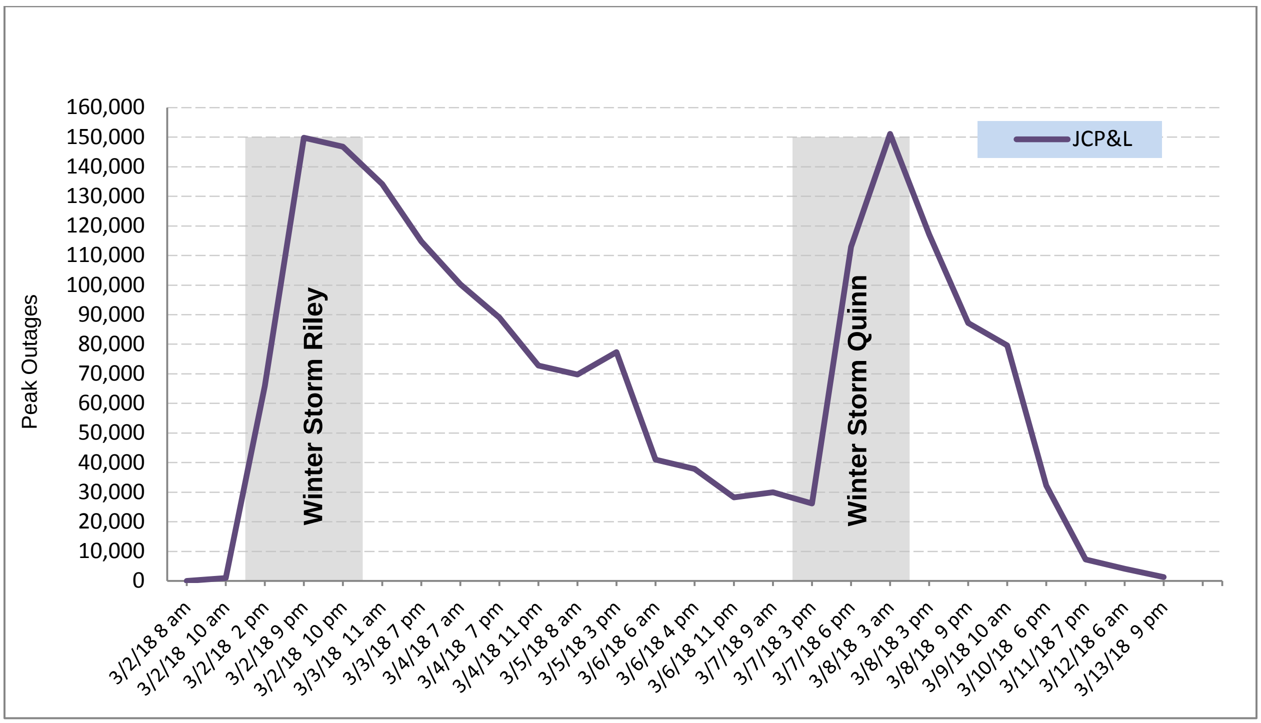
As with EDCs in other parts of New Jersey, ACE started to see outages caused by Winter Storm Riley ramp up quickly between early morning and late evening on March 2. The storm hit ACE's Glassboro and Winslow operating districts hardest, which is where most outages from storm damage occurred. As outage numbers began to grow, restoration work began immediately with assistance from contractor crews. The extent of the tree-related damage, coupled with the lengthy process of restoring one customer at time, extended ACE's restoration timeline for Winter Storm Riley to March 6, a day before the second storm arrived.

The damage to ACE's infrastructure caused by Winter Storm Quinn was much less extensive than it was during Riley. ACE was able to fully restore all of its customers affected by Quinn in approximately two days.

3.4.2. JCP&L

Damage to JCP&L's overhead infrastructure from Winter Storms Riley and Quinn was extensive, particularly in the Northern Region where tree canopy is dense. Downed trees and broken branches caused by higher-than-expected wind gusts and heavy snow damaged more than 800 utility poles, 517 pole-top transformers and approximately 68 miles of wire.

Figure 14. JCP&L Customer Outages During Winter Storms Riley and Quinn



More than 526,000 customers were impacted by the two storms. The majority (77%) of these customers were in JCP&L's Northern Region. Figure 14 depicts customer outages by storm and reflects the overall restoration timeline. Customer outages from Riley peaked at 150,000 on the afternoon of March 2. Customer outages from Quinn peaked at slightly more than 150,000 during the evening of March 7. Despite eventually mobilizing a workforce of more than 6,300 FTEs, JCP&L was unable to complete its storm restoration until March 13; a full 11 days from the time Winter Storm Riley arrived. The back-to-back nor'easters resulted in an overlapping restoration process as approximately 29,000 customers impacted by Riley had yet to be returned to service before the arrival of Winter Storm Quinn on March 7.

JCP&L responded to more than 6,400 trouble locations during the course of a nearly two week restoration period. Of those, 40% involved single customer outages. Similar to ACE's experience, the low ratio of customers restored per utility repair effort slowed the overall pace of restoration. (Compared to PSE&G, JCP&L and ACE have fewer customers per linear mile of utility infrastructure.)

Dangerous weather conditions also hampered restoration. JCP&L ramped-up its restoration efforts quickly between mid-afternoon and evening on March 2. However, for safety reasons, work halted around 9:00 pm due to dangerously high winds. Unexpectedly high snowfall amounts in areas of northwestern New Jersey also hampered restoration. Five days later, Winter Storm Quinn compounded restoration difficulties when significant amounts of snow fell in parts of northern and northwestern New Jersey, which encompass a large part of JCP&L's Northern Region. Restoration work was halted again during the evening of March 7 due to dangerously high wind gusts. Between Riley and Quinn, these work stoppages totaled 27 hours.

JCP&L also devoted a significant amount of time to clearing downed wires and broken poles from a large number of snow-covered surface roads before repairs could commence. As noted in Section 3.2, clearing public safety hazards is the highest priority for EDCs during storm restoration activities. Working closely with local emergency management officials, JCP&L focused its efforts on prioritizing and clearing hazards, particularly in the early stages of the restoration process.

3.4.3. PSE&G

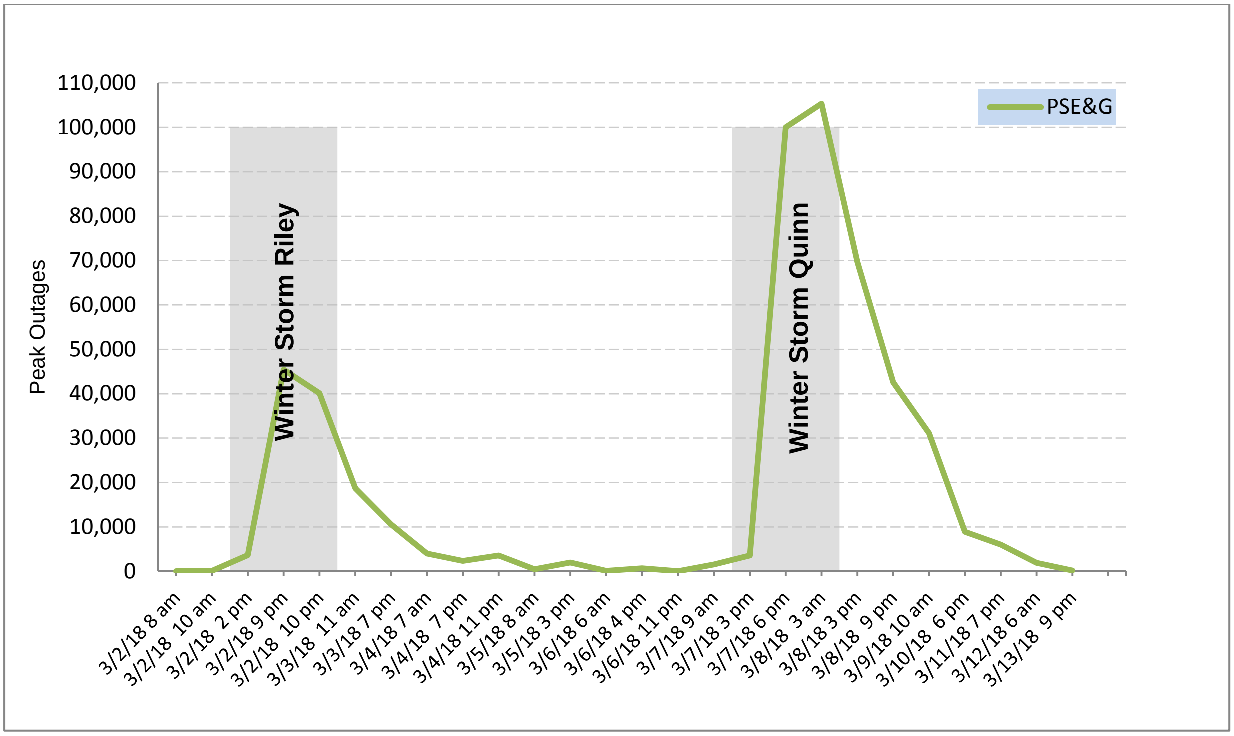
PSE&G experienced overhead utility infrastructure damage from both Winter Storms Riley and Quinn; however, damage was much more extensive during the second nor'easter. The heavy wet snow from the March 7 storm caused significant tree-related pole and overhead facilities damage, especially in its Central and Southern Divisions. During the course of restoration, PSE&G replaced more than 800 poles and 400 transformers.

PSE&G responded to more than 1,600 trouble locations, the majority of which occurred during the March 7 storm restoration. Of these locations, more than 90% involved restoring 10 or more customers at a time per trouble location. This reflects the company's high customer density and, in part, explains the relatively steep decline in customer outages following each storm. The more customers restored per crew deployment, the quicker the restoration process.

In total, more than 475,000 PSE&G customers were impacted by Winter Storms Riley and Quinn. The storms affected the entire PSE&G service territory, but the majority of customer outages were in the Southern and Central Divisions. During Riley, outages in the PSE&G system peaked at approximately 45,000 customers around 9:00 p.m. on March 2. Outage restoration was completed on March 5, two days before the arrival of Winter Storm Quinn.

The March 7 storm was much different both in terms of the weather and the extent of damage inflicted on PSE&G's overhead utility infrastructure. Of the more than 475,000 customers impacted during both Riley and Quinn, nearly 340,000 were interrupted during Winter Storm Quinn. Despite mobilizing a workforce of more than 5,200 FTEs, PSE&G did not complete restoration until March 13, approximately 6 days after Quinn arrived.

Figure 15. PSE&G Customer Outages from Winter Storms Riley and Quinn



3.4.4. RECO

As discussed in Section 2.1.4, RECO is a wholly owned subsidiary of ORU and has no workforce of its own. Restoration following events such as the March nor'easters is performed by ORU personnel and other resources acquired by ORU to assist in restoration efforts. According to ORU, RECO and ORU's service territories experienced levels of damage from Winter Storms Riley and Quinn not seen since Superstorm Sandy. The severity of these storms resulted in more than 370 road closures and damage to 219 poles, 166 transformers, and nearly 13 miles of wire replacement across New Jersey and New York service territories.[20]

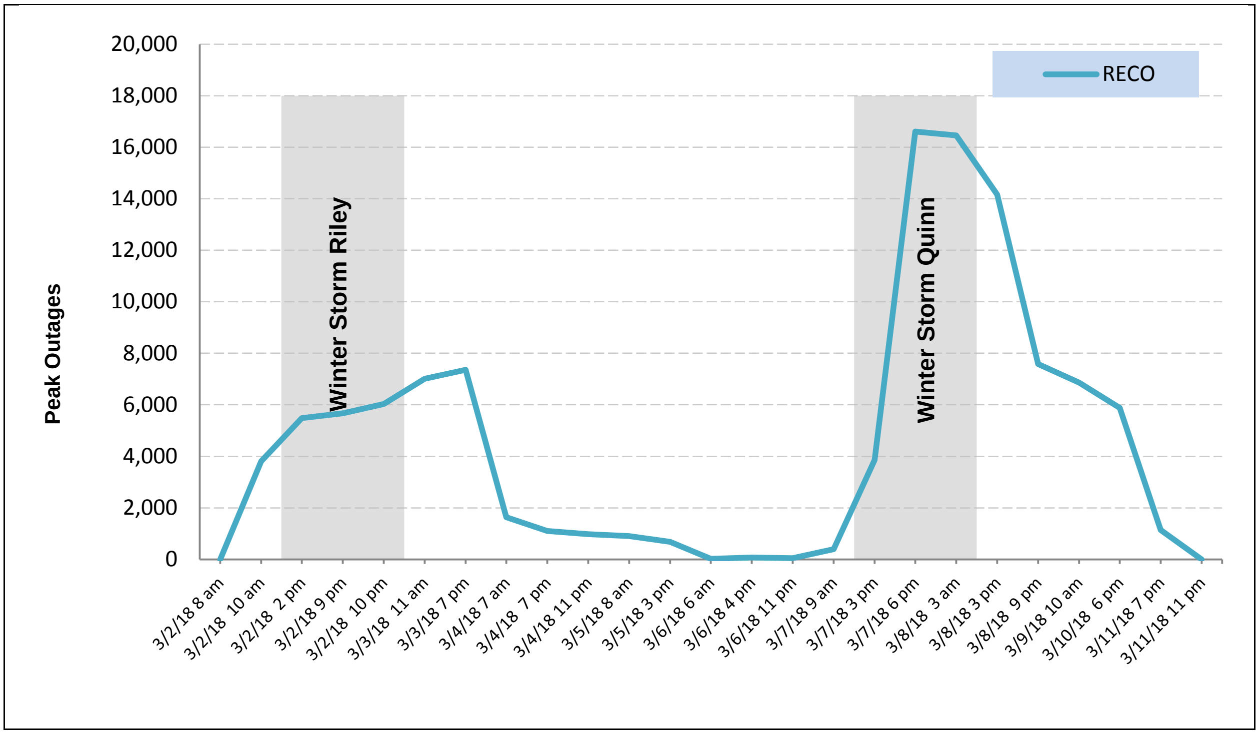
Between March 2 and March 11, ORU responded to more than 1,900 trouble locations in New Jersey and New York. Of those, 67% were identified as single customer premise outages. Similar to the storm impact profile for JCP&L and ACE, this significant number of single

[20] ORU does not track storm related damage information separately for RECO. All the information provided in this report for storm damage pertains to ORU.

customer trouble locations extended the restoration process for customers in New Jersey, leaving some without power for as much as 10 days.

During the nearly 2 week restoration from both storms, most of the 72,000 customers in RECO's service area lost power for some period of time. Most of the longest-duration outages were in Bergen County. Figure 16 depicts customer outages by storm and reflects the overall restoration timeline. During Riley, outages for RECO

Figure 16. RECO Customer Outages from Winter Storms Riley and Quinn



customers peaked at roughly 7,400 the evening of March 3. This was due to the combination of strong winds, saturated soil, and the weight of the heavy snow causing mature trees to uproot and tree limbs to fall even after the storm had left the area. Outages for Quinn peaked at slightly more than 16,000 on the evening of March 7. Restoration was completed on March 11.

3.5. Findings and Recommendations

3.5.1. Damage Assessment

As discussed in Section 3.1, during Winter Storms Riley and Quinn more than 1,400 damage assessors and hazard responders were deployed throughout the state to assess damage and respond to hazard conditions. Each EDC, with the exception of PSE&G, used a combination of company employees and contractors. PSE&G relied on internal personnel for damage assessment.

JCP&L used considerably more damage assessors and hazard responders than the three other EDCs. During the nearly two week restoration following Winter Storms Riley and Quinn, JCP&L employed approximately 900 hazard responders and damage assessors, which included company personnel, FirstEnergy affiliates, and contractors. Despite the number of resources available, Staff's review of documentation provided by JCP&L suggests that inefficiencies in the damage assessment process exist. First, it appears that the sheer size of JCP&L's service territory (3100 square miles), coupled with the terrain in its Northern Region, present damage assessment challenges. Impassible roads in the first few days after Winter Storm Riley impaired damage assessment activity, while extensive tree damage across broad swaths of sparsely populated areas in JCP&L's Northern Region required more time to complete assessments. Second, it appears that JCP&L's use of contractors for damage assessment also may introduce inefficiencies. Company employees have direct access from the field into the EDCs' OMS via Mobile Data Terminals (MDTs). Damage information can be entered immediately and work orders created expeditiously. For security reasons, however, contactors typically are not provided direct access to the OMS. Rather, information collected by contracted damage assessors is transmitted to the EDC via phone, email, or mobile app then entered manually into the OMS. This creates a lag between the time damaged is assessed and the time it is entered into the OMS and work orders created. The greater the time lag, the longer it takes for repair work to get underway. This inefficiency is not unique to JCP&L, but it may become amplified during a restoration effort due to the challenging nature of JCP&L's service territory.

Recommendation # 5 (JCP&L)

RQ-JCPL-2: Staff recommends that the Board direct JCP&L to train as many employees as practical to perform second role damage assessment activities. A training plan describing how this training is to be accomplished and a timeline for putting it into practice should be submitted to the Board.

Staff also recommends that the Board direct JCP&L to improve its capability to rapidly mobilize trained third-party damage assessors within each of its service regions and to introduce solutions to maximize their efficiency. JCP&L should submit an improvement plan that addresses this capability to the Board.

Both plans should be submitted to the Board within 120 days.

3.5.2. Restoration Priorities

As noted in Section 3.2, when damage to the electric utility system is severe, the overarching goal is to restore power quickly and safely. Establishing restoration priorities helps achieve these goals. Staff finds ample evidence provided by each EDC that it acted in accordance with established restoration priority guidelines, as described in Figure 11. For example, EDCs dedicated considerable resources to clearing roads of downed wires in the immediate aftermath of both nor'easters. They coordinated with the Board's emergency management staff, with New Jersey's Department of Transportation and with local officials to identify high-priority roadways and to expedite hazard removal. JCP&L alone cleared more than

720 roads in the first 48 hours of the restoration Winter Storm Riley, many of which were in response to requests from the state DOT and local officials.

3.5.3. Workforce Deployment

Before the arrival of an approaching major weather event, EDCs must make resource and workforce mobilization decisions based on the expected level of damage to their infrastructures. As described in Section 3.2, EDCs are likely to call for additional resources once the weather event passes and they have better awareness of the extent of damage to their systems. These resources are local contractors and personnel and contractors from sister utilities and RMAG members. Between March 2 and March 13, more than 13,000 FTEs were involved in power restoration activities in the state.

JCP&L alone deployed more than 6,300 FTEs, including 3,400 line worker FTEs. Between March 5 and March 12, JCP&L more than doubled its workforce, activated four staging sites, and opened three additional sites to handle parking. While these numbers are significant, they did not appear to have yielded the desired result – an efficient and rapid restoration. On March 6, the day before the arrival of Winter Storm Quinn, JCP&L still had approximately 29,000 customers out of service. Full restoration from the second storm took until March 13, another 6 days. These durations suggest that a contributing factor may have been JCP&L's ability to manage the influx of large numbers of external resources. Management in this context involves the acquisition, safety, sustenance, housing, travel, deployment, work/job packaging and tracking and other general supervisory responsibilities. Ineffective span of control impedes efficiency.

Recommendation # 6 (JCP&L)

RQ-JCP&L-3: Staff recommends that the Board direct JCP&L to reevaluate its span of control to ensure that all aspects of restoration work is effectively managed considering the size and terrain of its system, the type of work that must be performed and its expectations of non-company FTEs as well as their capabilities. To improve storm restoration efficiency, Staff also recommends that the Board direct JCP&L to hire or contract with additional personnel to increase the number of workers with specialized skill sets to effectively manage and direct the resources required to recover from a major weather event.

A plan of action to effectuate this increase in staffing of skilled workforce should be submitted to Board Staff within 60 days.

Like JCP&L, RECO had not fully recovered from Winter Storm Riley before the arrival of Winter Storm Quinn. Although RECO is the smallest of New Jersey's four EDCs both in terms of customers served and area covered, the company still took 9½ days to fully restore service from both storms. As discussed in Sections 2.4 and 3.3, ORU initially acquired 40 line FTEs and continued to add to its workforce during the storm restoration process. On March 6, just before Winter Storm Quinn arrived, ORU had more than 390 FTEs dedicated to the storm restoration effort. By March 11, that number grew to over 1,000 FTEs. While ORU continued to acquire resources, the documentation provided by ORU does not detail the number of line workers, damage assessors, tree trimmers, or service restoration personnel that were dedicated to RECO in New Jersey. Furthermore, decisions made by ORU with respect to pre- and post-storm resource acquisitions and workforce deployments do not appear to give proper consideration to RECO customers. For example, on March 9, ORU determined that just 309 line FTEs were needed to complete restoration although 500 FTEs were available through NAMAG. That decision was made despite still having more than 7,000 customers out of service in New Jersey. Approximately 24 hours later on March 10, RECO still had more than 5,000 customers out of service. Approximately 2,200 customers were still out on the morning of March 11, most of which were in Bergen County. Because ORU does not disaggregate data to show resources working in New York and resources working in New Jersey, the long duration of the restoration from Riley and Quinn leads staff to conclude that ORU did not adequately prioritize the restoration of customers in RECO's service territory.

Recommendation # 7 (RECO)

RQ-RECO-1: Staff recommends that the Board direct RECO to document and provide for all Major Events, a complete breakdown of all workforce FTEs deployed to New Jersey in the company's Major Event Report. Further, Staff recommends that the Board direct RECO to provide to BPU emergency management staff its pre-event resource FTE requests specifically for New Jersey and daily FTEs dedicated to New Jersey until all customers are restored.

3.5.4. Storm Impact, Outage Response and Restoration Timeline

Winter Storms Riley and Quinn left a footprint of extensive utility infrastructure damage throughout the state knocking down nearly 100 miles of overhead wires and cables and severely damaging approximately 2,000 poles. While the two storms were different from a weather perspective, the damage to the overhead utility infrastructure was the same for both storms. Tree-related damage to the utility infrastructure was on a level not seen since Superstorm Sandy in 2012. JCP&L alone responded to over 11,000 tree-related orders.

In the wake of the March 2018 nor'easters, there continues to be widespread debate and concern about what to do to mitigate tree-related damage to power lines. This concern was reinforced by residents and elected officials during the public hearings. The general consensus among many residents is that the current approach to vegetation management (VM) has not been effective in mitigating widespread tree-related damage to overhead electric facilities during major storms, and that changes are needed to the overall approach to VM.

During the 2014 stakeholder process to revise the Boards Vegetation Management rules, the EDCs commented that "… the majority of the tree-related damages during the 2011 and 2012 major storms were caused by large, healthy trees that were uprooted. These types of trees would not have been addressed as part of an EDC's ordinary, day-to-day, cycle-based vegetation management program…" An analysis of tree-related damages from the March 2018 nor'easters appears to support some of the comments from stakeholders during the 2014-2015 rulemaking process that argued for a non-uniform approach to VM. Commenters to the 2014 stakeholder process also suggested that VM should not be a "one size fits all" approach. Others commented that there was a need for particularized vegetation management practices for each utility given the variety and differences of vegetation hazards presented within New Jersey.

The Board's VM rules[21], which were revised in 2015 and provide for a 4 year cycle based VM program are consistent with industry best practices and are believed to improve long-term reliability. However, tree-related power outages during severe storms continue to be a major point of contention and extreme frustration for electric utility customers. Not only do tree-related outages add to the significant number of customers impacted by a weather event, but are also the main reason for the prolonged restoration process.

To achieve any measurable results in reducing the number of tree-related outages and thereby effectively mitigating widespread damage to power lines during major weather events, a new approach to VM may be needed, one that focuses on resiliency and not simply on long-term reliability.

Recommendation # 8 (BPU)

RQ-BPU-1*:* Staff recommends that the Board's Energy Division initiate a stakeholder process to revisit the 2015 Vegetation Management rules with the primary objective of revising the existing 4 year cycle based program with a more resiliency-focused program that emphasizes a targeted, risk- and circuit-based tree trimming and removal, including the removal of overhanging tree branches beyond the distribution lock out zone*.*

Beyond revising the Board's existing VM rules, it must also be recognized that the Board's authority is limited to adopting VM rules within the boundaries of the utility right-of-way (ROW). As previously noted, damage data from severe storms continues to show that many of the tree-related damage to overhead power lines and other utility infrastructure is caused by off-ROW trees.

Additionally, during the Board's 2013 investigation of Hurricane Irene, JCP&L and PSE&G reported that most of the tree related outages were from off -ROW trees that require permission before pruning or removal. More recently, the EDCs' Annual System Performance Reports also indicate that the majority of tree-related outages are caused by off-ROW trees.

New Jersey's four EDCs provide electric utility service to over 550 municipalities, many of which have varying sets of rules on tree trimming and planting that can create conflicts with utility VM programs. To avoid conflicts that can arise from competing interests (i.e., the EDC's need to aggressively trim or remove trees and local communities' desire to maintain the aesthetics of the ROW) the following should be considered: (1) a review of the current VM rules which address vegetation management in the public ROW where utilities have overhead facilities; (2) clarification of the rights of EDCs and the oversight agency concerning the trimming

[21] See N.J.A.C. 14:5-9.1 et. seq.

or removal of off-ROW trees identified by the EDC as a potential hazard or a danger to overhead power lines; and, (3) if necessary, pursue legislation that preserves agency authority in this area, to ensure the provision of safe, adequate and proper service.

Recommendation # 9 (BPU and NJ Legislature)

RQ-NJ-1: The Board should consider: (1) a review of the current VM rules that address vegetation management in the public ROW where utilities have overhead facilities; (2) clarification of the rights of EDCs and the oversight agency concerning the trimming or removal of off-ROW trees identified by the EDC as a potential hazard or a danger to overhead power lines; and, (3) if necessary, pursue legislation that preserves agency authority in this area, to ensure the provision of safe, adequate and proper service.

In addition to downed utility wires from extensive tree damage, the EDCs also experienced significant utility pole damage. As noted above, trees and high winds not only took down wires, but also broke or severely damaged approximately 2,000 utility poles. JCP&L and PSE&G combined replaced over 1,500 as a result of storm related damage. Utility poles belonging to Verizon and CenturyLink were also severely damaged. In total, 348 telecommunications-owned poles were replaced in JCP&L's service territory.

Many of the state's wooden utility poles that are still standing today are more than 50 years old and were installed before the proliferation of Cable TV and Telecommunications attachments following the 1996 Telecommunications Act. Under N.J.A.C. 14:5-2.1 EDCs are required to construct and install their plant and facilities in accordance with both the National Electrical Safety Code. The NESC covers the basic provisions for the safe installation of poles and overhead facilities.

In New Jersey, utility pole attachments are generally governed by joint-use agreements and maintained by the pole-owning utility. It is unclear, however, from a review of the EDCs' Annual System Performance Reports, or the joint-use agreements, to what extent pole-owning utilities take into account the most up-to-date strength and loading standards when installing new or replacement poles, or performing new joint-use attachments on existing poles. This could be a factor in pole susceptibility to damage and influence the restoration process.

Recommendation # 10 (NJ Pole-owning Utilities)

RQ-U-1: Staff recommends that the Board direct all New Jersey pole-owning utilities, including telecommunications providers, to conduct a Pole Safety Audit of their wooden utility poles consistent with the most recent NESC pole safety requirements on pole strength and pole loading. The pole-owning utilities should conduct a randomly sampled assessment of pole-line compliance with NESC strength and loading rules using the appropriate construction grade and environmental loading factors (wind and/or ice).

At a minimum, the Pole Safety Audit should take into account parameters that contribute to the structural integrity of the pole-line infrastructure during a major weather event (e.g., class of pole, age of the pole, span length, geographic loading zone, etc.). The

Pole Safety Audit should be completed within 180 days, at which time the pole-owning utilities should submit a report to the Board. The Board should then determine, based on the results of the audit, if further action is needed, including a pole replacement initiative, to ensure structural integrity of the state's wooden poles and overhead facilities.

In the aftermath of a major storm, replacing broken and severely damaged wooden utility poles is a labor intensive process requiring significant utility resources. Historical data shows that replacing a single pole can take up to 18 hours from start to finish.[22] This time consuming process can significantly increase the length of a major outage event. Data reviewed by Staff has shown that during the March 2018 nor'easters, the vast majority of broken and severely damaged wooden poles were joint-use poles with electric, telecommunications and Cable TV attachments. Additionally, a significant number of joint-use poles damaged during winter storms Riley and Quinn were non-EDC owned pole. These poles were either owned by Verizon or CenturyLink.

A review of the EDCs' emergency operation plans indicates that PSE&G and RECO both have a specific provision in their plans for addressing the issue of joint-use coordination of pole replacements with telecommunications providers during a major storm. It is unclear, however, what level of storm response coordination ACE and JCP&L have with telecommunications providers who share the same poles, as their plans are not specific on this issue. JCP&L has indicated that during the restoration effort arrangements were made for a Verizon employee to work out of JCP&L's Holmdel office coordinating restoration activities. This approach, however, appears to have achieved only limited success, as JCP&L made the decision to replace 118 poles owned by telecommunications providers to maintain the pace of restoration (34 of which were owned by Verizon).

Outage data from the March nor'easters for the EDCs and telecommunications providers clearly shows that the level of urgency to respond and restore service quickly lies with the EDCs. Whereas more than 1.2 million electric utility customers were impacted by the 2 storms, Verizon and Century Link indicated that they had minimal disruption of service to their customers. Despite little customer impact, telecommunication providers share responsibility with EDCs to repair pole-line infrastructure after major storms as expediently as possible. This requires a high level of coordination and a quick response from all pole-owning utilities whose infrastructure shares the utility poles.

Since the expansion of the definition of pole attachments in the 1996 Telecommunications Act, telecommunications attachments have become pervasive and it is not uncommon to see as many as 4-6 separated telecommunications attachments in the communications space on a single joint-use pole. In many cases, overhanging tree limbs on the

[22] Section 5.3 of the ACE EOP estimates a pole restoration rate of up to 18 hours, which is based on historical event data.

communications space are in direct contact with large heavy cables creating clearance and loading issues for joint-use poles posing an added risk to the pole-line infrastructure during major storms. Staff finds that the current joint-use coordination process between EDCs and telecommunications providers for addressing pole damage and pole replacements during a major storm event appears to be inadequate and in need of improvement.

Recommendation #11 (NJ Pole-owning Utilities)

RQ-U-2: Staff recommends that the Board direct all EDCs and pole-owning telecommunications providers to develop a formal joint-use storm coordination plan detailing roles and responsibility for the coordination of repairs or replacements of joint-use utility poles during a major storm event. Furthermore, the plan should provide for rapid response with all the necessary equipment and materials needed to perform the repairs or replacements within an agreed upon prescribed timeframe. The joint-use storm coordination plan should be completed and submitted to the Board for review and approval within 90 days. Once reviewed and approved by the Board, the joint-use storm coordination plan should be incorporated into the Emergency Operations Plans of all pole-owning utilities.

Undergrounding

The burial of overhead utility infrastructure or undergrounding as it is more commonly known is not a new concept. Over the last ten to fifteen years, undergrounding of overhead electric utility lines has often been cited as a means for mitigating storm damage as evidenced by the number of reports published on this subject. Since the mid-2000s, no less than 10 reports and studies have been written to evaluate the pros and cons of converting overhead electric utility lines to underground lines. One of the most comprehensive reports on this subject is a 2012 report issued by the Edison Electric Institute (EEI) titled, “Out of Sight, Out of Mind” which summarizes the costs, benefits and challenges of undergrounding electric utility lines.[23]

In the context of our investigation of the EDCs’ response and restoration efforts following the March 2018 nor’easters, Staff has reviewed the most recent studies on the subject of undergrounding. The following is a summary of those studies and how their findings and conclusions relate to New Jersey with regard to the benefits and challenges of undergrounding the State’s overhead electric utility infrastructure. Although most studies address the undergrounding of both the transmission and distribution infrastructure, for the purpose of this report we have limited our review to the conversion of the EDCs’ overhead distribution system.[24]

[23]Out of Sight, Out of Mind 2012: An Updated Study on the Undergrounding of Overhead Power Lines (January 2013) prepared by Kenneth, L. Hall, P.E. of Hall Energy Consulting, Inc. for Edison Electric Institute. http://www.eei.org/ourissues/electricitydistribution/Documents/UndergroundReport.pdf

[24] Most storm related damage to the utility infrastructure involves tree-related damage to the EDCs distribution system.

All the reports and studies on this subject conclude that undergrounding incurs a substantial additional cost when compared to overhead utility construction. Ultimately, the question that must be answered is under what circumstances do the benefits outweigh the cost. In the 2012 EEI report, the EDCs that were surveyed on this topic were all asked "What benefits does your utility derive from your underground system?" Some of the answers given included:

- Increased reliability during high winds and storms.
- Reduced exposure to lightning.
- Reduced exposure to outages caused by trees.
- Decreased tree trimming costs.

The 2012 EEI survey of EDCs also identified a number disadvantages in converting from overhead to underground. In addition to higher construction costs, some of the answers given included:

- Outages are fewer, but repair times are longer resulting in long duration outages.
- Difficulty making system changes or upgrades.
- More damage from third-party excavation.
- Underground facilities are susceptible to flooding.
- Conflicts with other underground utilities.
- More specialized skillset and equipment is required for installation and repairs.

Of the studies reviewed, no one study recommended a complete conversion of overhead distribution infrastructure to underground facilities. Additionally, none of the studies reviewed identified a single state requiring complete conversion of its distribution system as the costs are estimated to be in the billions of dollars. As previously noted, ultimately the cost of undergrounding utility infrastructure is the overarching challenge for EDCs and their customers.

When determining cost, there are many variables that must be considered, including customer density (urban, suburban, and rural), soil conditions (sandy or rocky), labor costs, construction techniques, and vegetation impediments. Because each construction project is unique, there is no precise cost per mile to build utility facilities. Even the most reliable cost estimates reviewed by Staff were intended to provide a range of cost data that utilities have estimated on various projects. During Staff's review of approximately 10 reports and studies, three in particular were determined to provide conditions and cost estimates that best match conditions and possible cost estimates for New Jersey: (1) the EEI study "Out of Sight, Out of Mind 2012", (2) a 2013 New York report 'Utilization of Underground and Overhead Power Lines in the City of New York"[25] , and (3) a 2005 Navigant report prepared for the Long Island Power Authority (LIPA) titled "A Review of Electric Utility Undergrounding Policies and Practices."[26]

[25] Utilization of Underground and Overhead Power Lines in the City of New York (December 2013) www.nyc.gov/html/planyc2030/downloads/pdf/power_lines_study_2013.pdf

[26] A Review of Electric Utility Undergrounding Policies and Practices (March 8, 2005) www.lipower.org/pdfs/company/papers/underground_030805.pdf.

The EEI report, while national in scope, is the most comprehensive study to date and covers all aspects of conversion to underground including the often overlooked cost of converting customer service connection points to the building once the utility has completed its ROW overhead conversion. The 2013 New York City report and the 2005 Navigant LIPA report both present cost estimates based on home density and a utility infrastructure profile that best match those seen in New Jersey. All three reports lead to similar conclusions in terms of benefits, challenges and costs.

While the aforementioned reports and studies provide varying viewpoints and different cost estimates, they all conclude that the decision to convert electric utility lines from overhead to underground is complex, expensive, and the costs would likely be borne by rate payers. Further, the reports cited also acknowledge that not all the cost components have been fully studied, and that most studies and reports provide only the ROW cost of converting overhead utility lines. There are other important components that add substantially to the overall cost of converting or burying overhead lines. Specifically, they include: (1) the customer or property owner cost of converting the service line connection point or building attachment from overhead to underground, and (2) the costs of either removing the utility poles or transferring ownership of the poles to the joint-use utilities occupying many of the EDC owned poles.

As previously noted, even the best estimates can only provide a range of costs. Estimates provided in the 2012 EEI survey presented the following range for converting overhead to underground distribution:

- EEI, 2012 Estimate Minimum Cost $158,100 per mile
- EEI, 2012 Estimate Maximum Cost $5,000,000 per mile

The 2013 New York City report which includes cost estimates for Westchester County, the Bronx, Staten Island, Queens and Brooklyn includes costs that more closely reflect expected costs for the northeast region or tristate area. The estimates for undergrounding in the 2013 New York City report averaged some $8.29 million per mile for the Bronx/Westchester, and $7.81 million per mile for Staten Island.

The common conclusion among the reviewed studies is that when weighing pros and cons, a complete undergrounding is cost prohibitive. Given the range of costs, even assuming a median average for New Jersey, complete undergrounding would not be a cost effective measure for mitigating storm damage during major weather events. Most studies concluded, however, that under very limited circumstances undergrounding could be a viable solution to hardening the infrastructure through targeted or selective undergrounding rather than a total conversion.

Advanced Metering

The most important aspect of storm restoration, second only to safety, is efficiency as measured by the number of customers restored per hour or day. During the nearly two week period it took for EDCs to restore power following Winter Storms Riley and Quinn, the response and the pace of restoration seemed to be noticeably slow once restoration shifted to restoring single customer outages. This was particularly noticeable and frustrating for customers in rural areas of the state.

For rural communities, the slow pace of restoration was magnified when customers were out of service as a result of nested outages.[27] Nested outages can be especially frustrating as customers incorrectly assume the utility knows they are out of service. For example, when circuits are re-energized after having been turned off to prevent accidental damage to equipment or personnel during a major repair, customers in isolated pockets can remain out of service because of localized damage that was unrelated to the initial major repair. During Winter Storm Toby, which is discussed in greater detail in Section 5 of this report, nested outages were especially problematic for customers in the ACE service territory resulting in customers being out of service for an extended period of time.

Aside from the issue of nested outages, restoring individual customers over a large geographic area becomes a labor intensive process, and as in most major storms, the number of single customer outages was significant during the Riley and Quinn restoration process. As discussed in Section 3.4, approximately 40% of ACE's and JCP&L's trouble locations involved single customer outages. For RECO, the number of single customer outages was 67%.

Staff's review of the outage restoration profile for Winter Storms Riley and Quinn, as well as Winter Storm Toby, reinforces previous findings about the EDCs' lack of visibility into the downstream distribution system and their continued reliance on individual customer feedback, particularly at the tail end of a prolonged restoration. In order to provide greater visibility and improved awareness of their outage profile, many EDCs are turning to Advanced Metering Infrastructure (AMI). AMI technology, also known as "smart meters," has both blue sky and storm restoration applications.

While the blue sky applications of AMI are not part of Staff's analysis, there has been significant literature written, and evidence suggests, that for storm restoration purposes AMI can be a valuable tool. AMI has the capability to not only provide greater visibility for deploying resources after a major event, but also shortening the tail of a long duration outage event such as the March 2018 nor'easters.

During a large-scale outage event, AMI can be used to send an outbound "ping" to a meter after repairs have been made upstream to confirm whether service is restored and detect any nested downstream outages that still remain while crews are still in the area (thereby reducing truck roll time and accelerating service restoration). The application of integrating AMI data into OMS also provides greater situational awareness. Use of AMI was also cited in ACE's Major Event Report as a valuable technology currently used in PHI's other jurisdictions during storm restorations. Further, the communications path necessary to deploy AMI also would allow

[27] A nested outage is a hidden pocket or pockets of customers who remain out of service after the larger outage has been restored.

for other field data acquisition components such as pole integrity sensors that relay information to the EDC about pole damage.

Recommendation # 12 (BPU)

RQ-BPU-2: Staff recommends that the Board direct JCP&L, PSE&G and ACE to each submit a plan and cost benefit analysis for the implementation of AMI. The EDCs' plans should focus on the use and benefits of AMI for the purpose reducing customer outages and outage durations during a major storm event.

Plans should be submitted to the Board within 180 days.

4. Communication and Outreach: Winter Storms Riley and Quinn

Communication is an important element in storm response. Customers want to know how they will be impacted and when they can expect power to be restored. Local government officials want to know how and when their communities will function normally. Emergency managers need to understand restoration priorities and alert EDCs to existing hazards. For these reasons and as required by the Board, the EDCs' protocols for notifying and communicating with electric utility customers and other stakeholders during weather events are well established and incorporated into their emergency response plans.[28] This section describes EDCs' communications with customers, local officials, and the Board before and during the March 2018 nor'easters.

4.1. Pre-Storm Notification

Before the arrival of Winter Storm Riley on March 2, each EDC issued pre-storm notifications and alerts through a variety of customer-facing mechanisms including the EDCs' websites, televised news organizations, municipal webpages and social media outlets (e.g., Twitter, Facebook, etc.). EDCs also sent storm warnings and outage notifications via text message and email to those customers who opted into those services.

Figure 17. Example Pre- Storm Alerts via Twitter

Alerts were first issued beginning on March 1 advising customers to be prepared for potential power outages and providing information as to how to report an outage (see Figure 17). Notifications and updates continued throughout the restoration process for Winter Storms Riley and Quinn.

[28] After Hurricane Irene in 2011, issues were raised by customers and public officials about a lack of information from the EDCs concerning ongoing restoration efforts. To address this complaint, the Board's 2013 Hurricane Irene Order, Docket No. EO11090543, noted that "Clear and consistent messaging to the public and local officials before and after a storm is crucial to help in planning for the possibility for outages of a long duration" (p. 12).

4.2. Customer Outreach

EDCs notified customers who were pre-registered on their Critical Care lists of the impending storms and the potential for outages lasting more than 24 hours. These customers typically are dependent on electricity-operated, life-sustaining equipment or have other critical care needs. During large-scale outage events such as Winter Storms Riley and Quinn, critical care customers are given priority at the single customer service restoration level. At this phase in the restoration process, dispatchers identify those customers as part of the corresponding work orders in the OMS, which are then prioritized to the extent possible.

- ACE initiated automated preparedness phone calls to registered medical equipment customers (i.e., critical care customers) on the morning of March 3. ACE made automated calls to all customers without service, which included its medical equipment customers, at 12:30 p.m. on March 3. ACE also made automated calls to all customers without service, which included its medical equipment customers, on March 8.

- JCP&L notified its critical care and well water customers on March 1 and again on March 6 through the company's Interactive Voice Response (IVR) system. Customers were advised to prepare for potential outages due to the impending weather event.

- PSE&G initiated call campaigns on March 1 and again on March 6, notifying customers with life-sustaining equipment of the impending weather and providing them tips on how to prepare. Critical care customers also received emails or text alerts if they opted into PSE&G's MyAlerts messaging system.

- ORU initiated automated telephone calls to its medical emergency and special needs customers on March 1 and again on March 6. The message included instructions to prepare as needed for approaching inclement weather and the possibility of a power outage.

Similar notifications were made to customers pre-registered on lists of homes and businesses that use water wells operated by electric pumps. These customers were also notified of locations where water and ice would be available to them.

4.3. Customer Call Center Performance

Depending on the type of emergency event or storm classification, the EDCs will either use their normal complement of Customer Service Representatives (CSRs) to handle incoming calls, or increase staffing with additional internal and external CSRs. As discussed in Section 4.1, EDCs will also use various communication mediums to either get the message out to customers and to receive incoming customer calls. For incoming calls these mediums may include incorporating technologies such as IVR, internet based applications, and text messaging. However, not all customers are comfortable using these various types of communication technologies, and for many customers, the Call Center is still a vital means of communicating with the utility during a weather event such as the March 2018 nor'easters.

4.3.1. ACE

From March 2-10, ACE received 125,708 total calls, of which 68,045 were outage-related inquires. ACE had a total of 713 internal CSRs to answer calls during that period. In addition, 198 CSRs from its two vendors were used throughout the restoration process. The Manager of Resource Management in conjunction with the Call Center Managers were responsible for ensuring adequate staffing levels and, based on the weather information, collaborated to develop initial staffing plans. During the restoration of Winter Storms Riley and Quinn, calls were answered by company representatives in their offices located in Carneys Point, NJ; Wilmington DE; and Salisbury, MD; and by their outsourced partners in San Antonio, TX and Atlanta, GA.

During the restoration period, ACE also activated its Voice Response Unit (VRU). The VRU system was updated regularly and included restoration information for customers with additional messaging for Life Support and Elderly/Blind/Disabled customers.

4.3.2. JCP&L

During the period between March 2 and March 13, JCP&L used its Call Center locations in Akron, Ohio; Fairmont, West Virginia; and Reading, Pennsylvania, which were staffed with a total of 700 customer service representatives[29]. On March 2 JCP&L also activated its third-party vendor to handle incoming calls. During this period, the company used a staffing model that estimates staffing needs based on the estimated number of customers remaining out of service for the relevant planning horizon (i.e., next shift, day, etc.). Inputs to the staffing model include, among other things, the estimated number of outages, call volume and average handle time.

JCP&L also has the ability to record in the IVR at the operating company level (i.e., JCP&L), district level, or circuit level, a message containing outage information for specific outages affecting a service area. The message is then played for the customer in place of the estimated restoration time normally provided by OMS to the IVR. From March 2 to March 12, JCP&L activated IVR messages which contained specific information on restoration of service and were updated throughout the restoration process. The IVR played one of the following three messages to customers: 1) the assessment message used early in the event, 2) the global ETR message, and 3) the individual restoration ETR message.

4.3.3. PSE&G

From March 2 through March 12, PSE&G received 429,765 calls, of which 261,443 were outage related. PSE&G's Call Center used 237 CSRs for Winter Storm Riley and 242 CSRs for Winter Storm Quinn. In addition, a total of 65 representatives from PSE&G's Credit and Collections Department were utilized to support its internal CSR staff with outage calls during the 2 storms. In addition to PSE&G employees, the company also used two Call Center contract

[29] JCP&L is supported by three FirstEnergy-operated Call Centers, all of which are located outside of New Jersey.

vendors to handle the high volume of incoming calls. During the restoration process, the 2 vendors provided a total of 134 CSRs.

Additionally, to ensure that PSE&G could handle the high volume of incoming storm-related calls, the company coordinated with its telecommunications vendor, AT&T, to increase the simultaneous inbound call capacity of the Voice Tone high call volume system (the storm Voice Response Unit or VRU). The VRU contained regularly updated service restoration information. During the restoration, the VRU was updated and also tested daily to ensure that the functionality was working properly.

4.3.4. RECO

Between March 2 and March 12, ORU's Call Center received 11,472 outage calls. ORU has 2 Call Center locations which are both located in New York. The Blooming Grove Call Center located in Monroe, NY and the Spring Valley Call Center located in Spring Valley, NY. For the Riley and Quinn restoration, ORU used 54 company CSRs to answer outage calls during this period. Staffing levels were developed based on a Storm Category/Classification rating. This rating is based on storm severity; number of customers projected to be out of power and expected restoration.

According to ORU's Emergency Operations Plan, at the onset of an event, the company routes calls coming into its toll-free number to a third-party IVR vendor. By using the IVR platform, ORU's call handling capability increases to approximately 30,000 calls per hour. Customers receive a recorded message from ORU with information about the event and have the opportunity to report their outage and receive ETR information as the information becomes available.

4.4. Estimated Time of Restoration

An ETR is the amount of time the EDC expects it will take to restore service after a power outage. Under blue sky conditions, when a customer reports an outage, either over the phone or online, the customer will receive an ETR automatically generated by the OMS. Based on the type of equipment failure or infrastructure damage, this estimate can typically range anywhere from two to eight hours. The actual "clock time" that service is expected to be restored is based on an average of actual restoration times for similar work. As more information becomes available during the outage event, the ETR may be updated by the dispatcher.

During a major weather event when outages begin to rapidly escalate, the automatically generated ETR is suppressed. As the weather event subsides and damage assesments are ongoing, the EDCs must wait untill the initial damage assesment information is recived before issuing ETRs. Under this protocol, ETRs are issued in accordance with the procedures outlined in the EDCs' EOP. This includes issuing a Global ETR within 24 hours per the Board's 2013 Huricanne Irene Order which indicates the date and time when the last customer affected by the storm is expected to be restored. The ETR process then progresses to more granular

ETRs including municipal level and individual ETRs as additional information from completed damage assessments becomes available.

After the initial damage assesment of the March 2 and March 7 nor'easters, the EDCs all issued an initial Global ETR for their respective systems, eventually progressing to municipal and finally indavidual ETRs. Table 2 provides an example of the ETRs issued by ACE during the restoration of Winter Storm Quinn.

Table 2: ACE's Global Municipal and Indavidual ETRs for Winter Storm Quinn Issued on the Morning of March 8, 2018

The global ETR at 3/9/18 23:59 represents the 1-5 tier out of the Winslow District highlighted below.			
Glassboro Tiered ETRs			
Outage Tiers	**# of Orders**	**# of Customers (Currently out)**	**Expected Return Date & Time**
>150	0	0	n/a
101-150	0	0	n/a
26-100	0	0	n/a
6-25	2	26	3/8/2018 @ 18:00
1-5	35	42	3/8/2018 @ 18:00
Winslow Tiered ETRs			
Outage Tiers	**# of Orders**	**# of Customers (Currently out)**	**Expected Return Date & Time**
>250	8	4603	3/8/2018 @ 12:00
101-250	9	1550	3/8/2018 @ 18:00
26-100	68	3494	3/9/2018 @ 12:00
6-25	75	790	3/9/2018 @ 16:00
1-5	373	448	3/9/2018 @ 23:59

4.5. Communication with Local Officials and the BPU

Providing timely and accurate outage restoration information to elected officials and government regulators is key to their decision making on a myriad of issues including public safety, sheltering and critical care needs.[30] These calls are held to provide up-to-date information on the restoration process and to allow officials to ask questions.

[30] This was an area of concern raised by several commenters following Hurricane Irene in 2011. Accordingly, the Board's 2013 Hurricane Irene Order (Docket EO11090543) issued a directive requiring EDCs to hold daily conference calls with municipal officials of the affected municipalities prior to and during a major weather event.

Within 24 hours of the arrival of Winter Storm Riley, the EDCs' liaisons began holding daily conference calls with the mayors. In addition to providing daily updates to municipal officials, the EDCs also worked with the county OEMs by staffing the OEMs that opened during the two storms with a company representative. Between March 2 and March 12, during the overlaping restoration process of Winter Storms Riley and Quinn, the EDCs all provided staffing to county OEMs that opened. JCP&L, the largest of the 4 EDCs in terms of total square miles, provided representatives to 13 county OEMs.

Prior to the arrival of Winter Storm Riley, the BPU began holding pre-event conference calls with the EDCs to discuss the weather forecast, storm tracking and EDC staffing levels. Each EDC sent representatives to those local Offices of Emergency Management that were activated in anticipation of the nor'easters to facilitate hazard response. JCP&L also sent a representative to the Regional Operations and Intelligence Center (ROIC) to work with Board Staff, DOT, the Department of Environmental Protection, and other state agencies to identify and coordinate priority restoration needs. This communication and outreach process continued throughout the restoration process until the vast majority of customers were back in service.

4.6. Findings and Recommendations

4.6.1. Pre-Storm Notification and Customer Outreach

As discussed in Section 4.1, measures were put in place by the EDCs after Hurricane Irene to improve how they notify and communicate with customers before and after a major event. Since that time, protocols and procedures have been established and pre-storm notifications and alerts were issued by each of the EDCs prior to Winter Storms Riley and Quinn in accordance with those protocols.

In addition to notifying customers in general about the impending storm, EDCs are also required to call critical care customers who previously registered with the utility as a special needs customer. The Critical Care list is used to contact customers should an outage affect their service for more than 24 hours. During Staff's investigation, the EDCs all reported that they followed their EOP procedures with regard to critical care customers by sending automated messages through the IVR system. Under the Board's 2013 Irene Order, recommendation BPU 43 requires EDCs to communicate with special needs (critical care) customers and that the communication including, at a minimum, a pre-event call to warn of impending possible outages and an intra-event call to provide an ETR.

Critical care customers by definition are especially reliant on electricity for their health and welfare and should receive notification of the possible loss of service from a live person and not an automated message. Without a live call, EDCs have no way of knowing if customers have been removed from their home, making it difficult to confirm when service has been restored. A live call can also be used to close the loop with the local or county emergency management office.

Recommendation # 13 (ACE, JCP&L, PSE&G, RECO)

RQ-EDC-4: Staff recommends that the Board direct each EDC to maintain direct and live contact with critical care customers before, during, and after any outage event. In the event an EDC has not been able to reach the critical care customer (or their designee) within a 24-hour period via live phone call, the EDC should make referrals to local or county Emergency Operations Centers, first responders or other health and human service organization for further direct contact attempts.

4.6.2. Customer Call Center Performance

After the initial customer notification process, the EDCs turned their focus to increasing staffing levels to handle the expected call volume. Each of the EDCs, with the exception of RECO, used third-party CSR vendors to supplement their Call Center CSRs. ORU/ RECO's 2 Call Centers which are located in New York used 54 company CSRs to answer customer calls. Between March 2 and March 12, the ORU Call Centers received more than 11,000 outage calls. According to RECO, staffing levels were developed based on a storm category or classification rating that uses the number of customers projected to be out of power.

Based on comments and customer complaints reviewed during the April 16, 2018 public hearing held in Mahwah, it appears that RECO either did not have the adequate CSR staffing levels to handle the call volume from the 2 storms, or the CSRs were not properly trained to respond appropriately to customer inquiries about their outage status. Criticism of the RECO and ORU CSRs continues to be a recurring theme. During the Hurricane Irene public hearings in 2011, customers complained about the lack of information provided by the Call Centers. Similar complaints were voiced at the April 16, 2018 hearing as customers expressed frustration over the perceived indifference shown by company Call Center employees about the length of the outages. Customers also expressed frustration over the lack of information provided about ongoing repairs in their area. Staff's review of information posted on Twitter about the status of ongoing repairs by RECO also seemed to lack New Jersey specific information. Of the more than 100 Twitter posts reviewed, very few even mentioned ongoing restoration activities in Bergen or Passaic counties. It appears there was little consideration given to New Jersey RECO customers on the ORU social media posts during the ongoing restoration.

Similar to RECO, all of JCP&L's incoming customer calls are handled by call centers in Ohio, West Virginia, and Pennsylvania. During the Board's public hearings, customers voiced similar frustration about JCP&L's call centers. The most common complaint involved a general lack of knowledge on the part of call center representatives about ongoing repair efforts in the area. Frustration about inaccurate ETR information also was expressed by customers and public officials at the public hearings.

Recommendation # 14 (RECO and JCP&L)

RQ-RECO-2: Staff recommends that the Board direct RECO to develop a training program for its Customer Service Representatives (CSRs) that, at a minimum, ensures that calls are handled in a professional and courteous manner. Furthermore, Staff recommends the Board direct RECO to ensure that its Call Centers have the capability of tracking when utility crews are working in New Jersey and that customers are provided accurate information about ongoing repair work in their area including regular updates on social media.

RQ-JCP&L-4: Staff recommends that the Board direct JCP&L to ensure that its Call Centers have the capability of tracking where utility crews are working at any time during the restoration process and that accurate and up-to-date information is provided to customers about ongoing repair work in their area.

4.6.3. Estimated Time of Restoration

During a prolonged outage event, ETRs are often cited as one of the most, if not the most, important piece of information that customers need for making plans and informed decisions about their families' welfare. Following both Winter Storm Riley and Winter Storm Quinn, global ETRs per the 2013 Irene Order were issued by each of the four EDCs. These ETRs were later revised and more granular ETRs were issued as the restoration progressed.

Staff's review of the ETRs issued by each of the four EDCs indicates that while attempts were made to provide the best available information within the required timeframe, gaps still exist in both the accuracy and timeliness of the ETRs. More importantly, as in past major storms, customers continue to express frustration and confusion over multiple ETR revisions and inaccuracies, particularly with ETRs issued by JCP&L and RECO. Confusion and frustration over the inaccuracy of ETRs was further magnified when JCP&L failed to recognize early in the restoration process that the IVR system was in default mode for customers who opted in for ETR callback feature. Customers were receiving regular callbacks with incorrect ETRs.

The March 2018 nor'easters, as well as past storms, have demonstrated that ETR calculations are highly dependent on an accurate and quick damage assessment process. Depending on the size of the area impacted by the weather event, an initial assessment of all the damage can take more than 24 hours which is the required timeframe for issuing a global ETR. In the case of the March 2018 nor'easters, the entire state was impacted by the storms to varying degrees. For EDCs with large geographic areas like ACE, JCP&L and PSE&G, issuing a realistic and reasonably accurate global ETR for the "entire system" becomes increasingly difficult as damage assessment information is still coming in after the required 24 hour reporting period for a global ETR.

Staff's review of the EDCs' global ETRs indicates that some EDCs were able to improve the accuracy of their ETRs by issuing a global ETR at the District level. For example, on March 3, ACE issued a global ETR of March 5 at 8:00 p.m. for its Winslow and Glassboro Districts and a global ETR of March 4 at 11:59 p.m. for its Cape May and Pleasantville Districts. PSE&G also issued global ETRs at the Division level. JCP&L, on the other hand, issued a March 3 global ETR for March 6. On March 6 JCP&L still had approximately 29, 000 customers out of service.

It appears from a close review of the ETRs issued by the EDCs that there needs to be a clear definition of the global ETRs in terms of what service area is included in the global ETRs. While global ETRs at the Division or District level seem more manageable for the EDCs than a system wide global ETR, in terms of being able to more quickly assess damage at the district or division level and turning that information into more precise global ETRs, the defined area and restoration timeline has to be better communicated to customers.

Recommendation #15 (ACE, JCP&L, PSE&G, RECO)

RQ-ACE-1: Staff recommends that the Board direct ACE to provide a global ETR separately for each of its 4 operating districts (Cape May, Glassboro, Pleasantville and Winslow) within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a district level global ETR, ACE should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-JCP&L-5: Staff recommends that the Board direct JCP&L to provide a global ETR separately for each of its 2 regions (Northern Region and Central Region) within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a region level global ETR, JCP&L should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-PSE&G-1: Staff recommends that the Board direct PSE&G to provide a global ETR separately for each of its 4 operation divisions (Central, Metropolitan, Palisades and Southern) within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a division level global ETR, PSE&G should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-RECO-3: Staff recommends that the Board direct RECO to provide a system wide global ETR for its entire service New Jersey territory within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a global ETR, RECO should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

5. The EDCs' Response to Winter Storm Toby

5.1. ACE

As discussed in Section 1.3 of this report, Winter Storm Toby arrived approximately 2 weeks after Winter Storm Quinn, and a full 8 days after all customers had been restored from the overlapping restoration caused by the previous 2 storms. Although not as impactful as the other storms in terms of electric utility outages, the final nor'easter of the month, Winter Storm Toby, still caused significant damage to ACE and parts of JCP&L's Central Region. At peak between midnight and 3:00 a.m. on March 22, ACE had more than 59,000 customer outages. Full restoration took a little more than 4 days as ACE struggled at the end of the restoration process on March 25, 2015 to identify and restore the remaining few hundred customers who were still out because of nested outages and backyard easements.

- ***Pre-Storm Preparations***

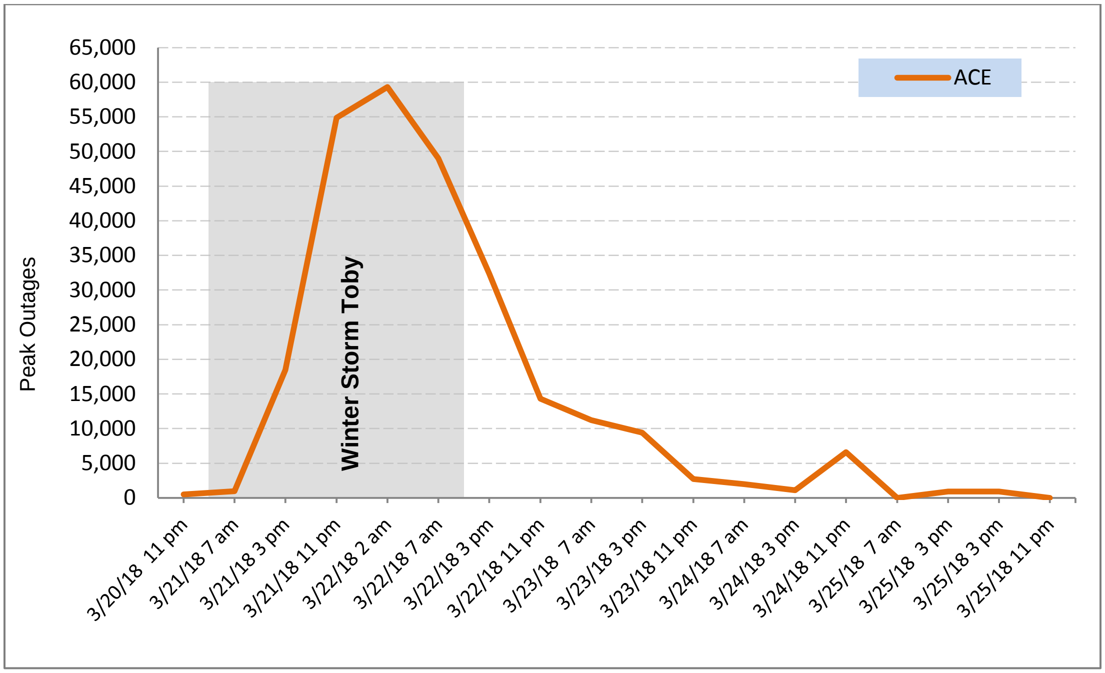
Leading up to the arrival of Winter Storm Toby, ACE classified the storm as a Level 3 storm. Based on this classification, ACE was expecting between 10,000 and 50,000 customer outages. For Winter Storm Toby, ACE was able to mobilize local contractors, affiliated utility contractors, affiliated utility crews, and utility crews and contractors from RMAG member utilities. Unlike Winter Storm Riley when out-of-state resources were scarce, for this storm, ACE received pre-storm assistance not only from local contractors, who began arriving in the afternoon of March 21, but also from Exelon affiliates. By the morning of March 22, ACE had a combined workforce of more than 740 FTEs dedicated to restoration activities. As the restoration progressed, assistance from other utilities including RMAG member utilities and contractors continued to arrive in stages between the afternoon of March 22 and March 25. As with the previous 2 storms, all RMAG conference calls and requests were made by PHI on behalf of ACE and other PHI affiliates.

- ***Restoration of Service***

Although ACE made staffing decisions and resource acquisitions before the full impact of the storm, as the storm subsided and the full extent of the damage began to emerge, ACE took steps to increase its workforce by requesting additional resources through the RMAGs. On March 22, ACE secured additional contractors from RMAG member utilities and line crews from Baltimore Gas & Electric (BG&E), Delmarva, PSE&G and Hydro Quebec. These additional resources arrived between March 23 and March 25. At the height of the restoration process, ACE had a workforce of more than 2,000 FTEs working 12-16 hour shifts. On March 23, ACE had more than 500 line and tree crews working on restoring customers, most of which were deployed to the Glassboro and Winslow Divisions. While ACE made significant progress early in the restoration process, the company struggled with nested outages, which extended the restoration process until the afternoon of March 25.

From the beginning of the storm, the greatest impact in terms of trouble calls and outages was felt in the Glassboro Division with Gloucester and Cumberland counties experiencing the most outages due to tree-related damage to wires and poles from the heavy wet snow. Outages in the Glassboro Division began to escalate almost immediately representing more than 87% of ACE's total outages by early afternoon on March 21. On the afternoon of March 22, the number of outage orders peaked at 1,582 with more than 57% of the orders attributed to outages in the Glassboro Division. By midnight on March 22, ACE had reduced peak outages from approximately 59,000 the previous night to fewer than 15,000. However, between the evening of March 23 and March 25 restoration slowed, mostly due to previously unidentified nested outages in the Glassboro and Cape May Divisions. Figure 18 shows the outage restoration timeline.

Figure 18. Winter Storms Toby Peak Outages Over Time for ACE



- ***Communication and Outreach***

Before the arrival of Winter Storm Toby, ACE followed the same communication and outreach protocols and procedures as it did during the early March restoration of service from outages caused by Winter Storms Riley and Quinn. ACE issued its first press release on the morning of March 20, 2018 alerting customers of the impending storm and the possibility of extended power outages. The company also issued alerts, notifications and updates on its website and on social media including Facebook and Twitter. Daily conference calls to local officials began within 24 hours of the arrival of Winter Storm Toby and continued throughout the March 20 to March 25 restoration. ACE was also in contact with and provided support to county OEMs. Communication was also ongoing on a daily basis with BPU Staff. ACE issued its Global ETR on the morning of March 22 for the remaining customers still out of service (see Table 3 for a breakdown of the ETRs). The initial ETRs were later revised on March 24 for all customers to be restored by 6:00 p.m. that day. However, customers were not fully restored until the following day, March 25.

Table 3. ETRs Issued by ACE on the Morning of March 22, 2018

All storm related outages are expected to be restored by midnight Friday night (23:59 3/23)				
Glassboro/Winslow/Pleasantville Tiered ETRs				
Outage	# of Orders	# of Customers (Currently	Expected Return Date &	Update
>250	53	44269	03/22/2018 @ 18:00	
101-250	36	5347	03/22/2018 @ 22:00	
26-100	130	6623	03/22/2018 @ 23:59	
6-25	204	2392	03/23/2018 @ 18:00	
1-5	1028	1197	03/23/2018 @ 23:59	
Total	**1451**	**59828**		

5.2. JCP&L

Winter Storm Toby's impact on JCP&L was far less severe than the previous two nor'easters of March 2 and March 7. Peak outages for Toby were at their highest on the morning of March 22 with approximately 31,000 customers out of service. Unlike the previous 2 storms, most of JCP&L's outages were concentrated in the Central Region with only a minimal number of outages in the JCP&L Northern Region. Most customers were restored within 48 hours and by the afternoon of March 23, JCP&L had fewer than 100 customers still out of service from Winter Storm Toby.

- ***Pre-Storm Preparations***

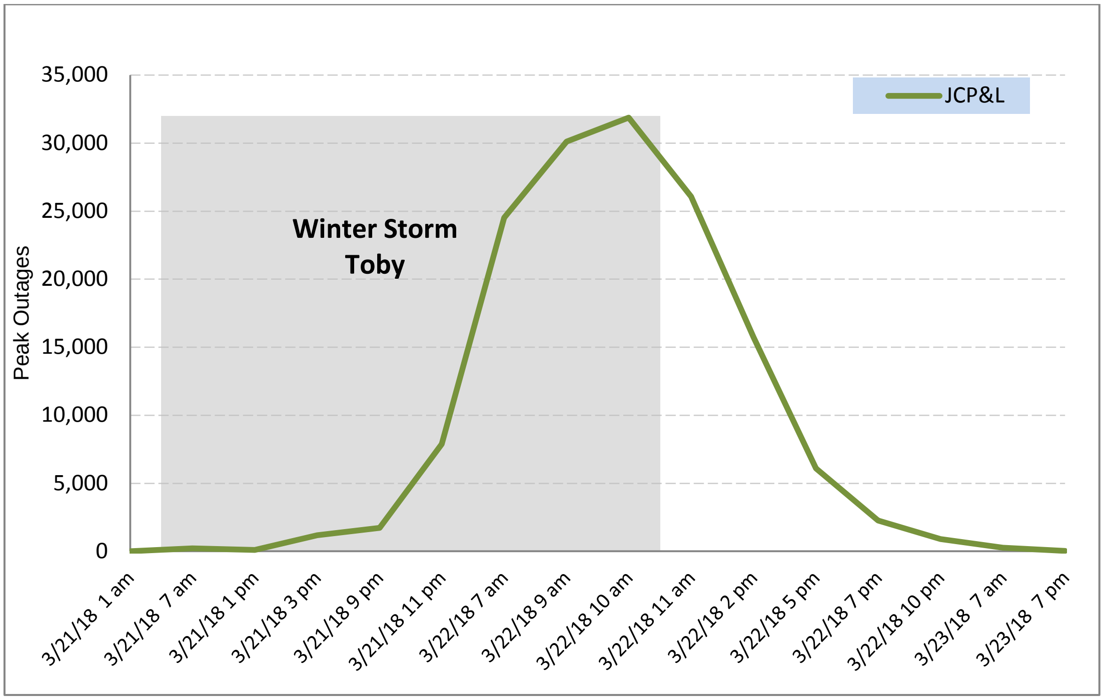
JCP&L began pre-storm preparations on March 19 and started making resource acquisition plans based on its major event classification matrix. For Winter Storm Toby, JCP&L classified the storm as an event level 2 and began making resource acquisitions and RMAG requests in anticipation of the impending weather event. The first of these crews began arriving on March 19 at 10:00 p.m. JCP&L also requested and received FirstEnergy-affiliate crews. By the morning of March 22, JCP&L had a combined workforce of more than 2,900 FTEs including internal line workers, contractors, tree trimmers, damage assessors, hazard assessors, and other support personnel. As the restoration progressed, assistance from other utilities including RMAG member utilities and contractors continued to arrive.

- ***Restoration of Service***

As the restoration progressed, JCP&L continued to increase its workforce as crews from the JCP&L Northern Region and other First Energy affiliates became available. During the course of the restoration, approximately 3,500 FTEs took part in restoring power to JCP&L customers. This included more than 1,500 line FTEs from 36 contractor companies, 4 FirstEnergy affiliated companies and one RMAG member utility. Most of the workforce was deployed in the Central Region including 31 line FTEs normally assigned to the JCP&L Northern Region. At the height of the restoration on the afternoon of March 22, more than 92% of all crews working had been deployed to the Central Division where the damage was most significant.

As noted above, most of the JCP&L outages were concentrated in Ocean, Monmouth and Burlington counties where heavy wet snow and high winds caused significant damage to the overhead wires and poles. Lacey Township, for example, received 15 inches of snow and Harvey Cedars saw wind gusts of 48 mph. In total, JCP&L reported 47 broken utility poles and more than 19,000 feet of damaged overhead wires. JCP&L crews also responded to 630 outage orders, of which 87% were in the Central Region. By the evening of March 22, JCP&L had made significant progress, reducing peak outages from approximately 31,000 that morning to less than 2,500. Figure 19 depicts the outage restoration timeline from the beginning of the storm until March 23 when all but 100 or fewer customers remained out of service.

Figure 19. Winter Storm Toby Peak Outages Over Time for JCP&L



- ***Communication and Outreach***

JCP&L began its proactive communication and outreach campaign on March 19. For this storm, JCP&L followed the same protocols and procedures used for the prior 2 nor'easters. JCP&L issued its first press release on March 20 alerting customers of the impending storm and the possibility of extend power outages. The company also issued alerts, notifications and updates on its website and on social media including Facebook and Twitter. Daily conference calls to local officials began on the afternoon of March 21. JCP&L also provided staffing to four county OEMs on March 21 and March 22. Communication also was ongoing with BPU Staff. On March 22 at 11:21 p.m., JCP&L issued its Global ETR of March 23 at 11:30 p.m.

5.3. Findings and Recommendations

As previously noted, Winter Storm Toby's impact was far less severe than the previous 2 nor'easters — Winter Storms Riley and Quinn. PSE&G and RECO experienced little damage when compared to those storms and were able to quickly respond to customer outages. For JCP&L, peak outages were at their highest on the morning of March 22, with approximately 31,000 customers out of service. Most of JCP&L's outages were concentrated in the Central Region with only a few thousand outages in the JCP&L Northern Region. Most customers were restored within 48 hours. By the afternoon of March 23, JCP&L had less than 100 customers still out of service from Winter Storm Toby.

On the morning of March 22 JCP&L, before Winter Storm Toby had left the area, JCP&L had more than 800 line FTEs dedicated to the restoration effort. In total, more than 1,500 line FTEs were secured by JCP&L. JCP&L was able to reduce peak outages from approximately 31,000 earlier that morning to less than 2,500 by the evening of March 22. Given the total number of customers impacted by the storm (approximately 71,000) and the company's quick response, JCP&L's complement of line FTEs and supporting workforce appeared to be adequate. By the evening of March 23, JCP&L had fewer than 100 customers out of service.

In terms of customer outages, ACE received the brunt of the storm impact. Unlike the previous 2 storms, ACE was able to acquire pre-storm assistance not only from local contractors, but also from Exelon affiliates. By the morning of March 22, ACE had a combined workforce of more than 740 FTEs dedicated to restoration activities. As the restoration progressed, assistance from other utilities, including RMAG member utilities and contractors, continued to arrive between the afternoon of March 22 and March 25. At the height of the restoration process, ACE had a workforce of more than 2,000 FTEs working 12-16 hour shifts. In addition to securing contractors, crews from PHI affiliates and workers from Exelon, its parent company, ACE also received assistance from PSE&G and Hydro Quebec.

In less than 48 hours — between the early morning of March 22 and mid-day March 24 — ACE reduced the number of peak outages from more than 59,000 to approximately 2,700. During the next 12 to 24 hours, ACE's progress was slowed due to the identification of approximately 5,500 new outages. Most of these outages were either nested outages or outages from downed wires in backyard easements where vehicle access was difficult. Although restoration appeared to be on pace to be completed in less than 3 days, the tail end of the outage presented problems for ACE. Specifically, ACE lacked visibility into the downstream distribution system and had to rely on individual customer feedback to identify who was still out of service. As discussed in Section 3.5.4, advanced metering may be useful in providing the necessary degree of awareness to rapidly identify outages. See Recommendation # 10.

6. Compliance with Board Orders

Hurricane Irene made landfall in New Jersey on August 28, 2011 and disrupted service to 1.9 million of the state's 3.9 million electric customers with outages lasting up to eight days. On October 29, 2011, a snowstorm followed causing 1.0 million customers to lose power with outages extending seven days. The restoration that followed from these two major weather events initiated further analysis by the Board. Findings and recommendations led to the issuance of a Board Order, referred to as the Irene Order, which contained 106 directives to EDCs (Board Order dated January 23, 2013, Docket number EO11090543). Of these, 65 directives applied to all EDCs. Of the remainder, 19 directives applied only to JCP&L, 2 applied only to ACE, 12 applied only to PSE&G, and 8 were specific to RECO. Many directives required the EDCs to submit to the Board updated plans, processes, and procedures to improve storm preparedness and outage restoration efforts, and to address potential underlying infrastructure issues. Compliance with these directives was phased in over a period of 30, 45, 60, 90, 120, 180 and 365 days. Staff assessed submittals and determined each EDC to be in compliance with its directives.

Super Storm Sandy made landfall in New Jersey on October 29, 2012. The storm inundated 49 major substations with floodwater, toppled approximately 100,000 trees, and damaged more than 3,000 distribution circuits and 9,000 utility poles. Approximately 2.9 million customers were affected. Upon review of the EDCs' restoration performance, the Board found additional areas for improvement beyond those identified in its Irene Order. The Board issued a subsequent order on May 29, 2013[31] that included eight directives aimed at enhancing the content, accuracy and timeliness of service restoration information provided on the EDCs' public websites and by EDCs to municipal officials and to their respective customers. All the directives in the order applied to each EDC.

Whereas the majority of directives in the Irene Order required one-time submissions to the Board, directives contained in the Sandy Order require EDCs to take specific actions before and during major weather events as they arise. During its review of EDCs' pre-storm planning and post-storm restoration activities during Winter Storms Riley, Quinn and Toby, Staff examined relevant artifacts to ensure compliance to each of the Board directives identified above. The examination confirmed that the EDCs were in compliance with the Irene and Sandy Orders.

It is important to note, however, that compliance with Board directives is not the exclusive measure for ensuring effective pre-storm planning and post-storm restoration. Experience has shown that, in addition to compliance, performance rests on effective implementation of plans, processes, and procedures during each storm. As such, storm response and recovery will always be a function of EDCs' and the Board's commitment to continuous improvement in pursuit of service excellence.

[31] In the Matter of the Board's Review of The Utilities Response to Hurricane Sandy, BPU Docket Number EO12111050, May 29, 2013, ("Sandy Order").

Appendix A

Summary: Board Recommendations

Event Level Classification and Outage Prediction Modeling

Recommendation # 1 (ACE, JCP&L, PSE&G, RECO)

RQ-EDC-1: EDCs should participate in the Board's collaborative initiative with the National Weather Service for the purpose of exchanging information about storm prediction modeling and weather impacts on electric infrastructure with the goal of refining EDCs' outage prediction modeling capabilities.

Recommendation # 2 (ACE, JCP&L, PSE&G, RECO)

RQ-EDC-2: Staff recommends that the Board direct all EDCs to update their event level classification matrices to reflect data points and insights gained from all weather-related events for which a Major Storm Report was required by the Board since Hurricane Sandy in 2012, including the most recent March 2018 nor'easters. The updated matrices should explicitly account for locational differences such as tree canopy, surface terrain, and elevation. EDCs should revise their Emergency Operations Plans to include these updated matrices. Revised plans should be filed with the Board within 45 days. Each EDC also should submit to the Board a description of the process it will follow to ensure storm-specific pre-storm planning and post-storm recovery lessons learned are routinely incorporated into these matrices going forward.

Recommendation # 3 (JCP&L)

RQ-JCP&L-1: Staff recommends that the Board direct JCP&L to refine its outage prediction model to account for local, regional and division level differences. Specifically, JCP&L's prediction model should account for variations in weather patterns across its service territory as dictated by geographic locale. It also should include situational and locational variables that, at a minimum, include: (1) type and density of existing tree canopy; (2) the underlying soil conditions in heavily treed areas; (3) topology; (4) coastal and shoreline flooding and wind conditions; (5) distribution infrastructure configuration and resiliency; and (6) age and structural integrity of the overhead pole-line distribution system. JCP&L should detail its revised outage prediction modeling process including the specific inputs and outputs in a report to the Board within sixty days.

Pre-Storm Resource Acquisition and Mutual Assistance

Recommendation # 4 (ACE, JCP&L, PSE&G, and RECO)

RQ-EDC-3: Staff recommends that the Board direct New Jersey's four EDCs to work together to create an Intra-state Mutual Assistance Agreement that reflects a commitment to share internal company employees and contractors when out-of-state resources are likely to be unavailable through the RMAG process or when significant numbers of outages are predicted to affect New Jersey residents across the state. The EDCs also should seek participation from the state's nine municipal utilities and one cooperative utility and include those utilities in the development of the Intrastate Mutual Assistance Agreement. EDCs should submit the plan for Staff review within 60 days.

Damage Assessment

Recommendation # 5 (JCP&L)

RQ-JCPL-2: Staff recommends that the Board direct JCP&L to train as many employees as practical to perform second role damage assessment activities. A training plan describing how this training is to be accomplished and a timeline for putting it into practice should be submitted to the Board.

Staff also recommends that the Board direct JCP&L to improve its capability to rapidly mobilize trained third-party damage assessors within each of its service regions and to introduce solutions to maximize their efficiency. JCP&L should submit an improvement plan that addresses this capability to the Board.

Both plans should be submitted to the Board within 120 days.

Workforce Deployment

Recommendation # 6 (JCP&L)

RQ-JCP&L-3: Staff recommends that the Board direct JCP&L to reevaluate its span of control to ensure that all aspects of restoration work is effectively managed considering the size and terrain of its system, the type of work that must be performed and its expectations of non-company FTEs as well as their capabilities. To improve storm restoration efficiency, Staff also recommends that the Board direct JCPL to hire or contract with additional personnel to increase the number of workers with specialized skill sets to effectively manage and direct the resources required to recover from a major weather event.

A plan of action to effectuate this increase in staffing of skilled workforce should be submitted to Board Staff within 60 days.

Recommendation # 7 (RECO)

RQ-RECO-1: Staff recommends that the Board direct RECO to document and provide for all Major Events, a complete breakdown of all workforce FTEs deployed to New Jersey in the company’s Major Event Report. Further, Staff recommends that the Board direct RECO to provide to BPU emergency management staff its pre-event resource FTE requests specifically for New Jersey and daily FTEs dedicated to New Jersey until all customers are restored.

Storm Impact, Outage Response and Restoration Timeline

Recommendation # 8 (BPU)

RQ-BPU-1: Staff recommends that the Board's Energy Division initiate a stakeholder process to revisit the 2015 Vegetation Management rules with the primary objective of revising the existing 4 year cycle based program with a more resiliency-focused program that emphasizes a targeted, risk- and circuit-based tree trimming and removal, including the removal of overhanging tree branches beyond the distribution lock out zone.

Recommendation # 9 (BPU and NJ Legislature)

RQ-NJ-1: The Board should consider: (1) a review of the current VM rules that address vegetation management in the public ROW where utilities have overhead facilities; (2) clarification of the rights of EDCs and the oversight agency concerning the trimming or removal of off-ROW trees identified by the EDC as a potential hazard or a danger to overhead power lines; and, (3) if necessary, pursue legislation that preserves agency authority in this area, to ensure the provision of safe, adequate and proper service.

Recommendation # 10 (NJ Pole-owning Utilities)

RQ-U-1: Staff recommends that the Board direct all New Jersey pole-owning utilities, including telecommunications providers, to conduct a Pole Safety Audit of their wooden utility poles consistent with the most recent NESC pole safety requirements on pole strength and pole loading. The pole-owning utilities should conduct a randomly sampled assessment of pole-line compliance with NESC strength and loading rules using the appropriate construction grade and environmental loading factors (wind and/or ice). At a minimum, the Pole Safety Audit should take into account parameters that contribute to the structural integrity of the pole-line infrastructure during a major weather event (e.g., class of pole, age of the pole, span length, geographic loading zone, etc.). The Pole Safety Audit should be completed within 180 days, at which time the pole-owning utilities should submit a report to the Board. The Board should then determine, based on the results of the audit, if further action is needed, including a pole replacement initiative, to ensure structural integrity of the state's wooden poles and overhead facilities.

Recommendation # 11 (NJ Pole-owning Utilities)

RQ-U-2: Staff recommends that the Board direct all EDCs and pole-owning telecommunications providers to develop a formal joint-use storm coordination plan detailing roles and responsibility for the coordination of repairs or replacements of joint-use utility poles during a major storm event. Furthermore, the plan should provide for the rapid response with all the necessary equipment and materials needed to perform the repairs or replacements within an agreed upon prescribed timeframe. The joint-use storm coordination plan should be completed and submitted to the Board for review and approval within 90 days. Once reviewed and approved by the Board, the joint-use storm coordination plan should be incorporated into the Emergency Operations Plans of all pole-owning utilities.

Recommendation # 12 (BPU)

RQ-BPU-2: Staff recommends that the Board direct JCP&L, PSE&G and ACE to each submit a plan and cost benefit analysis for the implementation of AMI. The EDCs' plans should focus on the use and benefits of AMI for the purpose reducing customer outages and outage durations during a major storm event.

Plans should be submitted to the Board within 180 days.

Pre-Storm Notification and Customer Outreach

Recommendation # 13 (ACE, JCP&L, PSE&G, RECO)

RQ-EDC-4: Staff recommends that the Board direct each EDC to maintain direct and live contact with critical care customers before, during, and after any outage event. In the event an EDC has not been able to reach the critical care customer (or their designee) within a 24-hour period via live phone call, the EDC should make referrals to local or county Emergency Operations Centers, first responders or other health and human service organization for further direct contact attempts.

Customer Call Center Performance

Recommendation # 14 (RECO and JCP&L)

RQ-RECO-2: Staff recommends that the Board direct RECO to develop a training program for its Customer Service Representatives (CSRs) that, at a minimum, ensures that calls are handled in a professional and courteous manner. Furthermore, Staff recommends the Board direct RECO to ensure that its Call Centers have the capability of tracking when utility crews are working in New Jersey and that customers are provided accurate information about ongoing repair work in their area including regular updates on social media.

RQ-JCP&L-4: Staff recommends that the Board direct JCP&L to ensure that its Call Centers have the capability of tracking where utility crews are working at any time during the restoration process and that accurate and up-to-date information is provided to customers about ongoing repair work in their area.

Estimated Time of Restoration

Recommendation #15 (ACE, JCP&L, PSE&G, RECO)

RQ-ACE-1 Staff recommends that the Board direct ACE to provide a global ETR separately for each of its 4 operating districts (Cape May, Glassboro, Pleasantville and Winslow) within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a district level global ETR, ACE should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-JCP&L-5: Staff recommends that the Board direct JCP&L to provide a global ETR separately for each of its 2 regions (Northern Region and Central Region) within 24 hours after a weather event or other major event has exited the service territory.

Further, in issuing a region level global ETR, JCP&L should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-PSE&G-1: Staff recommends that the Board direct PSE&G to provide a global ETR separately for each of its 4 operation divisions (Central, Metropolitan, Palisades and Southern) within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a division level global ETR, PSE&G should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.

RQ-RECO-3: Staff recommends that the Board direct RECO to provide a system wide global ETR for the entire service territory within 24 hours after a weather event or other major event has exited the service territory. Further, in issuing a global ETR, RECO should ensure that the area for which the global ETR is intended be clearly defined through the issuance of a press release and other appropriate media outlets.