COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

PREPARATION FOR AND RESPONSE TO HURRICANE IRENE

SPECIAL REPORT OF THE DIVISION OF ENERGY REGULATION

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EXECUTIVE SUMMARY

This report presents the results of an analysis by the Virginia State Corporation Commission Staff ("Staff") of the preparedness and responsiveness of Dominion Virginia Power ("DVP") and five of the state's electric cooperatives[1] relative to power outages and service restoration following Hurricane Irene. The report addresses the utilities' preparations prior to the storm, describes the severity of the storm's impacts relative to previous storms as well as the impacts on each utility individually, and analyzes the utilities' restoration results. The report also presents results of the Staff's investigation into specific questions raised regarding the utilities' performance and provides summaries of the Staff's conclusions and recommendations.

The hurricane resulted in significant impacts on DVP's and the cooperatives' electrical infrastructures and customers;[2] however, the factors involved were, for the most part, beyond the control of the utilities. These factors primarily included the large damaging wind field, including wind gusts that exceeded expectations in central Virginia, and the heightened susceptibility to windthrow[3] of trees both inside and outside of the utilities' rights-of-way. Similar to Hurricane Isabel, but on a smaller scale, Hurricane Irene can be characterized in certain areas of the state as a "whole tree" event; that is, much of the damage was caused by uprooted and broken trees falling on the utilities' lines and poles.

[1] Rappahannock Electric Cooperative ("REC"), Southside Electric Cooperative ("SEC"), Northern Neck Electric Cooperative ("NNEC"), Community Electric Cooperative ("CEC") and Mecklenburg Electric Cooperative ("MEC").

[2] For example, approximately 1,600 utility poles replaced; approximately 1.2 million customer outages for up to eleven days in DVP's territory.

[3] In forestry, *windthrow* refers to trees uprooted or broken by wind. The risk of windthrow to a tree is related to the tree's size (height and diameter), the size of the crown, the anchorage provided by its roots, its exposure to the wind, and the local wind climate. Contributing factors can include tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and tree senescence.

As a result of its investigation, the Staff has concluded that the utilities' overall preplanning and restoration efforts following the hurricane were, except in some isolated areas, reasonable and satisfactory within the context of a catastrophic storm. Except for these isolated areas,[4] the time required for full restoration of service following the hurricane was neither unexpected nor unreasonable from the Staff's perspective given the number of customers impacted, the extent of damage, and the inaccessibility of facilities. The Staff also concurs with the utilities' prioritization plans for restoration of service following a major outage, which employ a strategy of first restoring service to critical safety and public welfare facilities and then proceeding to those circuits that result in the restoration of service to the greatest number of consumers.

The Staff also found no major problems with overall scheduling of work or deployment of linemen in the field; however the Staff believes there were isolated areas where mutual aid was under-deployed. In addition, the Staff found little evidence of deficiencies in the condition and maintenance of the utilities' distribution system infrastructure. Finally, although lessons were learned and improvements should be implemented, the Staff found no major problems with the utilities' storm management operations.

The Staff believes, however, that utilities generally could take a more active role in protecting their systems against the threat of old, fragile trees outside of their rights-of-way. The Staff recommends that utilities not already doing so intensify their efforts to work with municipalities and educate property owners with respect to the

[4] Isolated areas refer primarily to portions of DVP's Richmond/Tri Cities regional area, CEC and NNEC.

potential long-term benefits of removing aging, overgrown trees that exist outside of the utilities' rights-of-way, since these trees present a growing danger to the companies' distribution lines.

The Staff also identified some findings, formulated recommendations, and established reporting requirements specific to DVP, NNEC, CEC, and SEC. During the course of the investigation, the Staff received several comments from the public suggesting the need for improved communications. In this regard, DVP should continue its efforts to improve its ability to provide realistic customer specific estimated restoration times as soon as possible following such events.

In addition, the Staff recommends that DVP (1) evaluate the need to more aggressively maintain distribution rights-of-way, (2) review deployment plans for mobilization of mutual aid and contract personnel following a major storm with the goal of deploying additional resources in key areas during early stages of the restoration, (3) review storm management models for potential improvements relative to communications and management responsibilities, (4) evaluate effectiveness of independent contractors used to provide staging, catering, and sleeping arrangements for linemen and, (5) review and update plans and protocols for communication with the public. The Staff has asked the utilities to provide a written response to all recommendations in this report by June 1, 2012.

INTRODUCTION

Hurricane Irene struck the East Coast on August 26, making landfall in North Carolina. Over the weekend, the storm traveled up the East Coast and into the mid-Atlantic and New England areas of the U.S. In response to Irene, Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, and Virginia declared a State of Emergency.

Even before Hurricane Irene made landfall, power companies began their standard preparations of pre-positioning repair crews, equipment, and supplies and bringing in "mutual assistance" workers so that once the storm abated and winds were low enough, workers could begin restoring power to customers immediately. Mutual assistance agreements allow utilities to request line crews, contractors, trucks, and equipment from other utilities to help restore power. Assistance came from across the U.S., with some workers coming from as far away as the West Coast. On Sunday, August 28 – the worst day for power outages – nearly 6 million customers along the east coast had no electricity.

Electric utilities throughout Virginia experienced outages as a result of the storm; however, DVP was most impacted. Initial reports from weather bureaus indicated that the winds in central and southeast areas of the state were stronger than the winds in the rest of the state. These sustained winds caused entire trees to fall into sub-transmission and distribution facilities. The damage caused by these trees was catastrophic in some areas.

On Monday, August 29, DVP reported that service restoration would be completed for 90-95% of its customers by the end of the day on Friday, September 2, and that nearly all customers would be restored by Saturday, September 3. During the early stages of restoration, DVP reported that the wide scale scope of the devastation and poor travel conditions in the area hindered restoration activities; however, on Friday, September 2, DVP reported that it had restored power to 92% of its customers as of 4 pm.[5] DVP restored power to approximately 95% of its Virginia customers by Saturday, September 3, but did not complete restoration to all customers until September 6, 2011.

As a result of the devastated infrastructure and outages, the Staff of the Virginia State Corporation Commission ("SCC" or "Commission") received several inquiries and complaints from both elected officials and the public relative to the adequacy of the utilities' infrastructure and effectiveness of their restoration processes.[6] Few requests were made for the Staff to investigate the utilities' performance prior to and after the storm; however, as standard practice, the Staff performs a post-storm analysis following each major storm. Following Hurricane Irene, the Staff submitted data requests to DVP and the electric cooperatives.

The purpose of this report is to provide the results of the investigation by the Staff relative to the utilities' preparation for and response to the hurricane. The report addresses preparations made in anticipation of the storm, the severity of the storm's impact, restoration performance, customer and emergency management communications, lessons learned, a summary of the Staff's conclusions, and recommended actions to be completed.

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[5] DVP Update 10 with Rodney Blevins, 9/2/11, http://dom.mediaroom.com/index.php?s=43&item=1027
[6] DVP, primarily

PREPARATIONS PRIOR TO THE STORM

Reliance on pre-existing storm outage restoration plans and thorough planning prior to the arrival of any major storm is a key component of the successful management and execution of a post-storm restoration effort. While all storms provide challenges and uncertainties, hurricanes have the potential to inflict significant widespread destruction. Preplanning efforts for such storms typically involve meteorological forecasting, training employees for various storm roles, preparing the public for potential damage, notifying special needs customers, activating storm centers, ensuring the availability of materials, securing line and tree contractor commitments, and discussing with neighboring utilities the availability of materials and mutual aid assistance.

While the utilities employed different levels of sophistication relative to meteorological forecasting, DVP and the five cooperatives reported tracking the storm and initiating preparations prior to the storm. DVP anticipated widespread outages, substantial infrastructure damage, and the need for an extensive recovery effort. The utilities' storm centers were activated; inventory levels of necessary supplies were evaluated; suppliers were contacted as necessary; tree contractors and linemen were notified; and mutual assistance crews were called as necessary. In addition, news releases were issued during and after the storm.

As would be expected, the preparations implemented by the utilities prior to the arrival of the hurricane varied by utility. Generally speaking, however, the utilities' preparations appear to have been reasonable based on their responses to informal data requests after the storm. Nevertheless, the utilities reported that valuable lessons were learned as a result of the storm and that these lessons (including those related to preplanning and preparation) will be implemented for the future.

HURRICANE IRENE IN PERSPECTIVE

The first major hurricane of 2011 affected the Southeast, Mid-Atlantic and Northeast on August 26 through August 28 leaving behind significant destruction from North Carolina to New England. Hurricane Irene was a large and powerful Atlantic hurricane that left extensive flood and wind damage along its path through the Caribbean, the United States East Coast and as far north as Atlantic Canada. The ninth named storm and first major hurricane of the annual hurricane season, Irene originated from a well-defined Atlantic tropical wave that began showing signs of organization east of the Lesser Antilles. It developed atmospheric convection and a closed cyclonic circulation center, prompting the National Hurricane Center to initiate public advisories late on August 20, 2011. Irene improved in organization as it passed the Leeward Islands, and by August 21, it had moved closer to Saint Croix, U.S. Virgin Islands. The next day, Irene made landfall at Category 1 hurricane strength in Puerto Rico, where severe flooding resulted in significant property damage and the death of one person.

Irene tracked just north of Hispaniola as an intensifying cyclone, pelting the coast with heavy precipitation and strong winds and killing seven people. After crossing the Turks and Caicos Islands, the hurricane quickly strengthened into a Category 3 major hurricane while passing through The Bahamas, leaving behind a trail of extensive structural damage in its wake. Curving toward the north, Irene skirted past Florida with its outer bands producing tropical-storm-force winds. It made landfall over Eastern North Carolina's Outer Banks on the morning of August 27 as a Category 1 hurricane, the first landfall hurricane since Hurricane Ike in the U.S mainland, then moved along southeastern Virginia, affecting the Hampton Roads region.

After briefly reemerging over water, Irene made a second U.S. landfall near Little Egg Inlet in New Jersey the morning of August 28, becoming the first hurricane to make landfall in the state since 1903. Irene was downgraded to a tropical storm as it made its third U.S. landfall in the Coney Island area of Brooklyn, New York, at approximately 9:00 a.m. on August 28. Considerable damage occurred in eastern upstate New York and Vermont, which also suffered from severe flooding. Throughout its path, Irene caused widespread destruction and at least 56 deaths; monetary losses in the Caribbean were estimated to be as high as US$3.1 billion. Early damage estimates throughout the United States ranged from US$10 to US$15 billion.

DVP alone incurred approximately 900,000 customer power outages at the peak. In total, DVP experienced approximately 1,218,698[7] customer outages for up to 11 days, had to replace about 1,619 poles and 3,523 broken cross arms, and had to restring over 300,000 feet of conductor.[8]

In summary, while Hurricane Irene was not the strongest hurricane to hit Virginia, it did result in localized high levels of electric utility customer outages and destruction to energy infrastructure. The Staff believes that the high level impacts caused by the hurricane were a result of a combination of factors generally beyond the control of the

[7] Unique customer outages

[8] Among all types of storms, Hurricane Isabel caused the most extensive power outages ever in Virginia. Isabel interrupted power to approximately two million customers of four investor-owned electric utility companies and members of eleven member-owned electric cooperatives. Some consumers in Virginia were without power for up to sixteen days. Dominion Virginia Power, the Commonwealth's largest utility, sustained the greatest impact in absolute numbers. Of DVP's two million customers in Virginia, approximately 1.8 million customers lost power for up to sixteen days, and DVP had to replace about 8,000 poles.

utility companies, primarily (1) the widespread nature of the storm, (2) the strength and duration of high wind speeds, and (3) the heightened susceptibility to windthrow of those trees existing outside of the utilities' rights-of-way. In addition, DVP reported that during the hurricane, many areas were inaccessible due to closed roads for the first few days of the event, which delayed assessment and restoration.

UTILITY-SPECIFIC IMPACTS FROM THE STORM

As mentioned previously, the Hurricane Irene caused wide scale outages and destruction to DVP's energy infrastructure. The hurricane also significantly impacted five electric cooperatives. Primarily as a result of the path of the storm and the relative size of the various electric systems in the affected areas, DVP's system sustained the most damage (on an absolute basis) among all utilities in the state. For DVP, Hurricane Irene produced the most outages and damage since Hurricane Isabel, resulting in 31,356 work requests, and the Company estimates it replaced 1,619 poles and 3,523 cross arms. The total cost (pre-tax) of restoration was estimated at $132.4 million, including $12.4 million for tree cleanup by tree contractor services.

A comparison of the damage to DVP's Virginia system caused by Hurricane Irene with some other catastrophic storms is provided in Table 1. Note for example that the number of poles replaced after the hurricane was significantly greater than any recent previous storm. In addition to the extensive damage to the Company's infrastructure, the outage duration for some of DVP's customers was also greater than any storm since Hurricane Isabel.

Table 1. Catastrophic Storms Damage Comparison

Dominion Virginia Power	Work Orders	Poles Replaced	Crossarms Replaced	Customers Affected	Duration of Outage
Hurricane Irene - 2011	31,356	1,619	3,523	1,218,698	11 days
Trop. Storm Ernesto - 2006	10,148	250	1,200	597,187	5 days
Hurricane Isabel – 2003	52,000	8,000	9,000	1,708,137	15 days
Super Bowl Storm – 2000	5,000	22	190	285,000	4 days
Hurricane Floyd – 1999	10,100	469	1,329	730,000	5 days
Christmas Eve Ice Storm – 1998	12,300	815	3,144	401,000	10 days
Hurricane Fran – 1996	8,000	620	793	540,000	6 days

Five electric cooperatives were also significantly impacted by the hurricane, but not as severely as DVP in terms of facility damage and outage duration. The hurricane had very little impact on APCo or Kentucky Utilities and the other electric cooperatives. Summaries of customer impacts, infrastructure damage, and costs of restoration among DVP and the five electric cooperatives are provided in Tables 2, 3, and 4, respectively.

Table 2. Hurricane Irene Customer Impacts

Electric Utility	Total Customers Affected	Percent of Customers Affected	Total Duration of Outage
DVP	1,218,698	52%	11 days
REC	29,500	19.7	6
NNEC	16,800	90.3	8
MEC	11,105	35.7	5 2/3
CEC	7,000	64.6	7
SEC	25,864	48.6	4

Table 3. Hurricane Irene Infrastructure Damage

Electric Utility	Poles Replaced	Crossarms Replaced
DVP	1,619	3,523
REC	182	146
NNEC	145	112
MEC	52	41
CEC	51	32
SEC	132	61

Table 4. Estimated Costs of Restoration (Dollars)

Electric Utility	Total Cost	Company Labor	Tree Contractor	Line Contractor	Mutual Aid	Materials/ Supplies	Vehicles/ Misc.
DVP	132,400,000	25,000,000	12,400,000	45,200,000	13,300,000	2,800,000	33,600,000
REC	2,045,223	779,500	283,321	114,928	380,970	189,795	296,709
NNEC	1,467,889	353,803	168347	129,221	539,646	86,177	76,311
MEC	828,835	237,875	173,908	32,336	192,590	55,282	136,845
CEC	456,333	123,689	56,730	0	206,932	16,046	52,937
SEC	1,456,465	332,037	122,100	393,433	424,895	77,890	106,111

STANDARD RESTORATION PROCESS

The utilities generally follow similar strategies for the restoration of service following a major weather-related outage. As weather conditions permit following a storm, utilities afford the highest restoration priority to essential public health and safety facilities such as hospitals, 911 emergency call centers, and critical water pumping facilities. The utilities also intend to respond with the highest priority to remedy situations where damaged equipment poses a significant threat to public safety, such as a live high voltage wire down on a road. The prioritization of other restoration projects is driven by an attempt to restore service to the greatest number of customers in the shortest period of time, thus utilities might concentrate initially on transmission lines and delivery points to the electric cooperatives, for example. The utilities have both economic and public service incentives to execute their publicized restoration schedules.

Since it takes a few days to patrol (both by air and on foot) and reasonably assess thousands of miles of damaged circuits following a major storm event, utility management must initially make decisions regarding the marshalling and deployment of resources without the benefit of full information. The difficulty of this task is compounded by the demands of managing and coordinating the logistics of an unusually large workforce, including many non-company workers, who must perform dangerous work, frequently under inclement weather conditions.

It is electrically necessary to begin restoration work on each circuit at its source transmission line or substation and proceed sequentially to the end of the circuit. Therefore, in general, main-line three-phase portions of circuits are repaired first, as all three-phase and single-phase taps feed from the mains. Next, repair sites on the taps are prioritized in a declining order, beginning with the ones that will restore service to the most customers with each repair; however, there are several complicating factors that determine when any individual service is restored.

Protective devices (fuses, reclosers, sectionalizers, and the substation breaker) are situated at various locations on a circuit and operate automatically to de-energize a faulted (short-circuited) section of the circuit. This protects circuit components from sustained damaging fault currents and limits the interruption in service to the customers down-line (i.e., away from the substation) from the fault.

Each distribution line is protected by a circuit breaker at the substation. Typically, one or more sectionalizers and/or reclosers will be installed down line from the substation along the main-line circuit and along three-phase branches of the main-line circuit. Single-phase tap lines, usually protected by fuses, branch off of the main-line sections of the circuit and continue to the farthest points of the circuit. Customers are served directly from fuse-protected transformers, which step down the primary (or secondary) voltage of the circuit to voltages compatible with customer equipment. The important point to note is that there may be several protective devices between the substation and a customer.

The operation of any one protective device between the substation and a particular customer results in an interruption of service to the customer. Consequently, all of the faults down line from each of these protective devices must be cleared and facilities repaired before service can be restored to the down-line customers. During restoration efforts, each repair location or project may correspond to a protective device on a company's distribution lines. Therefore, restoring service to any individual customer may require several repair projects between the substation where the distribution line originates and the customer's meter.

Shortly after a major storm, utilities know which customers have lost power, as well as the protective device furthest upstream from each customer that has operated and locked-out to clear a fault. However, there is limited information about the status of any other down-line protective devices. Further, the cause and severity of damage to the circuit is unknown until a visual inspection is made. The work required for each repair project may vary substantially, ranging from a relatively simple replacement of a fuse (perhaps a five minute job) to a rebuild of sections of the circuit (sometimes requiring days).

Obviously, these two contrasting scenarios require vastly different repair resources in terms of manpower, materials, and restoration equipment. Since the objective is to restore service to the maximum number of customers in the shortest period of time, several factors in addition to the number of outages down line from each device must be considered in establishing restoration priority. Area field personnel have the most detailed information regarding damaged facilities and required restoration resources within a certain area and are in the best position to evaluate such considerations and to deploy available resources within that specific area.

The restoration work that results from widespread, devastating weather events will typically exceed the resources of the local utility. Hence, utilities call upon neighboring utilities (mutual aid) and contractors to accelerate the restoration work. Utility personnel familiar with the local system are assigned to visiting crews. Guides may also serve as a resource to handle field support activities, such as obtaining materials and meals, thereby enabling the line crews to focus their efforts on restoration work.

Contract tree crews are also necessary for restoration after a major storm. Some tree crews are teamed with line crews and accompany them to each job site. Other tree crews work independently with a guide and clear trees ahead of line crews when energized conductors or other safety issues are not a concern.

In any restoration effort, safety is a limiting factor in how many field personnel can work at one time. Adding more line crews increases the risk to safety as it is hazardous to overpopulate a circuit with workers. Safe operating practices demand knowledge of the status of all line personnel possibly impacted by a re-energized line during service restoration. Having different types of workers, from line crews to tree crews to patrollers, simultaneously working in the same area can complicate this endeavor. As more crews are added in the field, more time must be spent verifying their status. An excessive concentration of resources within a particular area could potentially lengthen the restoration effort.

Management practices are evolving to better utilize mutual aid crews. Most utilities have migrated away from full command and control of every single visiting crew. Instead, many mutual assistance crews are very nearly self-sufficient, autonomous workforces. Today's mutual assistance teams may consist of not only the traditional linemen and first-line supervisors but also patrol/assessment teams, safety personnel, second-line supervisors, logistics experts, and even materials coordinators, refueling teams, and caterers. This permits them to manage more visiting resources without increasing management personnel. For example, the former concerns of verifying that power lines have been cleared to be energized, which was very management- and time-intensive, can now be distributed to qualified off-system supervisory personnel placed in charge of specific circuits. The disadvantages of the new approach include diminished knowledge of specific job-by-job work progress (for the different jobs assigned within a larger work package) on the circuits/substations assigned to a particular off-system group, diminished capability to provide customer feedback on restoration progress associated with a specific job, and less ability to assure a most-customers-first restoration except at a "whole-circuit" level.

UTILITY-SPECIFIC RESTORATION PERFORMANCE

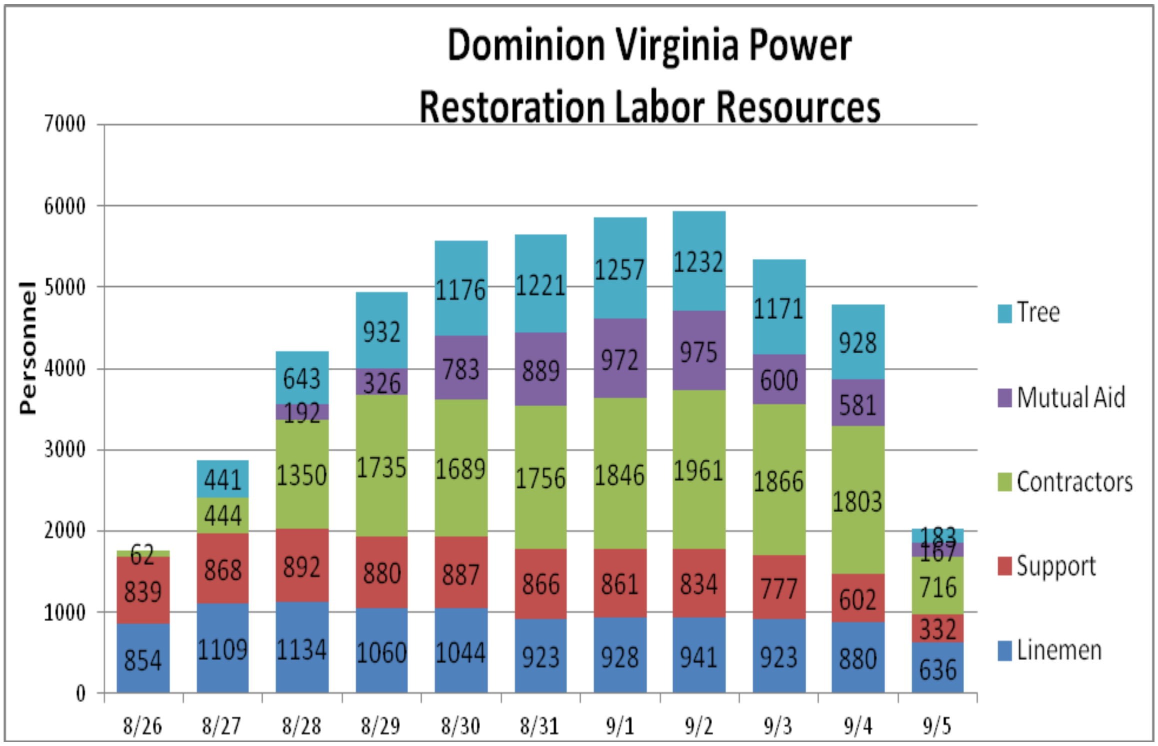
In the course of restoring service after Hurricane Irene, DVP and the affected electric cooperatives embraced a philosophy (regarding priority of restoration) similar to ones implemented after previous major storms. The companies sought to first respond to emergency situations and critical infrastructure. Thereafter they attempted to employ a strategy which would ensure that circuits impacting large groups of customers would be restored first. As the effort moved beyond main circuits and into neighborhoods, geographic-based (i.e., neighborhood) restoration became more efficient. A discussion and summaries of the resources used by the utilities and the results of the restoration effort, with an emphasis on DVP's performance, are provided below.

The utilities strived to restore electric service to as many customers as quickly and as safely as possible. They made advance provisions for equipment and labor force in numbers they anticipated would be sufficient, and crews began restoration work as soon as possible. However, the large damaging wind field, including wind gusts that exceeded expectations in central Virginia, and widespread damage caused by fallen trees impeded transportation and the overall restoration effort.

The management of personnel during the restoration effort varied only slightly among the state's utilities. Although the restoration process was a 24-hour-a-day effort, DVP and the electric cooperatives reported scheduling the large majority of their personnel to perform work during the daylight hours. The utilities believe that workers are more productive during the day, and that the nature of restoration activities such as tree removal is disruptive to customers at night. The majority of utilities have previously reported that it is common industry practice to limit shift work during an extended restoration event to 16 hours "on shift" followed by 8 hours "off," which allows employees a reasonable rest period and reduces the safety risk to employees.

DVP's total labor resources after the hurricane varied daily during the restoration effort but peaked at 5,943 on September 2, 2011. Included in that day's labor force were 975 mutual aid contractors, 1,961 line contractors, 1,232 tree contractors, 941 DVP linemen, and 834 DVP support personnel.[9] The following chart shows the number of personnel working to restore power on DVP's system on each day from August 26, 2011 through September 5, 2011. As mentioned previously, this was one of the largest deployments of resources for a post-storm restoration effort in the Company's history.

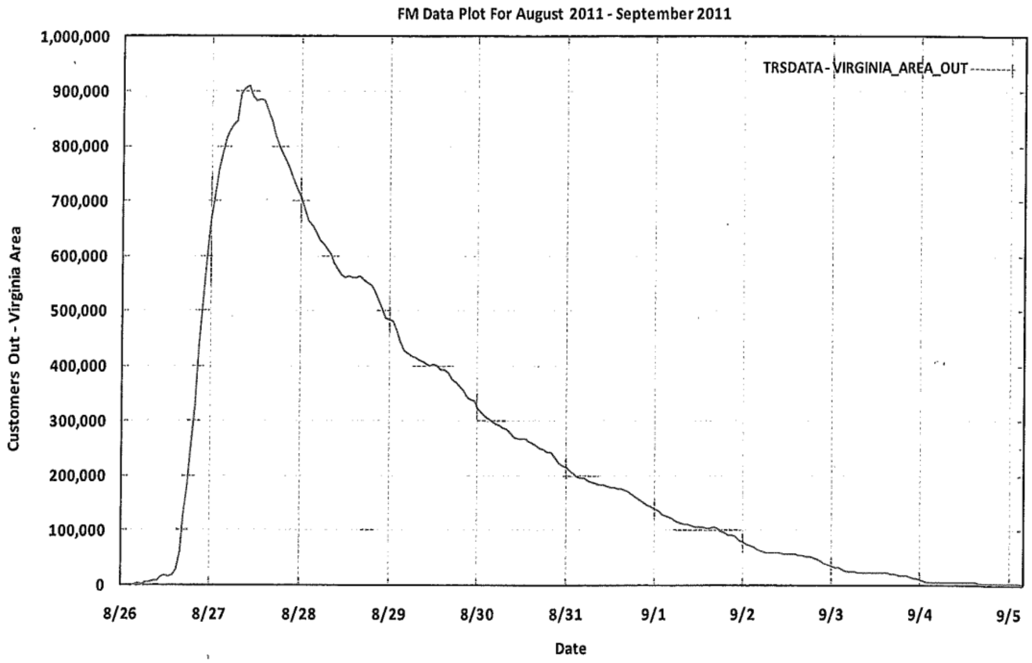
[9] Not all of the various employee/contractor types peaked on September 2. For example, DVP linemen peaked at 1,060 on August 29 and tree contractors peaked at 1,257 on September 1.



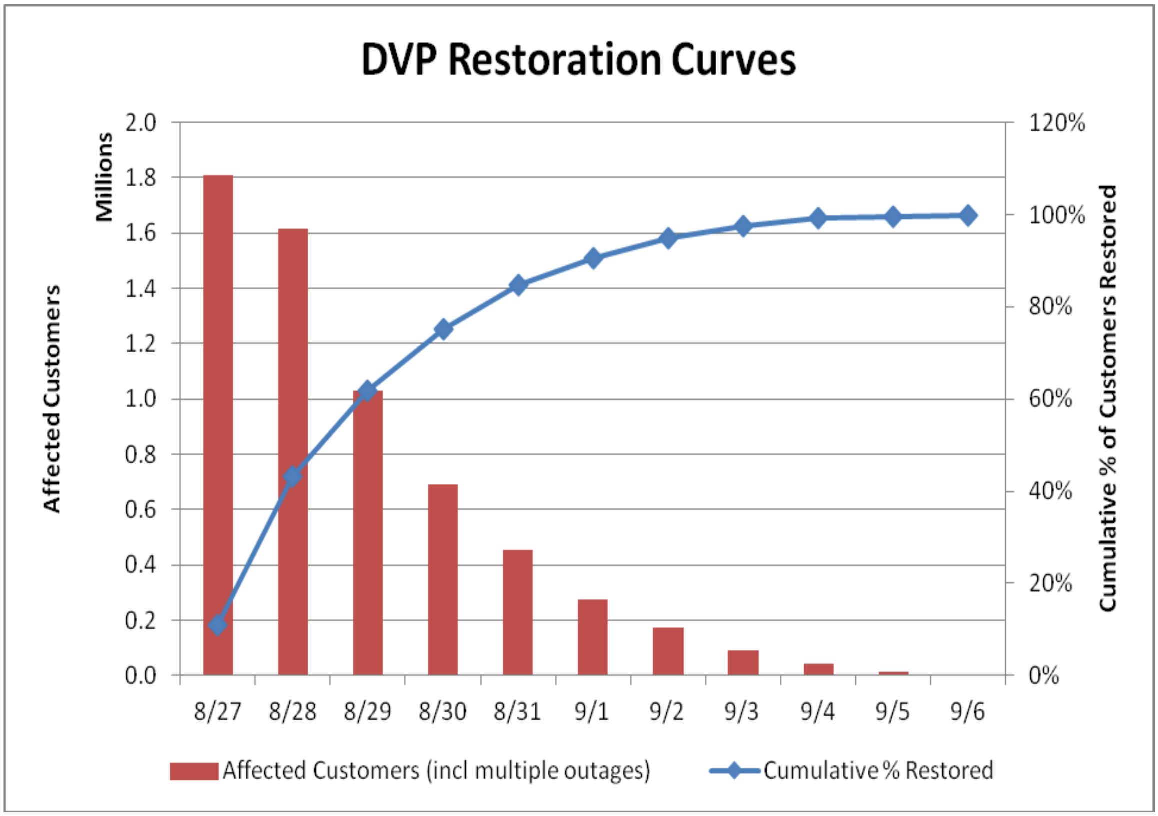
As with previous major storms, the utilities relied heavily on contract and mutual aid linemen for restoration after the hurricane. This is standard industry practice. The Staff agrees with this practice of relying primarily on contractors and mutual aid for restoration activities following catastrophic storms, which are unlikely to occur on a regular and consistent basis. The Staff believes a utility's baseline workforce should be maintained at the level necessary to preclude excessive overtime work, deterioration in new service connection completion times, and erosion of restoration times following day-to-day non-storm related outages.

The following chart is the restoration curve supplied by DVP which provides the actual number of "customers out" at any point during the restoration effort.

Restoration Curve for Virginia:



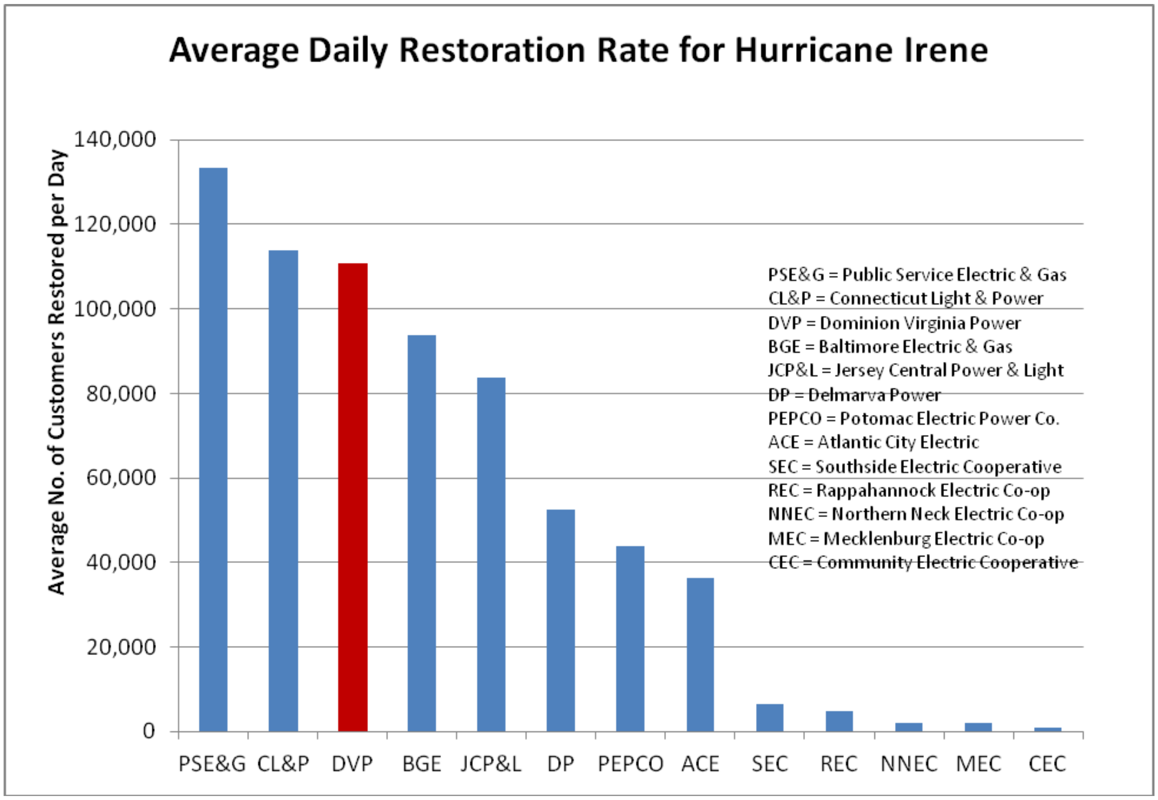
The Staff developed the following restoration chart based on the cumulative total of customer outages including those customers who experienced multiple outages. The "cumulative percent restored" is the percentage of customers restored through the end of each day and is based upon the absolute total number of customers affected over the full restoration period of August 26, 2011 through September 6, 2011. DVP had restored approximately ninety percent of its customers by September 1, 2011 (day 6 of the outage).



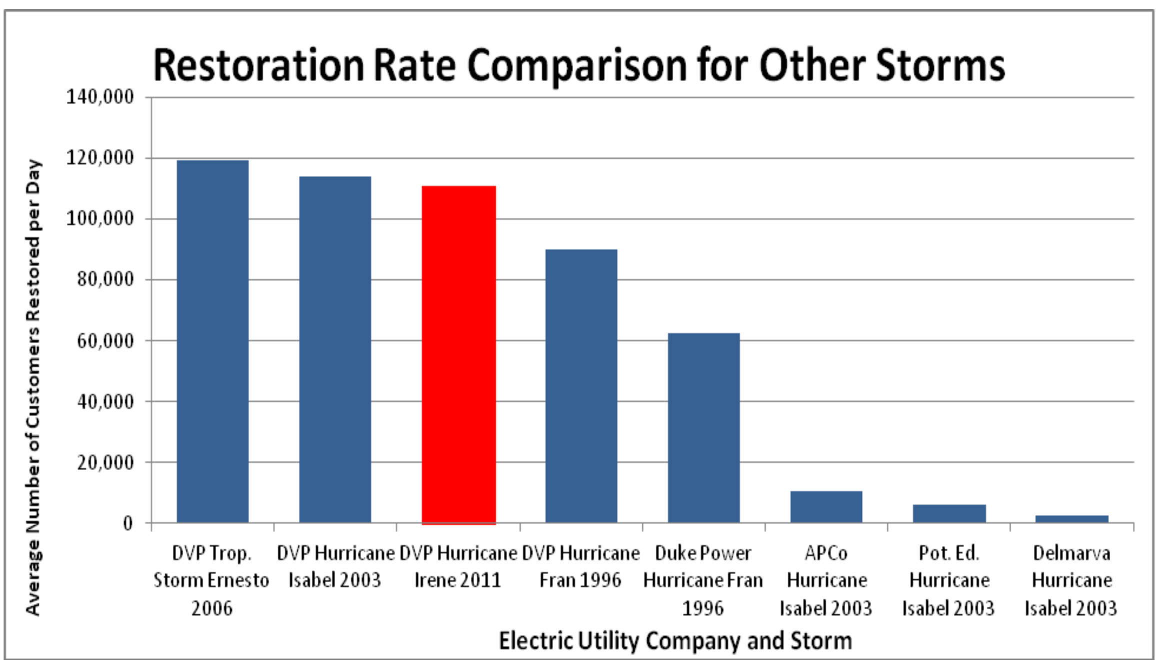
As indicated previously, DVP's policy with respect to restoration priority is to complete the jobs that will restore the greatest number of customers first. The following chart, which shows the number of jobs completed on each day and the number of customers restored per job completed, is an indication that the company's performance was predominantly consistent with this policy. For example, after the first three full days of the restoration, DVP had completed less than 6000 jobs (5724), but had restored service to over 1 million customers (1,120,894), restoring an average of almost 200 (195.8) customers per work order completed during that period. During the next three full days of restoration, the company would complete nearly 13,000 work orders, but restore service to approximately one-half million customers, averaging 40 customers per work order completed. On September 5, the final day of restoration excluding the

Richmond area, the completion of each work order restored on average 7 customers. However, on the final day of restoration in the Richmond/Tri Cities area (September 6), the completion of each work order restored an uncharacteristically high average of 129 customers.

Overall, DVP was able to restore service to an average of approximately 111,000 customers (110,791) per day following Hurricane Irene, close to DVP's restoration rate (113,797 per day) for Hurricane Isabel in 2003. A comparison of the restoration rates for Hurricane Irene for DVP and several other utilities is provided in the following chart.



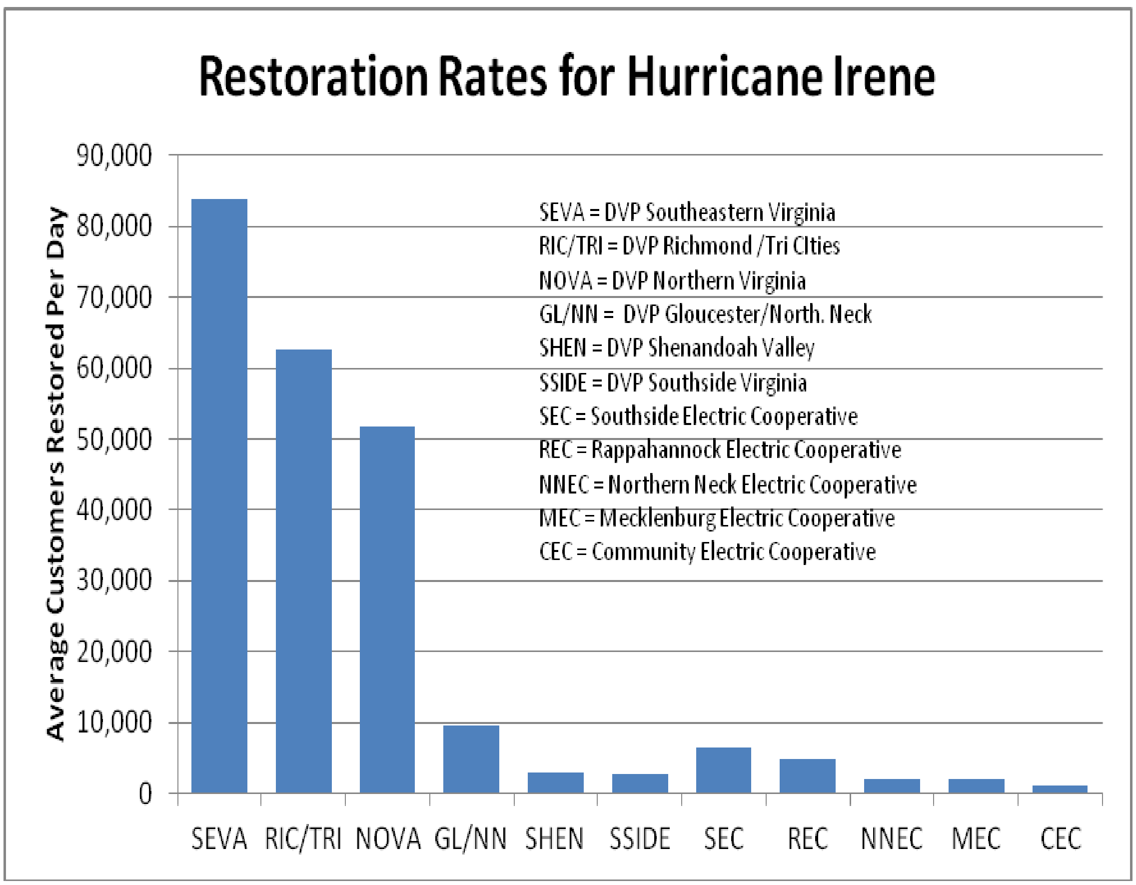
A sampling of restoration rates for other catastrophic hurricanes and tropical storms are provided in the following chart.



COMPARISON AMONG DVP REGIONAL AREAS
AND SELECTED ELECTRIC COOPERATIVES

Introduction

Three of DVP's regional areas consisting of Richmond Metro/Tri Cities, Southeastern Virginia, and Gloucester/Northern Neck incurred the most damage and longest outages from Hurricane Irene. While DVP was able to restore power in a week or less in the Shenandoah Valley, Northern Virginia, and Southside Virginia, the Richmond Metro/Tri Cities area required 11 days, while both Gloucester/Northern Neck and Southeastern Virginia required 9 days. The average restoration rates following Hurricane Irene for DVP's six regional areas and five electric cooperatives are provided in the following chart.



DVP's average daily customer restoration rates were the highest in Southeastern Virginia (83,724), Richmond (62,640), and Northern Virginia (51,734). The restoration rate for Gloucester/Northern Neck averaged 9,543 customers per day over a 9 day outage period. The lowest of DVP's restoration rates were in the Shenandoah Valley region (3,024) and the Southside Virginia region (2,662). The restoration rates for the five electric cooperatives ranged from a high of 6,466 customers/day for Southside Electric Cooperative to a low of approximately 1,000 customers/day for Community Electric Cooperative. It is not unusual for the restoration rates of the electric cooperatives to be significantly less than that of large investor owned utilities given the low customer density typically associated with the cooperatives.

Tables 5 and 6 provide comparisons of a number of key variables among the DVP regions and five electric cooperatives that were reviewed for this analysis.

Table 5. DVP Regions

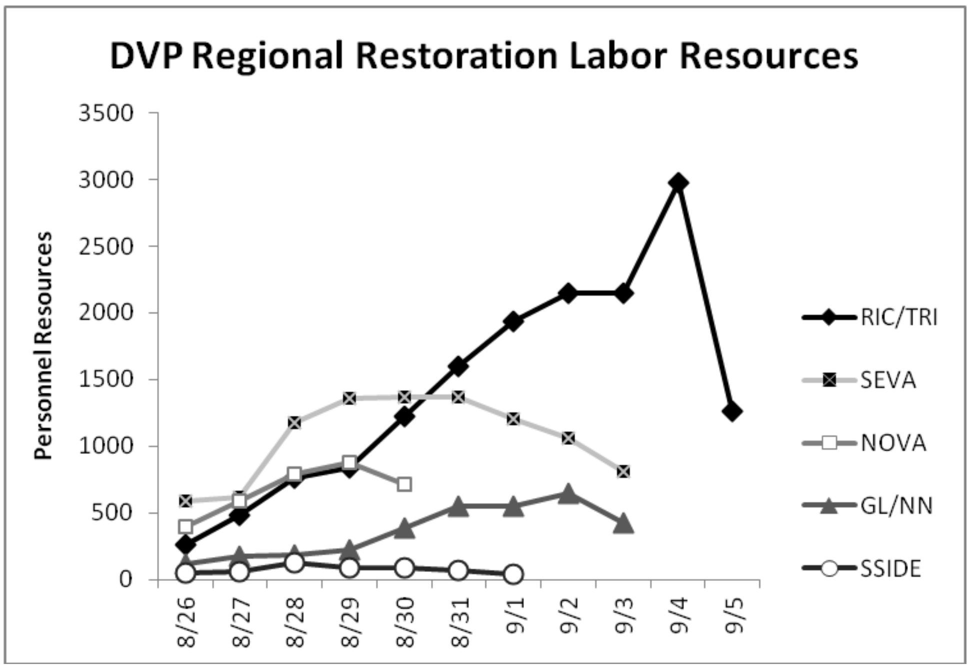
	RIC/TRI	SEVA	GL/NN	SSIDE	NOVA
Customers	491,200	694,049	61,928	68,474	824,413
Distribution Circuit Miles	11,270	11,102	3,497	4,412	14,375
Unique Customers Interrupted	436,650	487,292	54,289	15,388	214,223
Days to restore service	11	9	9	7	5
% Customers Interrupted	89%	70%	88%	22%	26%
Broken Poles	879	386	257	53	44
Broken Crossarms	1072	1317	592	102	438
Primary Conductor Restrung (miles)	26.7	25.6	3.4	0.4	3.8
Work Orders Issued	13,116	10,965	2,461	672	3,712
W.O.s per 1000 Customers	26.7	15.8	39.7	9.8	4.5
Customers per Circuit Mile	43.6	62.5	17.7	15.5	57.4
Linemen (daily average overall)	1,420	1060	360	73	670
Linemen (daily maximum)	2976 (10)	1369 (5)	641 (8)	121 (3)	876 (4)
Linemen (daily avg during 1st 5 days)	711	1021	215	80	670

Table 6. Selected Electric Cooperatives

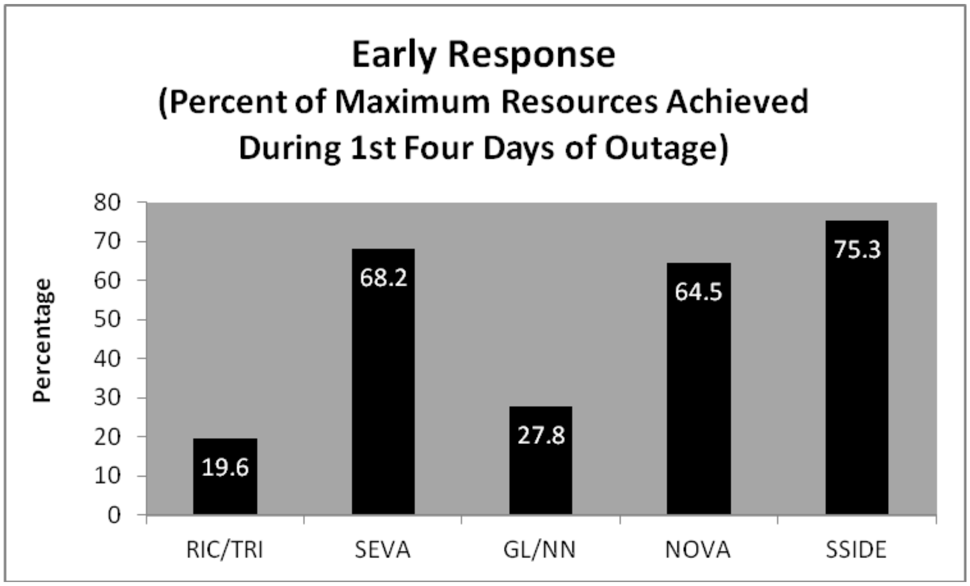
	REC	SEC	MEC	NNEC	CEC
Customers	149,811	54,393	31,136	18,611	10,829
Distribution Circuit Miles	16,128	8,054	4,400	1,493	1,307
Customers Interrupted	29,500	25,864	11,015	16,800	7,000
Days to restore	6	4	5 2/3	8	7
% Customers Interrupted	19.7%	47.6%	35.4%	90.3%	64.6%
Broken Poles	182	132	52	145	51
Broken Crossarms	146	61	41	112	32
Total Conductor Restrung (miles)	79.2	36.6	Not recorded	85	110
Work Locations/ Orders	1,081	1100	250	413	Not recorded
Customers per Circuit Mile	9.3	6.8	7.1	12.5	8.3
Line/Support Total	426	182	126	152	50

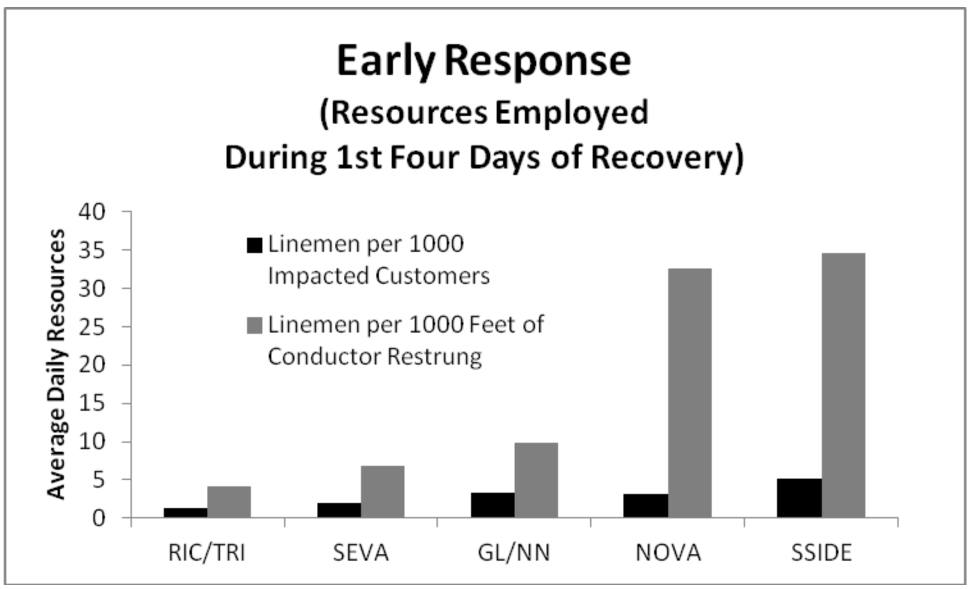
DVP Regional Areas

A review of the key variables in Table 5 and the following chart provides a clearer understanding of the different challenges faced by DVP in the different areas of its territory. The most significant damage (in terms of absolute numbers of outages, broken poles, and miles of conductor to be restrung) was incurred in the Richmond/Tri Cities and Southeastern regional areas, and these areas were where DVP employed the greatest number of restoration resources.

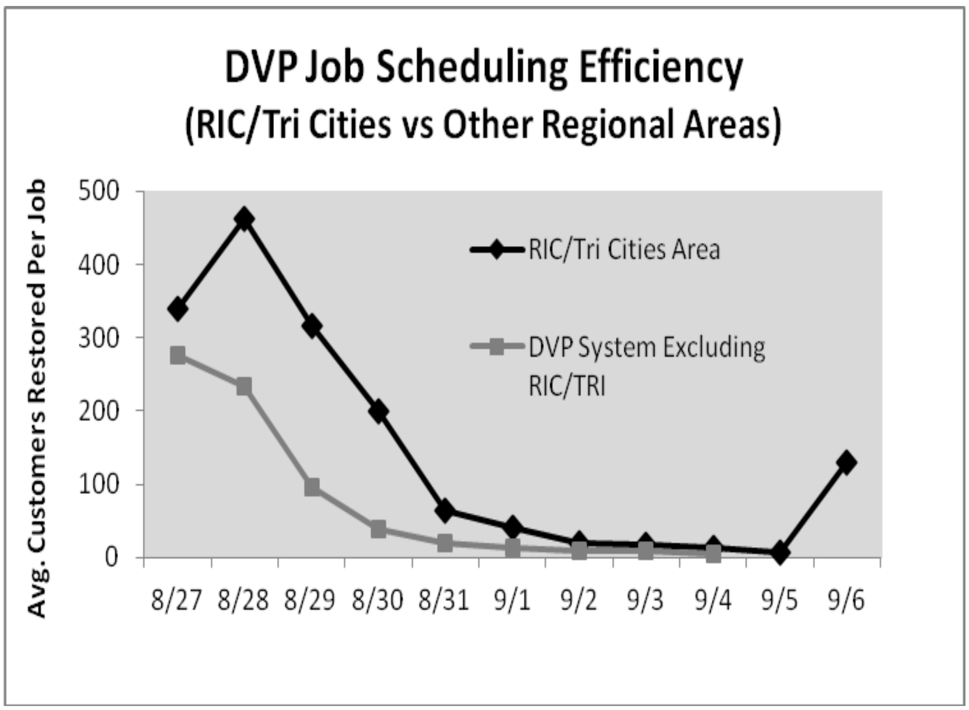


Although DVP was able to eventually commit the greatest number of resources to the areas impacted the most, the Staff has some concerns relative to the Company's early response (first four days of the outage) in the Richmond/Tri Cities regional area. The early response in this area was the lowest in terms of the percent of the maximum resources eventually employed, as well as the lowest based on two key normalized criteria, including both labor resources per impacted customer and labor resources per mile of conductor restrung. Early response data is displayed in the following two charts.





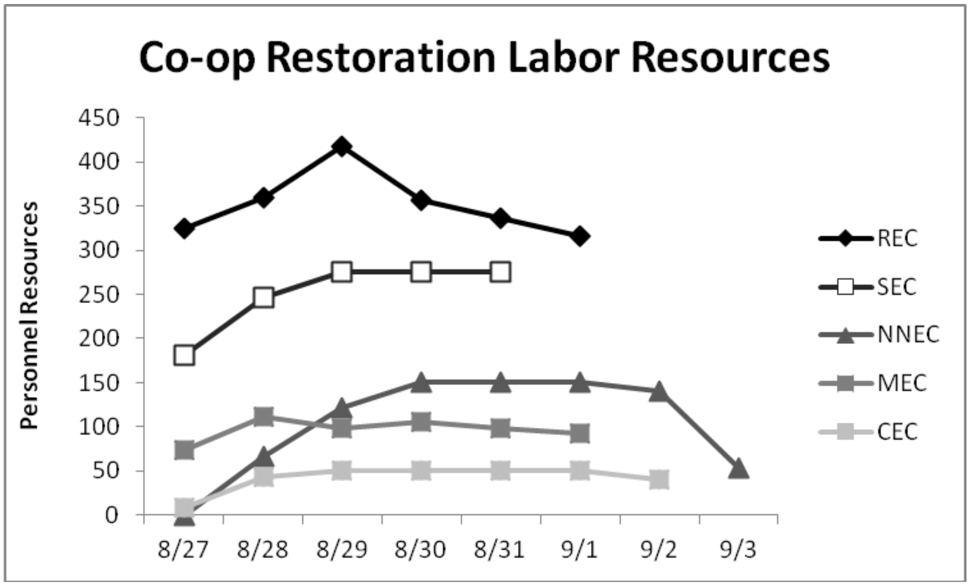
The Staff was also concerned with respect to the scheduling of certain work orders in the Richmomd/Tri Cities regional area. As discussed previously, utilities typically employ a strategy which ensures that circuits impacting large groups of customers will be restored first. As the effort moves beyond main circuits and into neighborhoods, geographic-based (i.e., neighborhood) restoration becomes more efficient. It is normal to see restoration rates in the early days of an outage approaching hundreds of customers restored per work order and declining to ten or less customers restored per work order on the final day of restoration. In the Richmond/Tri Cities regional area, the restoration declined daily as expected[10] except for the last day when 5,549 customers were restored as a result of the completion of 43 work orders, for an average restoration rate of 129 customers restored per work order. A comparison of the daily restoration for Richmond/Tri Cities compared to the rest of DVP's system is provided in the following chart.



Electric Cooperatives

The impacts on selected cooperatives were previously displayed in Table 6, and the labor resources employed for the restoration effort are provided in the following chart.

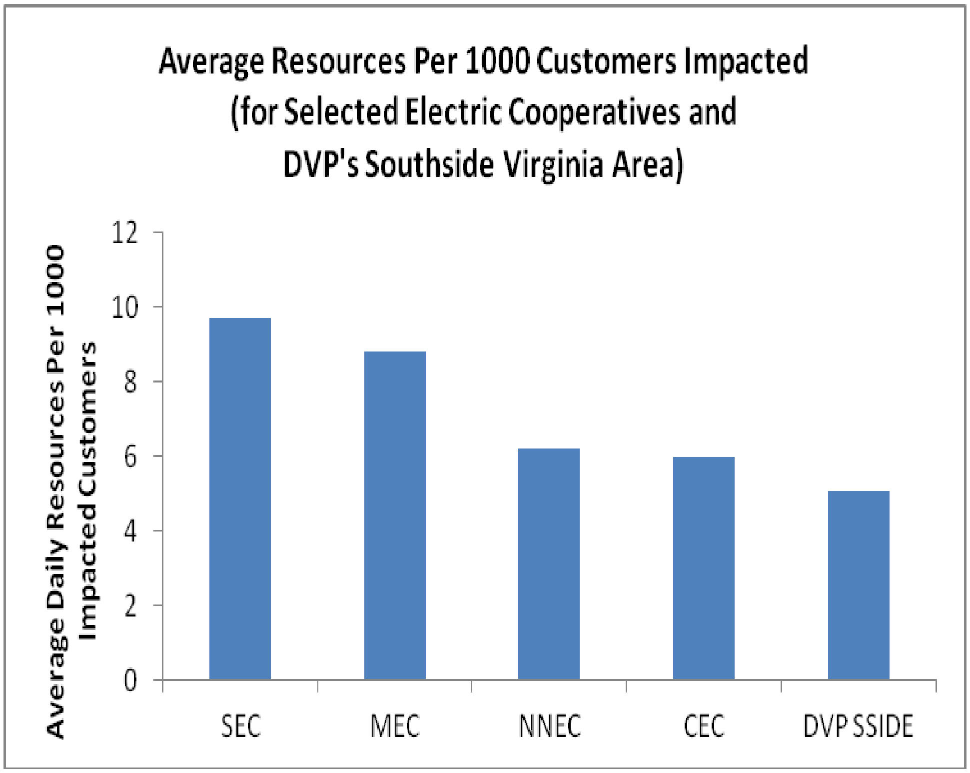
[10] From a high of 463 per day on the second day to approximately 7 per day on the next to last day.

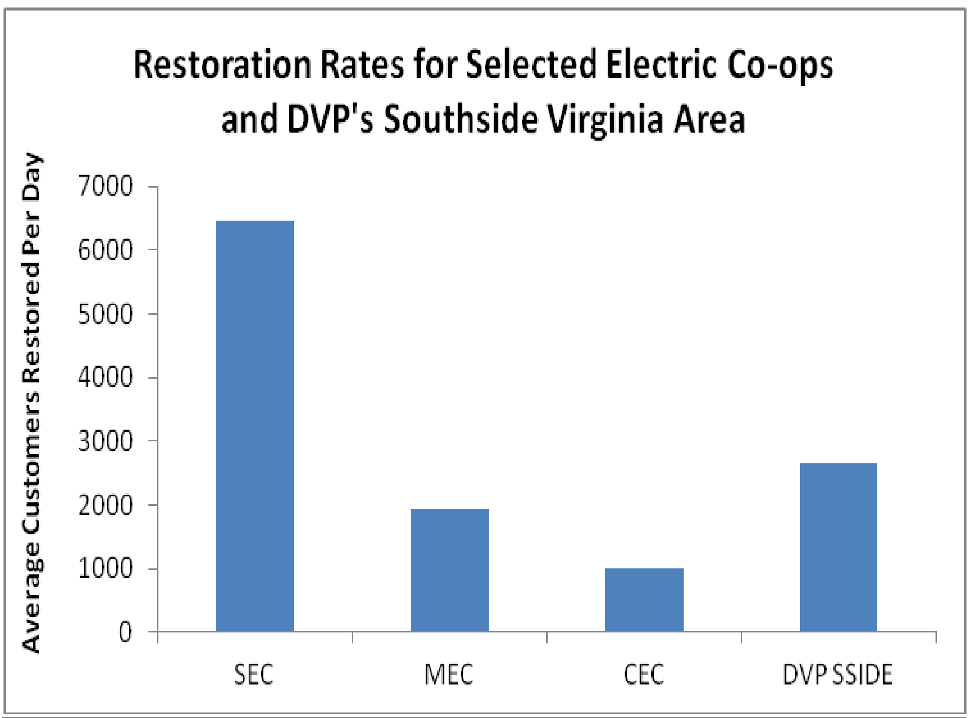


Based on the data provided by the cooperatives, the Staff had some concerns based on the resources and restoration rates for CEC and NNEC (see following charts).[11] In particular, the Staff is concerned (1) that field investigation teams might have underestimated the number of linemen needed and/or (2) that the cooperatives might have underestimated the logistics necessary to accommodate the number of linemen needed to accomplish a timely restoration.

NNEC explained that the impact of the storm on its customers was more severe than anticipated, the visiting workforce was twice as large as it had utilized during any pervious power restoration event, and some mutual aid assistance was refused due to reaching a limit on available accommodations. CEC reported that it was unable to obtain any line contractors and had difficulty obtaining needed mutual aid during the initial stages of the outage. SEC also noted that its restoration was delayed somewhat as a result of limitations for lodging.

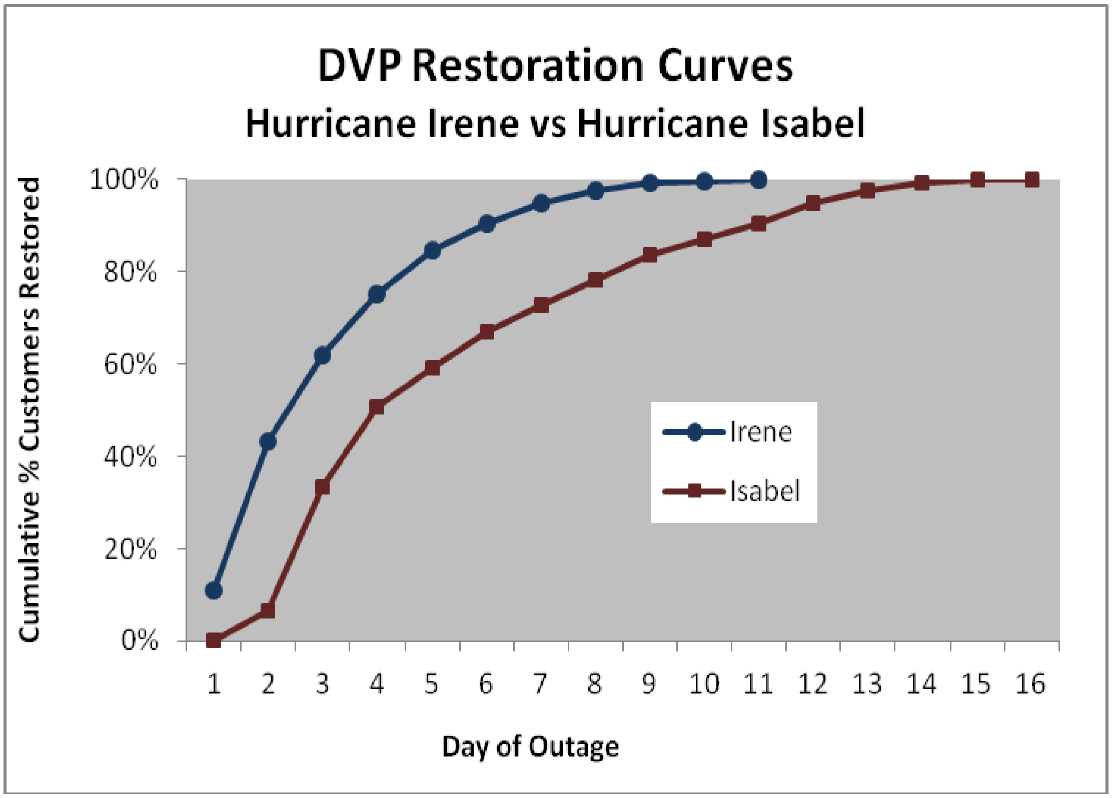
[11] MEC's restoration rate was also somewhat lower than expected; however, MEC reported that it lost approximately 24 hours of productive restoration time due to transmission outages to five substations.


Average Resources Per 1000 Customers Impacted
(for Selected Electric Cooperatives and
DVP's Southside Virginia Area)
Average Daily Resources Per 1000 Impacted Customers
12
10
8
6
4
2
0
SEC
MEC
NNEC
CEC
DVP SSIDE

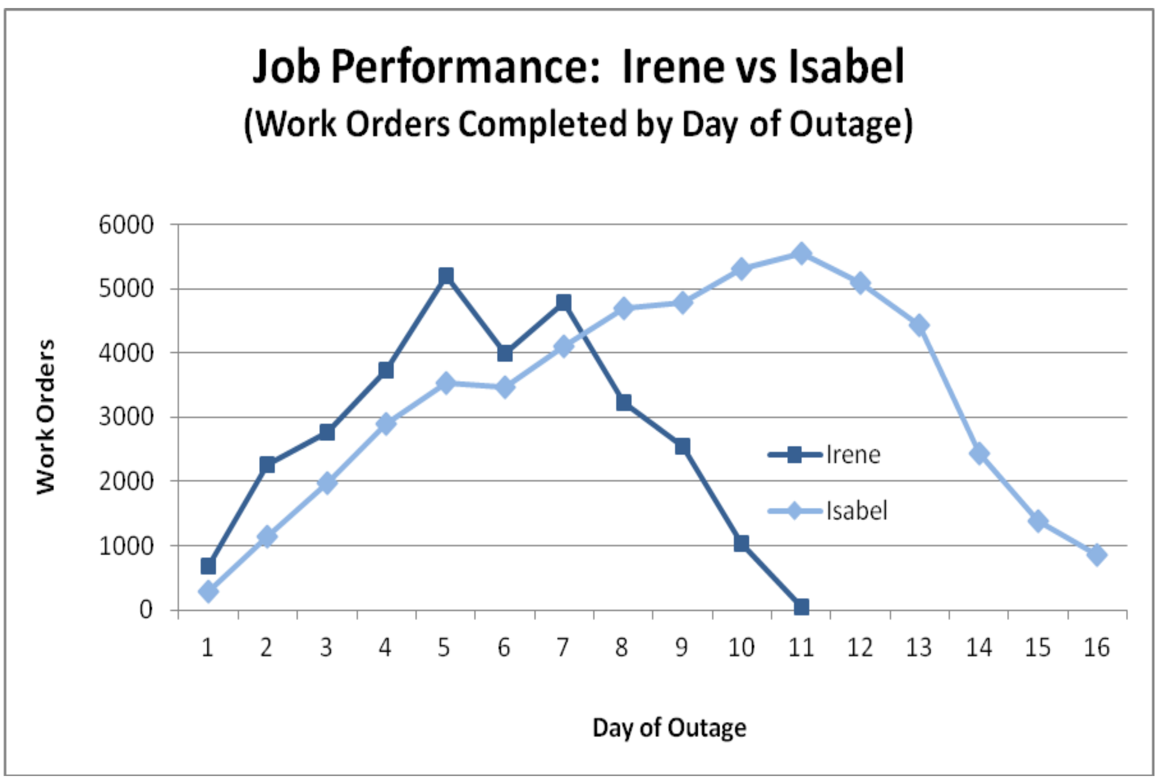

Restoration Rates for Selected Electric Co-ops
and DVP's Southside Virginia Area
Average Customers Restored Per Day
7000
6000
5000
4000
3000
2000
1000
0
SEC
MEC
CEC
DVP SSIDE

COMPARISON OF HURRICANE IRENE WITH HURRICANE ISABEL

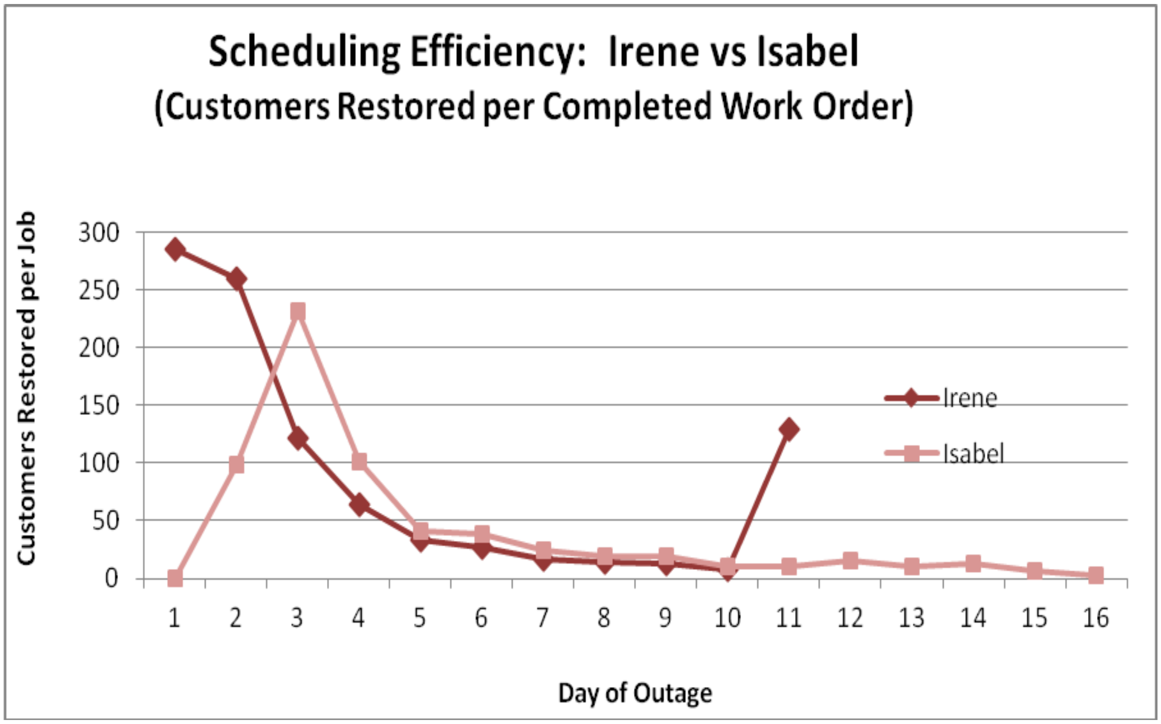
Hurricane Irene was not the first major hurricane in Virginia for which the restoration effort extended into double digit days. While the restoration effort after Hurricane Irene was 11 days in the Richmond area, the restoration effort following Hurricane Isabel in 2003 reached 16 days in some areas of DVP's system. Both Hurricane Isabel and Hurricane Irene, to a lesser extent, were whole tree events that resulted in prolonged restoration efforts and record impacts on the energy infrastructure. Although Hurricane Isabel was more widespread in its effect on DVP's territory, the Staff believes a case can be made that Hurricane Irene created similar hardships in certain areas of DVP's territory. In particular, the Staff was interested in investigating the similarities between the restoration effort in DVP's Northern Neck/ Gloucester area after both Hurricane Isabel and Hurricane Irene. In each situation, DVP was faced with geographical constraints and excessive infrastructure damage; however, there was an under deployment of resources following Hurricane Isabel. In addition, the Staff looked at the restoration efforts in the Richmond/Tri Cities area for both Hurricane Irene and Hurricane Isabel. Various charts comparing DVP's performance after Hurricane Irene with DVP's performance after Hurricane Isabel for the system as well as for the Richmond/Tri Cities and Gloucester/Northern Neck regional areas are provided below.

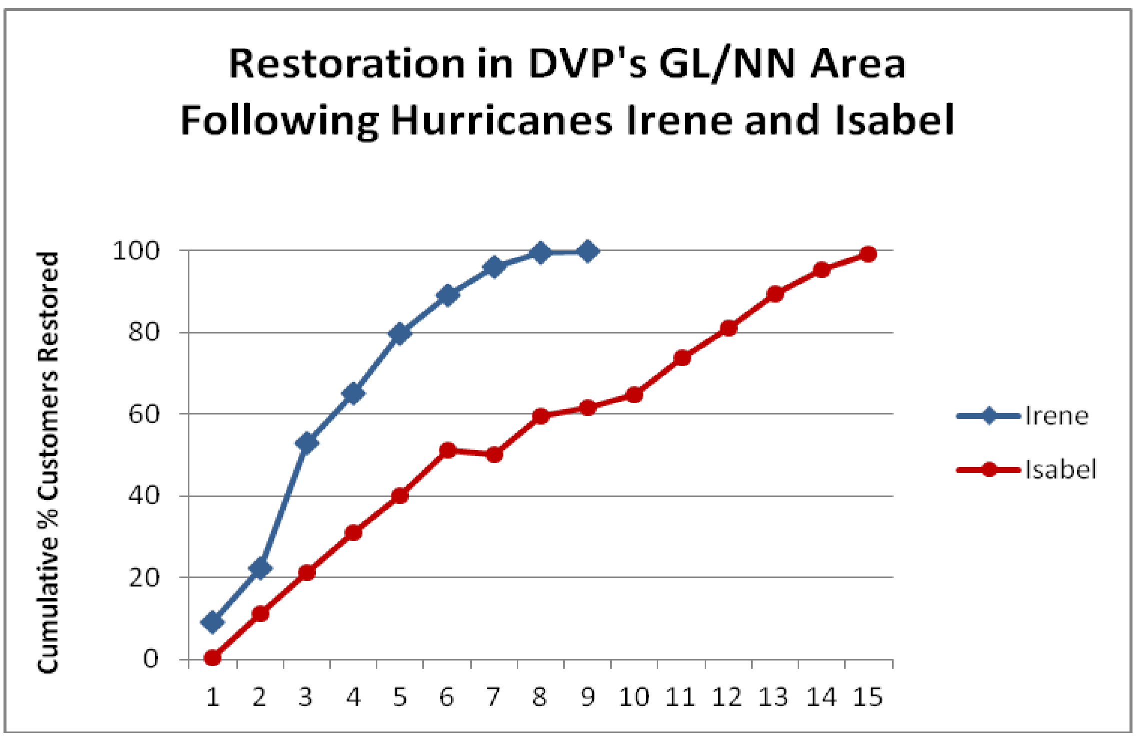


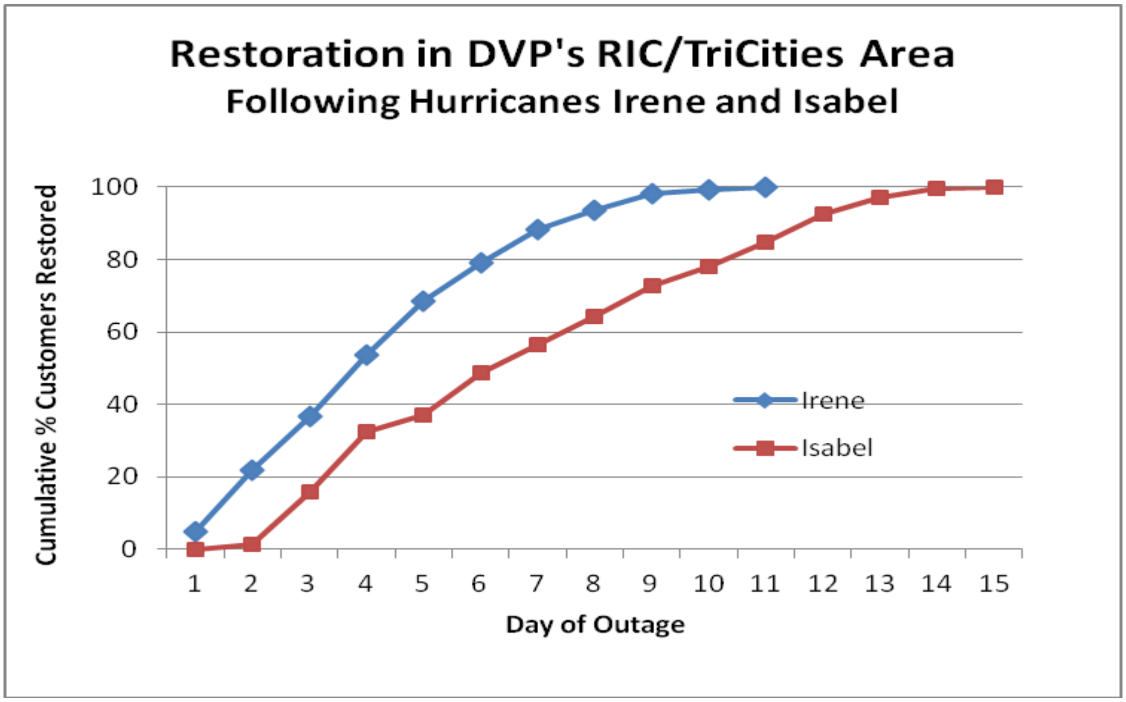
DVP Restoration Curves
Hurricane Irene vs Hurricane Isabel
Cumulative % Customers Restored
100%
80%
60%
40%
20%
0%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Day of Outage
Irene
Isabel



Job Performance: Irene vs Isabel
(Work Orders Completed by Day of Outage)
Work Orders
6000
5000
4000
3000
2000
1000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Day of Outage
Irene
Isabel


Scheduling Efficiency: Irene vs Isabel
(Customers Restored per Completed Work Order)
Customers Restored per Job
300
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Day of Outage
Irene
Isabel


Restoration in DVP's GL/NN Area
Following Hurricanes Irene and Isabel
Cumulative % Customers Restored
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Irene
Isabel



The Staff recognizes that the system-wide deployment of mutual aid and contract personnel for the restoration of service following a catastrophic outage is at best an inexact science. The Staff believes the overall implementation plans of DVP and the cooperatives were reasonable given (1) the widespread nature of the outages, (2) the variation among regions in the degree of devastation to the Companies' infrastructures, and (3) the early inaccessibility of some circuits due to uprooted trees and impassable roads. In addition, the Staff believes a fundamental tenet of restoration policy should be to saturate each region with the field personnel necessary to restore service independently in each region as soon as possible. The above charts demonstrate that DVP was able to restore service after Hurricane Irene sooner than after Hurricane Isabel as a result of completing more work orders per day and restoring more customers per work order during the initial stages of the recovery; however, admittedly, destruction of utility infrastructure was more widespread and severe from Hurricane Isabel (see Table 1).

RIGHT-OF-WAY MAINTENANCE

On an annual basis and following catastrophic storms, the Staff reviews the adequacy of the utilities' right-of-way maintenance practices. Based on investigation and analysis, the Staff has developed some recommendations relative to right-of-way maintenance which will be discussed in detail in subsequent paragraphs; however, the Staff believes the utilities have made good faith efforts to increase annual spending on tree trimming and to employ aggressive trimming. Unfortunately, the right-of-way maintenance practices employed currently did not prevent the extensive destruction from the hurricane. However, the Staff believes that the hurricane event was of limited value for assessing the effectiveness of the utilities' tree trimming programs because much of the damage to the utilities' infrastructure was due to whole trees being uprooted.

The widespread destruction of utility infrastructure from whole trees is not without precedent in Virginia. Climate conditions in the years prior to Hurricane Irene and the severity of the storm provided a situation similar to that encountered in 2003 with Hurricane Isabel, and again in 2009 with the December snowstorm in Southwest Virginia. The following conclusions taken from a 2004 Staff Report relative to Hurricane Isabel are also relevant for Hurricane Irene:

> The Virginia State Climatology Office concluded that the destruction of the trees was inevitable due to the presence of an aging and overgrown forest of urban and suburban trees. Contributing factors included tree damaged root systems due to past prolonged drought, saturated ground from excessive rainfall, and sustained storm force winds.[12]

The three years 2007-2009 were years of extreme drought. According to NOAA, the "Drought of 2007–2009. . . was the worst since the 2000–2002 drought. By some

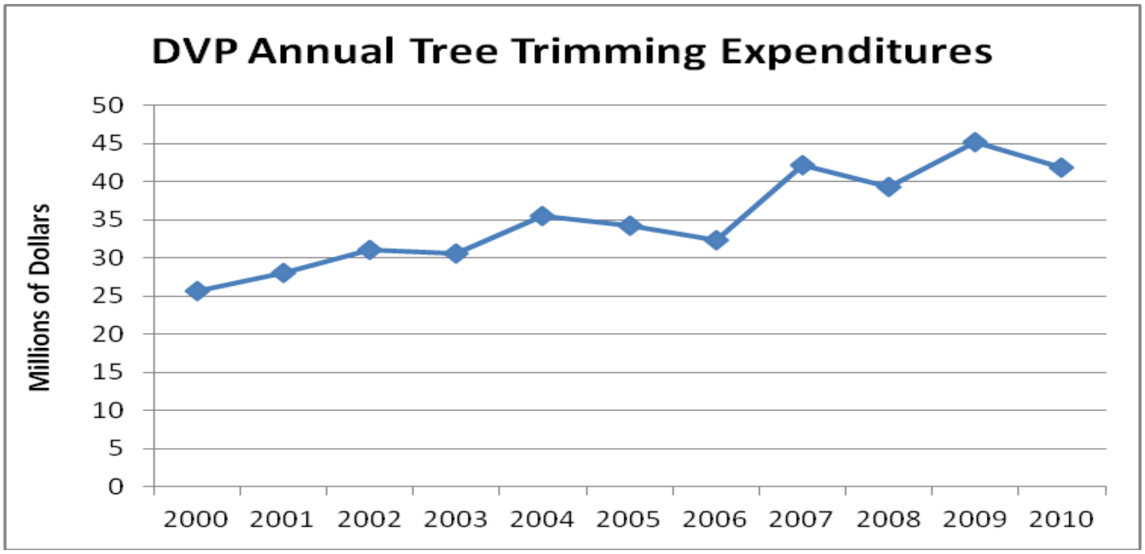
[12] *Preparation for and Response to Hurricane Isabel by Virginia's Electric Utilities*, Special Report of the Division of Energy Regulation, (September 20, 2004)

measures it surpassed that drought . . . ."[13] In addition, according to the Virginia Drought Monitoring Task Force, the summer of 2010 may have been the warmest, averaged statewide, in the history of modern recordkeeping—going back to 1895. This has brought correspondingly higher than average evaporation rates. These factors have led to enhanced drying of topsoil layers, exacerbating the decline in agricultural conditions, and are having an increasing impact on longer-term moisture conditions. Experts generally agree that drought causes primary and secondary physical damage in trees, including root damage and root death, branch dieback, and in extreme cases tree death. It is generally agreed that symptoms might not be evident until sometime after drought conditions have been encountered. For example, branch dieback and tree death could lag drought conditions by as much as two years.[14] Therefore, the factors contributing to the toppling of whole trees during the hurricane may have included tree damaged root systems due to past prolonged drought, shallow roots, saturated ground from excessive rainfall, and sustained high winds.

The Staff analyzed tree-trimming-related historical data collected on an annual basis in an attempt to determine whether there appeared to be any spending cuts or deterioration in service related to right-of-way maintenance practices. DVP's spending practices are provided in the following chart. The results of the Staff's investigation into the utilities' vegetation management practices are provided as follows.

[13] *The 2007-2009 Drought*, Peter Corrigan, NOAA 'Bout Weather, Spring 2009 Edition, NWS, Blacksburg, Va., http://www.erh.noaa.gov/rnk/Newsletter/Spring_2009/drought/drought_07_09.html

[14] *Drought Stress, Tree Health, and Management Strategies,* Sharon M. Douglas, Department of Plant Pathology and Ecology, The Connecticut Agricultural Experiment Station.



Staff's Assessment

As mentioned previously, the Staff believes the utilities have made good faith efforts to increase annual spending on tree trimming and to employ aggressive trimming; however, based on an analysis of certain reliability data, it appears the companies may need to enhance their vegetation management practices in order deal with an aging and overgrown forest of urban and suburban trees. Regarding the companies' right-of-way ("ROW") vegetation management practices, the Staff recommends that the utilities maintain the full widths of their rights-of-way[15] and increase expenditures for tree trimming as necessary to stabilize tree-related outages. The Staff believes that aggressive trimming is especially critical along circuits in remote off-road locations that are difficult to access. The Staff also recommends that the utilities attempt to educate municipalities and landowners of the potential long-term benefits of removing aging, overgrown hazard trees that exist outside of the utilities' rights-of-way but nevertheless present a growing danger to the companies' distribution infrastructure.

[15] APCo uses forty-foot ROW: ODP uses forty-foot ROW for three-phase lines, but only thirty-foot ROW for single phase lines; DVP, the state's largest utility, uses thirty-foot ROW for all distribution lines.

MAINTENANCE OF WOOD UTILITY POLES AND OTHER EQUIPMENT

All wood poles purchased by electric utilities meet National Electric Safety Code ("NESC") standards and conform to the requirements of the *American National Standard Specifications and Dimensions for Wood Poles*, ANSI 05.1. Thereafter utilities employ various inspection and replacement programs in an attempt to ensure the integrity of the wood poles on their systems. As a result of the high number of wood pole failures sustained by DVP during the hurricane, the Staff reviewed the adequacy of these inspection programs and the integrity of the utilities' infrastructure. Discussions relative to the utilities' inspection programs and the wood pole failure mechanisms are provided in the following paragraphs.

According to Osmose Utilities Services, Inc. ("Osmose"),[16] the typical electric utility system has an average pole age of about 32 years. Osmose maintains that without a comprehensive inspection and remedial treatment program, about eight percent of poles do not meet the NESC strength requirements, and an additional twenty-five percent or more are decaying and weakened.[17] Such inspection programs typically include visual inspections, sounding and boring tests, and ground-line treatments with insecticide/fungicide. DVP contracts with Osmose to conduct a comprehensive inspection and remedial treatment program for their wood poles. DVP inspects its poles on a twelve-year cycle. APCo and ODP contract with Utility Pole Technologies ("UPT") Inc., a division of Asplundh. The electric cooperatives typically employ Osmose, Southside Utility Maintenance, Inc., or other contractors to perform visual, sounding and ground-line inspections on a 7–10 year cycle.

The utilities generally attribute wood pole failures during hurricanes (directly or indirectly) to tree contact. According to the utilities and Staff's previous field observations, the majority of these failures are the direct result of trees making contact with the poles or the indirect result of trees pulling on overhead conductors.

Though not an issue following Hurricane Irene, the Staff is aware that some concerns have been expressed in the past relative to the possibility that the utilities' infrastructure might be old and, therefore, in poor condition. However, according to Daniel O'Neill, a former Director of Navigant Consulting,[18] age alone is not always a determinant of equipment condition. In fact, O'Neill stated that replacing infrastructure components based on age is one of the least cost-effective ways of improving service. With respect to wood poles, specifically, O'Neill noted that native pole species dating to the 1950s or earlier can have less decay than poles recently purchased from tree plantations.

In order to better understand the efficacy of classic methods for evaluating wood pole strength after Hurricane Isabel in 2003, the Staff contacted the National Electric Energy Testing Research and Applications Center ("NEETRAC").[19] According to the NEETRAC's program manager for mechanical systems,[20] lab tests have demonstrated that the age of a pole, the visual condition of a pole, and classic sounding tests are not reliable indicators of pole strength. Furthermore, ground-line inspections and boring

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[16] Osmose provides services and products designed to extend the useful life of critical utility infrastructure.
[17] *Overview: Asset Management and Pole Maintenance*, Osmose, www.osmose.com, (January 22, 2004)
[18] *Reliability Tradeoffs*, Electric Perspectives, (January/February 2004)
[19] The National Electric Energy Testing, Research and Applications Center (NEETRAC) is a nonprofit, member-supported electric energy research, development and testing center, housed in the Georgia Institute of Technology's School of Electrical and Computer Engineering.
[20] Paul L. Springer III, PE, landline communication, January 21, 2004

procedures test for wood rot at the ground line, but do not focus on defects elsewhere on a pole or on the overall weakness of a pole.

The Staff believes DVP's approach to the inspection and maintenance of its wood utility poles is reasonable and comparable to other utilities; therefore the Staff makes no recommendations at this time. In addition, the Staff has determined that DVP's inspection and maintenance of its overhead wires and devices is reasonable and comparable to other utilities. The Staff also found no evidence that any potential lack of maintenance of electrical wires had any impact on the extent of the outage. With respect to the contention that heavier wire should be used or that the existing wire had deteriorated, the Staff notes that using heavier wire than required by industry standards might actually result in an unintended consequence of more broken poles, as the heavy wire (when pulled by a fallen tree) could impart more force on a pole before the wire breaks.

COMMUNICATIONS

Communication with the public is a key component to the successful recovery from a major incident such as a hurricane. During these events the public relies on its government officials and the owners and operators of critical infrastructure, especially utilities, to provide a sense of confidence that life will return to normal as quickly as possible. In order to instill such confidence, it is critical that utilities involved in restoration efforts communicate service restoration progress as efficiently and effectively as possible. Failure to do so will result in diminished public trust.

A communication plan is completely effective only if the utility provides the public with reasonable estimates of when service will be restored. Such information includes system, regional and customer specific estimated restoration targets. Following Hurricane Irene, DVP provided reasonably adequate information relative to both system and regional restoration goals, but did not perform well with respect to providing consistently accurate customer specific estimated restoration times ("ETR"). The Company tracks ETR accuracy by measuring (i) the percentage of customers that are restored within a given time range (e.g., service will be restored during the six-hour window of 5:00pm - 11:00pm) and (ii) the percentage of customers that are restored on a given day (e.g., service will be restored on X date). According to the Company, 34% of ETRs were accurate to a given time range and 60% were accurate to a given day.

The poor customer specific ETR accuracy was evident in the complaints received by the Commission. As a result of the outages caused by the hurricane, the Commission Staff received approximately 155 consumer complaints and inquiries. Of these calls all but nine were from DVP consumers. Most callers were looking for information relative to when their service would be restored. Consumers expressed frustration that they could not get an accurate ETR from DVP and, as a result, could not adequately make plans for their families. Additionally, consumers indicated that the ETR provided by the Company changed frequently throughout the restoration effort adding to their frustration and sense that the Company was either being untruthful or was not competent.

Communication following a major weather event can be extraordinarily complicated because of the initial lack of information, the limited effectiveness of electronic communication media, and the volume of customers and organizations seeking individualized, case specific information. However, given the critical public interest of electric service, the Commission Staff believes that DVP, as well as all other utilities, must continually work to improve the ability to communicate during major outage events.

Following Hurricane Irene, the Company advised that it recognized a need to improve its performance with respect to providing accurate customer specific ETRs. It established an internal task force (ETR Task Force) to review its ETR procedures and develop recommendations to improve performance. The Company plans to implement the following recommendations for restoration activities after a catastrophic outage event:

- 24 - 48 hours after a storm leaves the Company's service territory it will publicly announce the date that it will complete system restoration.

- The Company will publicly announce the date that service restoration will be complete in a local area, once two-thirds of customers have been restored within such local area (i.e. local area specific restoration goals).

- The Company will begin providing customer specific ETR's once three-quarters of affected customers have been restored. The Company will no longer provide ETRs in six-hour time ranges; instead it will provide the estimated restoration date only.

- The Company will revise the call back script that is used to verify power had been restored. According to the Company, the script used during Hurricane Irene created confusion because customers thought the Company was calling to advise that service was restored. The new script will more clearly inform consumers that the Company completed work in the area and is calling to determine if the customer's service was restored as a result of that work.

The Commission Staff believes that the Company's proposed recommendations are reasonable. Following Hurricane Irene, DVP provided customer specific ETRs before it had the information necessary to accurately predict when service would be restored. Certainly the Company should endeavor to provide ETRs as soon as practicable; however, inaccurate ETRs contribute to customer confusion and anger. The Company should continually review the plan and make further improvements that appropriately balance the goals of providing accurate ETR's as quickly as possible.

Utilities must also establish a plan for communicating effectively with local and state emergency management personnel and elected officials. Such communication is essential both prior to a major outage event as well as during the event. Prior to the storm, the utilities should work with local and state officials to identify critical customers (i.e. hospitals, major pumping stations, etc.) so that following the storm the utility can adequately prioritize restoration activities to focus on such critical resources first.

Following Hurricane Irene, the Commission Staff received numerous comments from both state and local emergency management and elected officials who commended the utilities for providing relevant and timely information relative to the restoration of service especially as it related to critical infrastructure. As such, it appears that many of the lessons learned following Hurricane Isabel in 2003 have been incorporated into utility communication plans. Utilities should continue to meet with emergency management officials periodically to ensure that critical infrastructure lists and key contacts remain current.

LESSONS LEARNED

Electric utilities typically perform post storm critiques and then implement corrective actions for lessons learned in an effort to improve future restoration efforts. Following Hurricane Irene, the Staff asked the utilities to provide the lessons learned as a result of any post storm critiques or assessments, including information obtained from debriefings of the mutual aid crews. The following are the responses received from DVP, CEC, MEC, NNEC, REC, and SEC to the Staff data requests.

DVP

DVP performed regional, process, and individual location critiques/assessments after Hurricane Irene's restoration effort was complete. The Company also facilitated a survey addressed to jurisdictional Emergency Operation Centers from affected areas of the Commonwealth, as well as an exit survey provided to Mutual Aid partners asking for ratings in selected areas of performance.

Areas of performance that were identified as *"positive"* from DVP critiques/assessments included:

- Work schedules for line workers proved positive based on the number of restoration days and ensured crew safety and rest.
- Embedded tree crews with line crews improved efficiency.
- Use of helicopters and off-road and on-road vehicles for initial damage assessment accelerated completion.
- Staging centers and processing centers were efficient and well staffed.
- Use of Company retirees was productive and helpful.
- Use of "Priority Score" during work packaging enabled productive work to be performed each day.
- Materials group was well prepared for the large scale event.

Areas of performance identified as *"positive"* from EOC & Mutual Aid critiques/assessments included:

- Priority given to assisting jurisdictions with road clearing due to downed trees entangled with electrical conductors was well coordinated.
- Ease of communication with DVP was "invaluable."
- Staging centers and processing centers were well organized.
- Emphasis on safety by DVP was "well received."
- Work assignments were ready with good directions.
- Mobile Command Center use was successful.

Areas of performance identified as *"improvement needed"* from DVP critiques/assessments included:

- Estimated Restoration Times provided to customers too early in the event.
- Performance by DVP's outage management system was impacted by the high data volume.
- More contractor oversight required to ensure optimum performance of contract resources.
- Lodging vendor needs to meet DVP's expectation of blocking large numbers of rooms for utility workers. An after-action review of the hoteling process is needed.

- Need a defined process to collect asset information post-restoration event.
- Need additional laptops for distribution to storm support personnel.
- More frequent refresher training is required for customer service personnel augmenting the Customer Care and Energy Management Center.

Areas of performance identified as *"improvement needed"* from EOC & Mutual Aid critiques/assessments:

- Need to have more electronic, "Garmin-type" mapping available of the Company's distribution system available for Mutual Aid and off-system contractors.
- Outage Viewer was beneficial when active.

Community Electric Cooperative

In our post storm critiques/review, we had several issues with our new Outage Management System-some software and some procedural. No reports came back to the office of crews (either in-house or mutual aid) waiting for assignments or materials. As mentioned earlier, we had better coordination with VDOT than in the past. Other than the delay in getting additional help at the beginning of the storm, the actual restoration went well considering we lost over half of our consumers.

Mecklenburg Electric Cooperative

- MEC needs to resolve problems encountered with AT&T relative to the Cooperative's toll-free outage reporting number. MEC spent a tremendous amount of time with AT&T trying to get the telephone problem corrected. Verizon is our local phone carrier and our trouble ticket continued to bounce back & forth between AT&T and Verizon. Our toll free outage reporting phone number was not restored until Wednesday night, August 31st, at 8:30 p.m.
- Additional Dispatch Outage Management training needed for occasional users of the software.
- Establish a disaster recovery agreement with automated outage reporting system vendor in case of system failure.
- Obtain mutual aid crews to just do service work, i.e. repairing triplex and secondary service from pole to house – implemented during Hurricane Irene.
- Radio is the best means of real time communication with consumers during an extended outage.
- Post public service announcements of Cooperative's website.
- Develop a Facebook page to add another level of communication to members that can spread quickly throughout the community.
- Develop a generator program with specific key accounts that would benefit both parties during an extended outage.

Northern Neck Electric Cooperative

- NNEC's Staff conducted a de-briefing meeting on Thursday, September 15, to address areas of concern and suggestions for improvements to the restoration process after Hurricane Irene. As a result of this meeting, NNEC is going to explore different methods of housing and feeding visiting crews and more extensive ways to communicate work progress to our members.

Southside Electric Cooperative

The Emergency Restoration Plan covered the majority of all Operational impacts and provided a clear guideline for system restoration. The Cooperative will be reviewing specific issues with lodging for additional crews, food preparation and enhanced media reporting. The ERP will be updated based on the results of this storm operation.

Given the wide-spread outages in the Richmond/Petersburg areas, lodging was an issue as most hotel/motel facilities did not have power and were without power well after the Cooperative had completed is restoration. Crews had to be housed further to the west which added travel time to and from the outage sites and in turn lengthened the restoration. The Cooperative will be further investigating mobile housing options for future storms. The Virginia Department of Emergency Management and FEMA continue to assist the Cooperative in its efforts to recover. Both groups have done an exemplary job supporting the Cooperative to this point.

Rappahannock Electric Cooperative

- Develop and add to the Major Storm Guidelines a formal damage assessment process.
- Develop a logistics team in Fredericksburg which can support a district upon request.
- Fredericksburg Customer Service department will be responsible for communicating with Lifeline members.
- Districts are to supply Fredericksburg Customer Service a list of crew locations.
- Explore methods of eliminating multiple "dead spots" for both cellular and radio communications in far southeastern portion of REC distribution system.

CONCLUSIONS[21]

- The high level of impacts caused by Hurricane Irene were a result of a combination of factors, some of which were generally beyond the control of the utilities, including primarily the widespread nature of the storm and the heightened susceptibility to hurricane-force winds of those trees existing both inside and outside of the utilities' rights-of-way.

- Unlike many previous storms in Virginia (but similar to Hurricane Isabel in 2003 and the December 2009 Snowstorm in southwest Virginia) Hurricane Irene can be characterized as a "whole tree event" with respect to the root cause of the devastation to the electric utility infrastructure. That is, much of the damage was caused by uprooted trees falling on the utilities' lines and poles – as opposed to being caused merely by broken tree limbs.

- The Staff concurs with the utilities' prioritization plans for restoration of service following a major outage, which employ a strategy of first restoring service to critical safety and public welfare facilities and then proceeding to those circuits that result in the restoration of service to the greatest number of consumers.

- The time required for full restoration of service following Hurricane Irene was for most customers one week or less. Given the number of customers impacted and the extent of the damage, the outage durations for most of these customers were (from the Staff's perspective) neither unexpected nor unreasonable. However, Staff believes that the time required for full restoration of service for some DVP customers and cooperative members could have been shorter.

- The Staff is concerned that the utilities may have utilized inadequate vegetation management and insufficient resources in localized areas, especially during the early stages of the recovery.

- In the Richmond/Tri Cities region, DVP may have employed insufficient resources in the early stages of the restoration effort, as well as inefficient scheduling of certain work orders until the final day of the outage, leading to a longer than necessary outage duration for certain customers.

- DVP did not communicate with the public as effectively as possible during the restoration process, especially as it relates to customer specific restoration times.

- NNEC and CEC experienced difficulties obtaining sufficient resources which may have contributed to the length of the outages.

[21] The findings and conclusions summarized and listed in this section are the result of one or more of the following: (1) analysis of utility company responses to data requests, (2) meetings and conference calls with utility company management, (3) meetings with local county officials, (4) literature surveys, (5) utility territory field inspections, (6) customer complaints, and (7) analyses from other storm investigations.

RECOMMENDATIONS

- The Staff recommends that utilities that are currently not doing so begin to work with municipalities and educate landowners with respect to the potential long-term benefits of removing aging, overgrown trees that exist outside of the utilities' rights-of-way, since these trees present a growing danger to the companies' distribution lines.

- The Staff recommends that utilities aggressively maintain distribution right-of-way for overhead distribution lines and increase expenditures for tree trimming and removal as necessary to reduce tree-related outages. The Staff also recommends DVP more aggressively maintain distribution rights-of-way in areas where reliability has declined. CEC and SEC should evaluate the benefits of more aggressive trimming and a shorter trimming cycle (for example, four or five years) in areas where reliability has declined and/or in areas where the potential impact from trees during catastrophic storms is significant.

- The Staff recommends that DVP and the cooperatives continue to rely primarily on mutual aid for restoration activities following catastrophic storms. The baseline workforce of linemen should be maintained at a level necessary to preclude excessive overtime work, deterioration in service connection completion times, and excessive restoration times following outages. Efforts should continue to focus on how to maximize the effectiveness and efficiency of the infusion of a large external work force during catastrophic outage events.

- DVP should provide an explanation and corrective action for the relatively insufficient resources applied to the Richmond/Tri Cities region during the first four days of the outage.

- DVP should provide an explanation for any of the 43 work orders completed on the final day of the outage in the Richmond/Tri Cities region that resulted in the restoration of more than 10 customers, and possible management corrective actions to prevent such scheduling in the future.

- DVP should implement the recommendations of its ETR Task Force related to improving the customer communication.

- Utilities should continue to meet with emergency management officials periodically to ensure that critical infrastructure lists and key contacts remain current.

- NNEC, CEC, and SEC should evaluate logistics management alternatives, such as mobile housing and other options, for the purpose of supporting additional field resources in remote areas. CEC should also evaluate corrective actions for obtaining the necessary resources during the initial stages of the restoration.

- DVP, NNEC, CEC, and SEC should provide a written update to the Division of Energy Regulation relative to the implementation of all recommendations in this report no later than June 1, 2012.