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January 18, 2018

-VIA ELECTRONIC FILING-

Ms. Carlotta S. Stauffer
Office of Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Docket No.: 20170215-EU

In re: Review of electric utility hurricane preparedness and restoration actions.

Dear Ms. Stauffer:

Enclosed please find Florida Power & Light Company's responses to Staff's Second Data Request in the above referenced docket. Please note that while Staff's Second Data Request seeks responses related to Hurricanes Hermine, Matthew, Irma, Maria and Nate, FPL's service territory was not impacted by Hurricane Maria. As a result, unless otherwise indicated in the actual response, FPL's responses do not include information or data related to Hurricane Maria.

If you should have any questions regarding this transmittal, please contact me at (561) 691-2512.

Respectfully submitted,

/s/ Kenneth M. Rubin
Kenneth M. Rubin
Fla. Bar No. 349038

Enclosure

QUESTION:

For each year, please complete the following tables summarizing the number of miles of transmission and distribution underground facilities by county from 2006 through 2017.

Transmission			
Year			
County	Overhead to Underground	New Construction	Total Miles

Distribution			
Year			
County	Overhead to Underground	New Construction	Total Miles

RESPONSE:

Please see Attachment No. 1 to this response for the total number of miles of transmission and distribution underground facilities by management area reflected in FPL's accounting records for 2006 through 2017. Note, FPL does not maintain mileage information on its books and records for overhead to underground conversions or new construction projects. Therefore, this information is unavailable. In addition, FPL does not have distribution underground miles by county/management area for 2006 through 2009 or transmission underground miles by county/management area for 2006 through 2012. FPL has therefore provided the mileage in total for the respective years.

Florida Power & Light Company
Docket No. 20170215-EU
Staff's Second Data Request
Request No. 1
Attachment No. 1
Page 1 of 1

Distribution Underground Miles by Management Area by Year

Management Area	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Boca Raton	N/A	N/A	N/A	N/A	2,339	2,341	2,343	2,344	2,346	2,351	2,366	2,385
Brevard	N/A	N/A	N/A	N/A	1,358	1,360	1,365	1,371	1,378	1,382	1,387	1,399
Broward	N/A	N/A	N/A	N/A	4,836	4,855	4,891	4,916	4,945	4,960	4,976	5,013
Dade	N/A	N/A	N/A	N/A	4,640	4,660	4,691	4,738	4,760	4,790	4,809	4,856
CENTRAL FLORIDA	N/A	N/A	N/A	N/A	1,638	1,644	1,650	1,663	1,670	1,676	1,681	1,693
FORT MYERS	N/A	N/A	N/A	N/A	42	45	48	51	53	55	57	59
Gulf Coast Management	N/A	N/A	N/A	N/A	2,372	2,372	2,372	2,372	2,372	2,372	2,372	2,372
MANASOTA	N/A	N/A	N/A	N/A	2,281	2,282	2,284	2,288	2,292	2,299	2,304	2,321
NAPLES	N/A	N/A	N/A	N/A	59	60	61	63	66	70	74	78
NORTH FLORIDA	N/A	N/A	N/A	N/A	727	729	731	733	736	738	741	744
TOLEDO BLADE	N/A	N/A	N/A	N/A	490	491	492	494	496	498	502	509
TREASURE COAST	N/A	N/A	N/A	N/A	1,531	1,535	1,542	1,545	1,549	1,559	1,580	1,597
WEST PALM BEACH	N/A	N/A	N/A	N/A	2,732	2,737	2,739	2,745	2,748	2,756	2,770	2,792
Grand Total	24,679	24,863	24,981	25,074	25,045	25,111	25,207	25,323	25,411	25,506	25,620	25,818

Transmission Underground Miles by Management Area by Year

Management Area	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Broward	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	7	9	7	7
Central	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1	1	14	14
Dade	N/A	N/A	N/A	N/A	N/A	N/A	N/A	81	83	78	78	79
Ft Myers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	1	2	2
North	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0
Palm Beach	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0	2	3	3
Sarasota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0
Grand Total	88	88	88	92	92	92	92	91	91	91	104	105

QUESTION:

For Hurricanes Hermine, Matthew, Irma, Maria, and Nate, please provide a complete copy of the utility's post-storm forensic review of damaged infrastructure. If a forensic review was not performed or not documented, please explain why.

RESPONSE:

Post-storm forensics reviews are conducted based on the level of damage to infrastructure and the ability to deploy forensics teams to review the nature of the damage before restoration is completed.

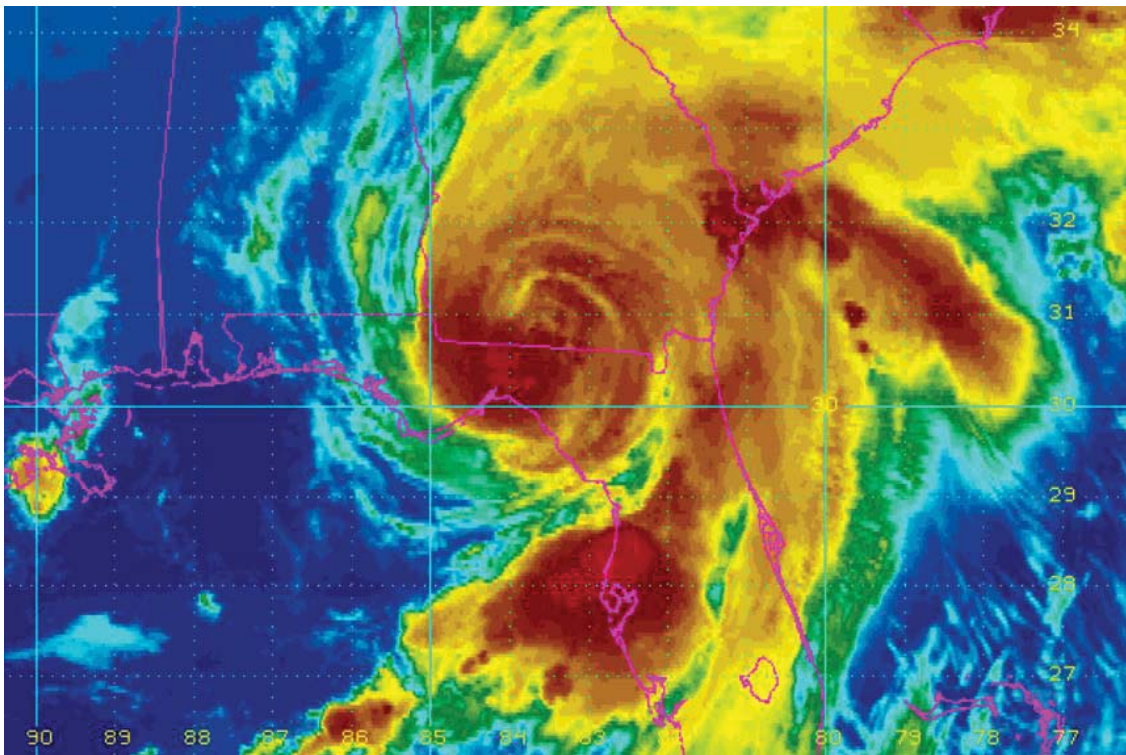
During 2016, FPL collected data and performed analyses on Hurricanes Hermine and Matthew. Please see Attachment Nos. 1 for the report on Hurricane Hermine - distribution only and Attachment No. 2 for the report on Hurricane Matthew - distribution and transmission/substation.

The post-storm forensics review report for Hurricane Irma is currently projected to be completed by the end of February 2018.

No forensics reviews were completed for Hurricanes Maria (did not impact FPL) and Nate (limited impact/service restored within one day).



Power Delivery Performance



Hurricane Hermine

Report Date: September 27th, 2017



Executive Summary

- Invest 99L, Tropical Storm and Hurricane Hermine impacted all FPL regions: Dade (CD, ND, SD, WD), East (BR, CB, NS, SB, WB), North (BV, CF, NF, TC) and West (MS, NA, TB).
- The Hurricane event time frame was Wednesday 8/31/16 through Friday 9/2/16
- FPL was essentially restored at 7:00 PM on 9/2/16

General Information

Customers out total	119,898
Transmission Out	2 line sections (both vegetation)
CI Avoided (Smart Grid)	32,845
Customers out at peak	38,000
Customers out > 24 hours	0
Feeder Poles down	1 (Vehicle Hit)
Other Poles down	16 Lateral + Service
TCMS Tickets	2388
Hardened feeder performance	2.2 times better than no hardened
ALS Performance	1.8 times better than non-ALS laterals

Forensics

Number of feeder outages	59 of 2055 (2.9%)
Number of harden feeder outages	9 of 691 (1.3%) (7 veg, 1 vehicle, 1 switching)
Forensics Teams Deployed	6



FEEDER	FPL			
	ACTIVE		RESTORED	
	TKT	CUST	TKT	CUST
OCR	1	32	73	81,357
OH LAT	1	165	18	3,999
UG LAT	60	1,579	677	24,711
TX	6	329	63	2,110
OTHER	54	377	928	6,747
TOTAL	131	191	376	974

Hardened Feeder Ticket Details						
Region	MA	Substation	Feeder Number	Ticket Number	Cause Code	Equipment Code
North	CF	ST JOE	102361	1090	Vehicle	Pole
North	NF	COLUMBIA	301132	65	Storm/Wind w/Equip Damage	Insulator
North	NF	COLUMBIA	301138	81	Tree/Limb Preventable	Other Equipment
North	NF	LIVE OAK	300631	206	Hurricane	Other Equipment
North	NF	LIVE OAK	300634	207	Storm/Wind w/Equip Damage	Conductor Down
North	NF	RIVERTON	105762	650	Tree/Limb Preventable	Other Equipment
South	WD	ROSELAWN	807035	1417	Storm /No Equip Damage	
West	MS	CLARK	500538	1749	Storm/Wind w/Equip Damage	Disconnect Switch
West	MS	OSPREY	500933	1459	Tree/Limb Unpreventable	Stirrup

Number of non-harden feeder outages =23/2083

Broken poles

Feeder = 1

Lateral = 16

Vegetation Related = 15

ATT poles (Decay) = 1

This ATT pole failed PIP in 2015 but, ATT had not yet replaced.

Number of Lateral outages



Total number of lateral outages	= 737
Number on non ALS	= 578 (1.056%)
Number on ALS	= 159 (.605%)
Refuse Percentage	= 38%

Transmissions & Substations

No damage except vegetation related interruptions

- The Belle Glade Hardened Feeder outage is the result of a hardening exclusion on the original jobs in 2008 and 2011 which hardened to the CIF, the community and residential areas. Agricultural areas were excluded from the original scope of work. See WR 2842943. Excessive span length resulting in phase slap and small wire are the primary contributing factors. Options to isolate the unhardened areas are being reviewed. This is a repeat failure from Colin.
- There was no pole damage on hardened feeders.
- Random Overhead Feeder and Overhead vs. Underground forensic analysis were not performed during Hermine.

Conclusion

- Hardened feeders performed as expected with no storm related pole damage.
- For this event Hardened feeders performed statistically better than non-hardened experiencing (1.3% hardened vs. 2.9 % non-hardened outage rate).

Distribution Forensics Background

FPL's Storm Forensic Organization was formed after the 2004-2005 active storm seasons to help evaluate Distribution infrastructure performance during extreme wind weather events. The data collected serves to meet FPL commitments to the FPSC which include annual summary reporting of infrastructure performance during hurricane events. The field forensic teams were created to investigate affected areas and collect damage information to analyze performance of:

- Hardened Feeders



- Random Overhead Feeders
- Overhead vs. Underground Laterals

Note: Forensic investigations exclude locations under safety, property damage or other special investigation team.

Hermine Activation

Based on the projected path of Hermine, the Forensics Team was pre-activated and pre-positioned to perform investigations in the affected areas. When the storm dissipated the team was deactivated and data was collected from the team and TCMS to analyze system performance.

Hardened Feeders

The primary objective of hardening is to reduce restoration times by minimizing the number of pole failures during extreme wind weather events. Pole failures typically lead to extended restoration times and longer outages. As a result, FPL forensic investigators use pole failure rates as the primary measurement criteria to evaluate performance of hardened vs. non-hardened feeders within the impacted areas. Based on findings, FPL damage forecast models can be re-calibrated and lessons learned incorporated into future engineering design standards.

Feeder field forensic data was collected to conduct root cause analysis and failure mode of previously hardened feeders that locked out during the storm. Data used for analysis was provided by TCMS.

Random Overhead Feeders

Investigation of randomly selected overhead feeders impacted by extreme wind events is an annual reporting requirement to the FPSC. Inspection locations are defined based on randomly selected routes within the path of the storm. The objective of random inspections is to collect sample data on randomly selected feeder locations in order to evaluate infrastructure performance during extreme wind events.

No random overhead field forensic data was collected to conduct random overhead analysis.



Overhead vs. Underground Performance

The investigation and performance of overhead vs. underground infrastructure during extreme wind events is an annual reporting requirement to the FPSC. Forensic investigators examine randomly selected underground or overhead lateral facilities that were affected within the path of the storm. The objective of these random inspections is to collect sample data from overhead or underground damage locations in order to evaluate and compare infrastructure performance of overhead and underground facilities during extreme wind event.

No field forensic data was collected to compare overhead vs. underground performance.

Defining Storm Affected Areas

The emergency preparedness department performs the storm tracking activities from forecast to actual storm path. This information is available to the GIS group Technology Coordinator and is used to identify the storm affected area. Prior to a storm event, the Forensic Leads and the Technology Coordinator will be in close contact to execute the below plan based on the latest possible forecast or pre-storm plan. After the storm has passed, the Forensics Team executes the pre-storm plan unless the actual event was significantly different; at which time a new plan based on the actual storm path will be developed.

During Hermine, the affected areas encompassed FPL's Dade, East, North and West Regions in the following Management Areas: Central Dade, North Dade, South Dade, West Dade; Boca Raton, Central Broward, North Broward, South Broward, West Palm; Brevard, Central Florida, North Florida and Treasure Coast; and Manasota, Naples, Toledo Blade.

System Performance

Hardened Feeders

Forecast

The 80+ mph winds experienced during Hermine were less than the extreme wind zones of 105-145 mph within the affected areas. Based on these wind speeds, minimal pole damage was expected during this event as a result of **wind**.

Interruption Summary of Affected Area

- Hardened Feeders 9 / 691 (1.3%)

Statistical Comparison



For this event Hardened feeders performed statistically better than non-hardened feeders (1.3% hardened vs. 3.2% non-hardened outage rate).

Conclusions

- Hardened feeders performed as expected with no pole damage.
- Data shows there was a statistical difference in performance between hardened and non-hardened feeder outages.

Random Overhead Feeders

Forecast

Based on these wind speeds experienced during Hermine, minimal pole damage was expected during this event as a result of **wind**.

Interruption Summary of Affected Area

- Non-Hardened Feeders 59 of 2055 (2.9%)

Forensic Analysis

No Random Overhead Feeder field analysis was performed during Hermine.

Overhead vs. Underground Performance

Forecast

Based on the wind speeds experienced, minimal pole damage was expected during this event as a result of **wind**.

Forensic Analysis

No formal Overhead vs. Underground Performance field analysis was performed.

Conclusions

- With no formal deployment of the Overhead vs. Underground Performance Forensics, there is not a valid sample to determine performance.



Pole Performance

The winds experienced during Hermine were less than the NESC 250 C and NESC 250 B construction standards. Based on these wind speeds, minimal pole damage was expected during this event as a result of **wind**.

Interruption Summary

- There were 16 lateral tickets with pole equipment code which required pole replacement. (excludes tickets with vehicle as cause code). All cause codes are based on ticket codes and comments entered by field personnel in TCMS.
- There were 7 tickets (1 feeder and 6 lateral tickets) with pole equipment code (includes tickets with vehicle as cause code). All cause codes are based on ticket codes and comments entered by field personnel in TCMS.
- The 1 feeder pole cracked related to a vehicle strike.

Conclusions

- The System performed as expected with minimal pole and equipment damage. The damage reported was related primarily to vegetation..

Recommendations

- Continue follow up work through Pole Inspection.

Smart Grid

- No change in devices availability was reported during Hermine
- No Smart Grid Device damage exceptions occurred on the Hardened Feeders during the patrols
- ALS Performance noted below



ALS:

ALS	Total Lateral Tickets	Non ALS Lateral Tickets	ALS Lateral Tickets	Total Non-Lateral Population all stages	Total ALS Lateral Population
All areas	737	578	159	54736	26264
				1.0560%	0.605%

AFS:

- 1) 32,845 CI Avoided
- 2) 91% AFS Availability Overall
 - a. 92% in the North
 - b. 90% in the West
 - c. 92% in the East
 - d. 90% in the South

Weather Appendix at Landfall

Hurricane Hermine Update #12

Issued: Thursday, September 1, 2016 at 7:00 pm EDT

Changes from Update #11:

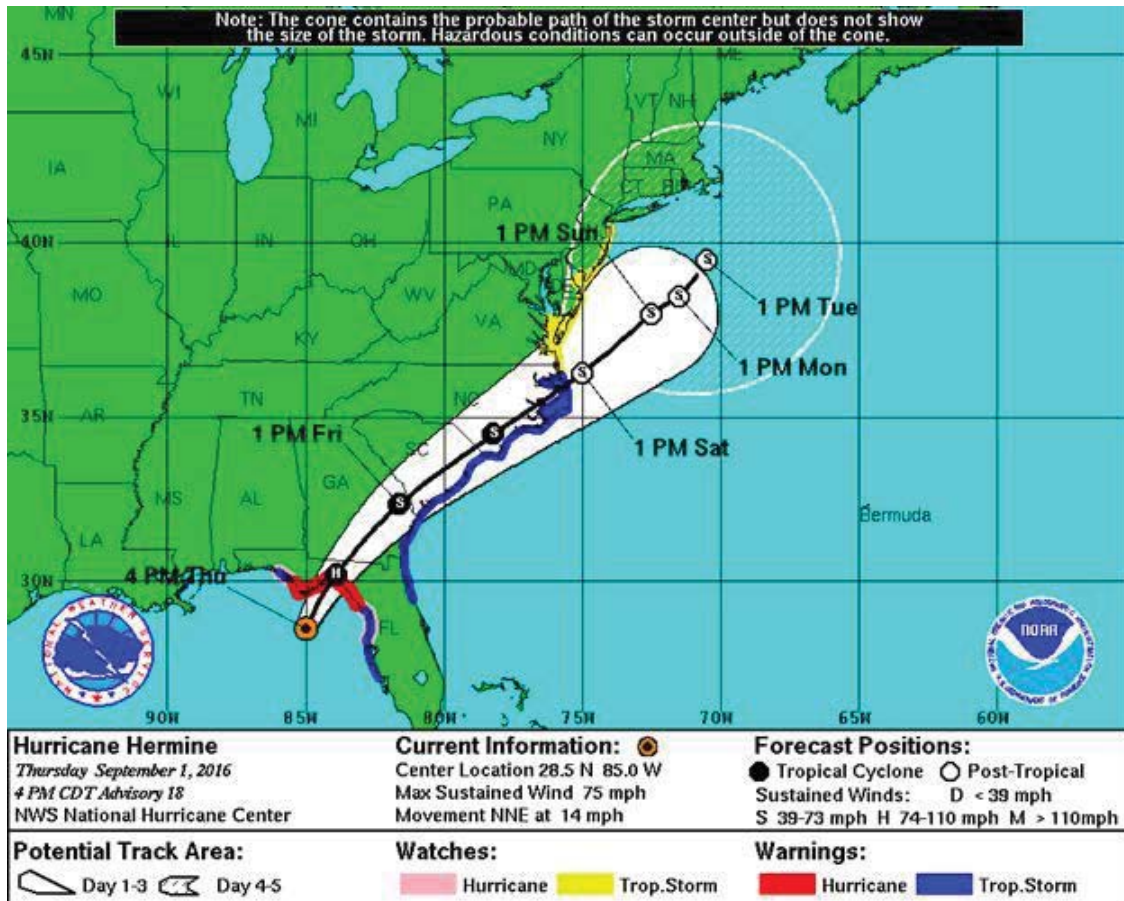
- Hermine is now a hurricane.
- A Hurricane Warning is in effect from the Suwannee River to Mexico Beach. A Hurricane Watch is in effect from Anclote River to Suwannee River and west of Mexico Beach to Walton/Bay County line. A Tropical Storm Warning is in effect from Englewood to Suwannee River including coastal sections of the Manasota Area and Toledo Blade Area, west of Mexico Beach to Walton/Bay County line and from Flagler County northward along the Florida east coast.

Discussion:

- Hurricane Hermine is located about 85 miles south of Apalachicola.
- Maximum sustained winds are near 75 mph with higher gusts. Slight strengthening is forecast until landfall, and Hermine is forecast to be a low-end category 1 hurricane by the time landfall occurs.



- Hurricane force winds extend outward up to 45 miles and tropical-storm-force winds extend outward up to 185 miles from the center, mainly to the northeast and southeast of the center.
- Hermine is moving north northeast around 14 mph and this motion with a slight increase in forward speed is forecast to continue for the next 48 hours.
- The latest model suite remains in good agreement about the evolution of Hermine during the next 48 hours. Significant uncertainties exist beyond 48 hours with implication to the southeastern US coast.
- Tropical storm force winds are forecast to impact the West Region until 10pm tonight. Tropical storm force winds are forecast to impact the North Region until 2pm on Friday.
- Heavy rains from 2" - 5" are possible along the Florida west coast and in the northern peninsula through Friday that may cause at least localized flooding.
- Outer bands of thunderstorms will impact the entire peninsula with isolated tornadoes possible into Friday.
- The current forecast indicates that a low-end hurricane will make landfall in the Florida Big Bend area early Friday and then slowly weaken while remaining near the Southeastern US coast.





I will continue to monitor.

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Tropical Storm Hermine Update #13
Issued: Friday, September 2, 2016 at 7:00 am EDT

Changes from Update #12:

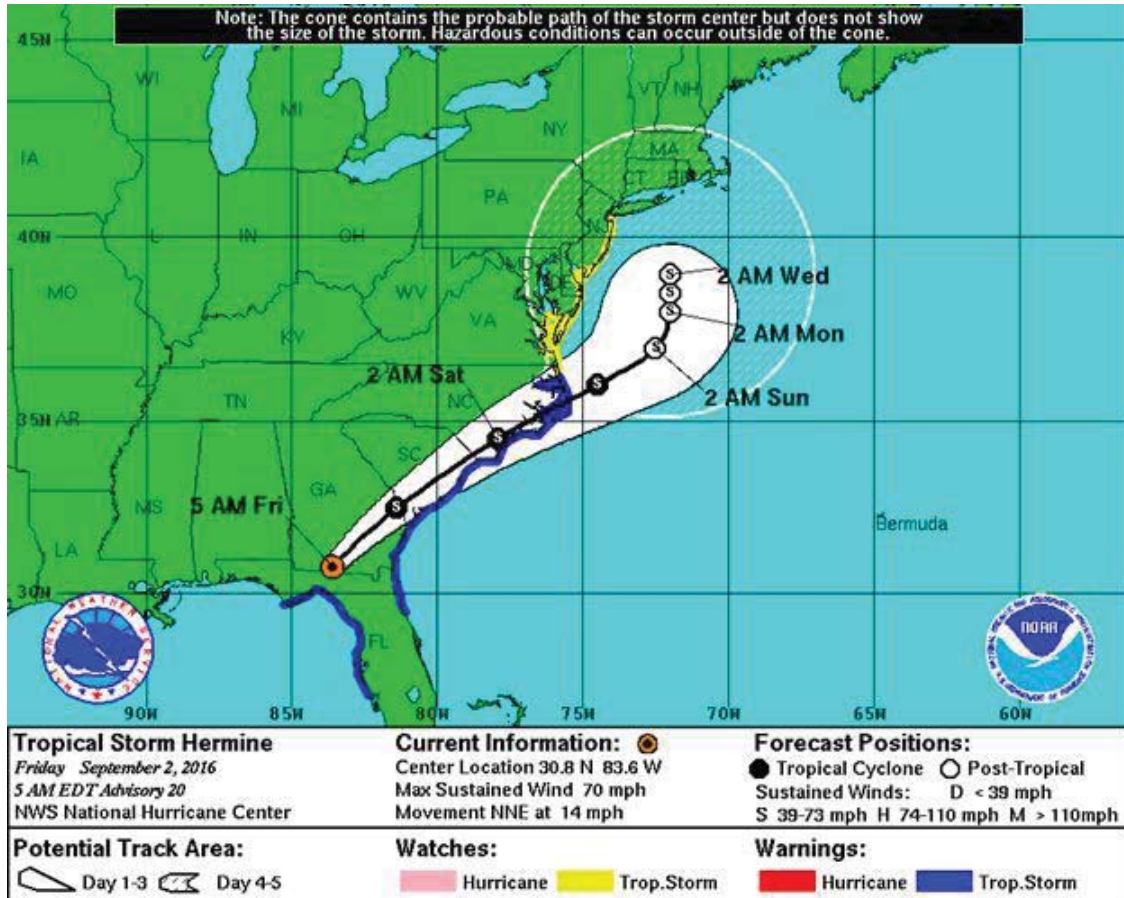
- Hermine is now a tropical storm.
- A Tropical Storm Warning is in effect from Englewood to Indian Pass including coastal sections of the Manasota Area and Toledo Blade Area, west of Mexico Beach to Walton/Bay County line and from Flagler County northward along the Florida east coast.

Discussion:

- Tropical Storm Hermine is located about 20 miles west of Valdosta, Georgia.
- Maximum sustained winds are near 70 mph with higher gusts. Weakening will continue today.
- Tropical-storm force winds extend outward up to 175 miles from the center, mainly in the eastern semicircle.
- Hermine is moving toward the north-northeast near 14 mph and this motion is expected to continue today and Saturday. On this forecast track, the center of Hermine should continue to move farther inland across southeastern Georgia today and into the Carolinas tonight and Saturday.
- Significant uncertainties exist beyond 48 hours with implications to the Mid-Atlantic US coast.
- Tropical storm force winds are forecast to impact the North Florida Area until 12:30pm today.
- Outer bands of thunderstorms will impact the entire peninsula with isolated tornadoes possible today, mainly from the Brevard Area northward.
- The current forecast indicates that Tropical Storm Hermine will continue affect the Southeast coast from Georgia into the Carolinas through Saturday.



Hurricane Hermine



I will continue to monitor.

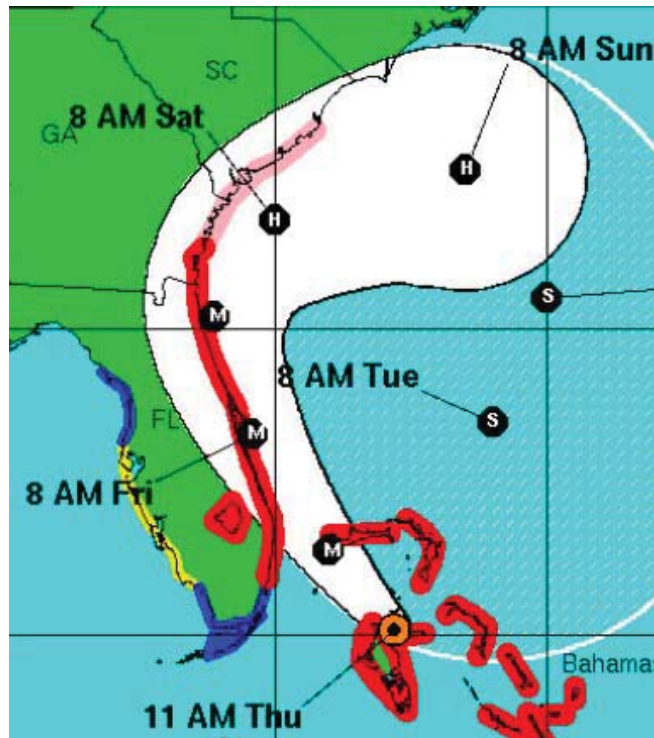
Tim Drum
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Power Delivery Performance

Hurricane Matthew

Report Date: January 17, 2018





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Executive Summary

Cat 4 Hurricane Matthew impacted all FPL regions. Within two days of Matthew's departure from the Florida coast, FPL had restored power to 98.7% of the more than 1 million customers who had been impacted by the storm.

The Hurricane event time frame was Thursday 10/6/16 through Saturday 10/8/16

FPL was essentially fully restored at 10:00 PM on 10/9/16

General Information

Customers Out Total	1.185M
Transmission Out	39 line sections
Substations Out	22
Feeders Out	646
Laterals Out	3807
CI Avoided (Smart Grid)	118K
Peak Customers Out	699,586
Transmission Poles Down	0
Substations Damaged	1 (St. Augustine flooding)
Hardened Feeder Poles Down	0
Other Poles Down	408 (feeder, lateral and service)
Injuries	12
TCMS Tickets	11K
Hardened Feeder Performance *	31.6% better than non-Hardened
ALS Lateral Performance	1.0 times and equal to non-ALS laterals
Forensics Teams Deployed	67 personnel (trans., sub, dist.)

**When non-feeder related causes such as substation outages are excluded.*



Storm Characteristics

Storm Characteristic Facts:

The latest reports confirm that Matthew has been one of the most deadly and destructive Atlantic hurricanes of the 21st century. As of October 10th the storm has killed over 1,000 and caused around \$6 billion in damage.

WIND

Cape Canaveral, Florida: 107 mph (Highest)
Tybee Island, Georgia: 96 mph
Daytona Beach, Florida: 91 mph
Hilton Head Island, South Carolina: 88 mph
Beaufort, South Carolina: 83 mph
Fort Pulaski, Georgia: 79 mph
Savannah, Georgia: 71 mph,
Melbourne, Florida: 70 mph

STORM SURGE

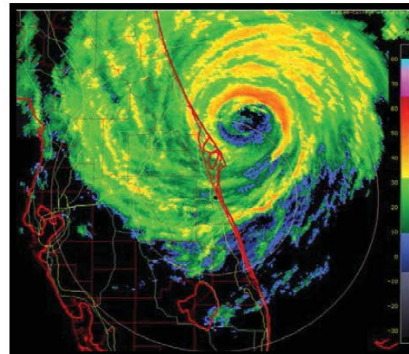
7.8' Fort Pulaski, GA
6.4' Fernandina Beach, FL
6.1' Charleston, SC

RAINFALL

Georgia: 17.49", Savannah/ Hunter Army Air Field
North Carolina: 15.65", William O. Huske Locke 3
South Carolina: 14.04", Beaufort MCAS
Florida: 7.89" Sanford/Orlando

MISCELLANEOUS

Matthew was the lowest-latitude Category 5 hurricane on record in the Atlantic. Its rapid strengthening of 80 mph in just 24 hours was the third fastest on record for the Atlantic, behind only Wilma (2005) and Felix (2007).

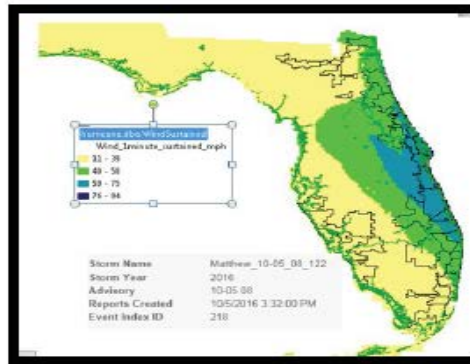




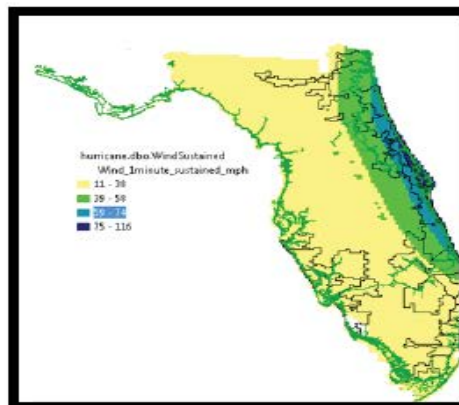
Damage Projections

Damage Model Estimates at key points:

- 24 hour pre landfall:
 - 133k – 142 CMH
 - 700k – 950k CI



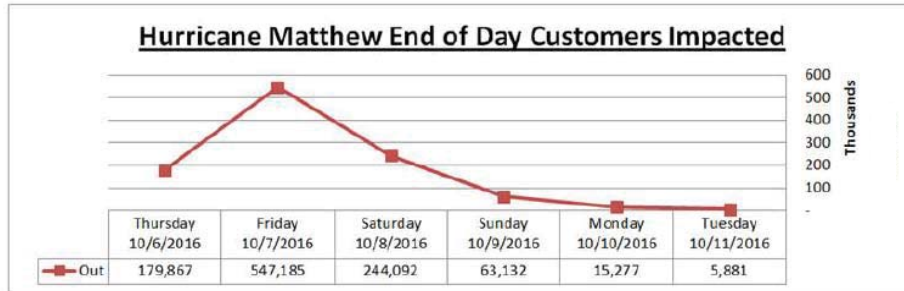
- Final Pre Landfall estimate:
 - 1.2 – 1.5M CI
 - 196k – 214k CMH
 - 201 Distribution Poles
 - 41 Transmission Line Sections
 - 16 Substations





Customers Impacted

Initial post landfall summary: 1.185M customers impacted



Actual Damage

Customers interrupted: 1.185M

The transmission structures which are built to extreme wind load performed as designed and expected with no reported failures. Trees falling from outside the right of way caused 39 transmission line section outages. All other FPL pole types performed as designed and expected for the storms intensity. The site counts indicate just 408 poles were replaced. These impacts were caused by a mix of tree conditions and flying debris. No decayed FPL poles were reported.

Transmission:

- 39 Transmission Line Sections Impacted
- 22 Substations
- 9 tree damage to line section
- 1 substation de-energized for flooding

Distribution:

- 408 Poles
- 757 Feeders Interrupted
- 3800 Laterals
- 11K Total Tickets





Resources

Field Resources:

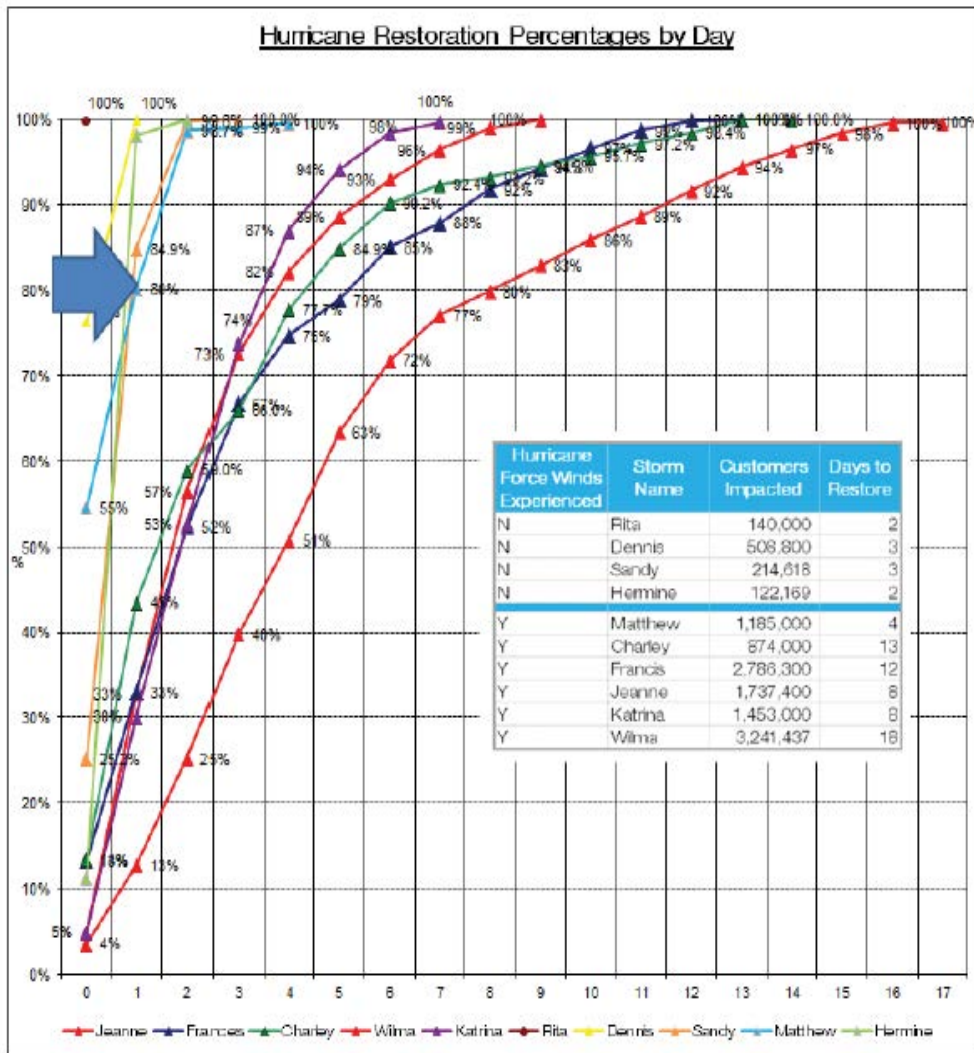
Resources	FPL	In-State Contractor	External Resources		Total
			On Site	Committed	
Line - DIST	921	1,052	3,152		5,125
Underground	82	350	-	-	432
SL/INV	-	150	-	-	150
Vegetation	-	1,049	1,984	-	3,033
Sub Total	1,003	2,601	5,136	-	8,740
Line - T/S	86	227	-	-	313
SUBST Electrician	120	126	-	-	246
P&C Eng.	80	66	-	-	146
<i>Total</i>	1,289	3,020	5,136	-	9,445



Hurricane Matthew

Restoration

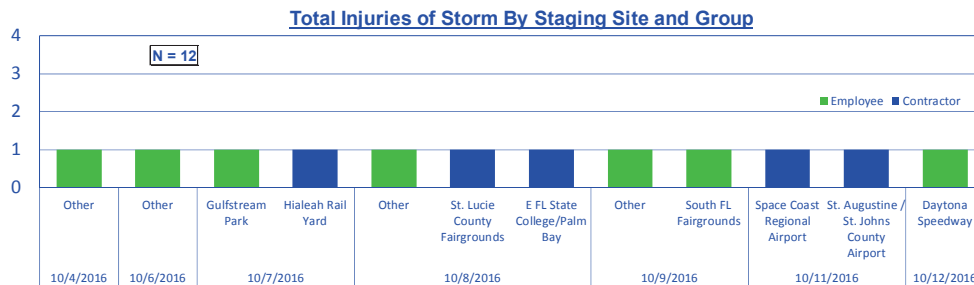
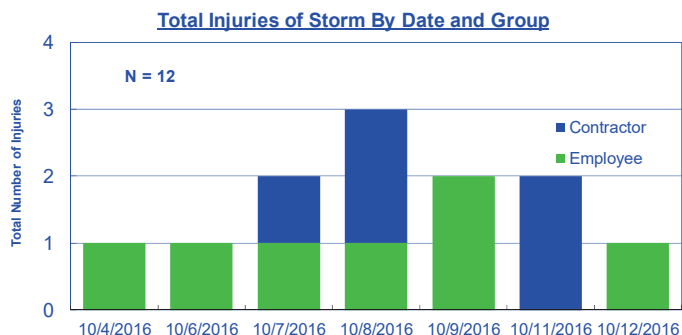
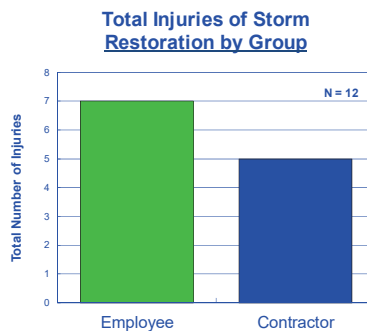
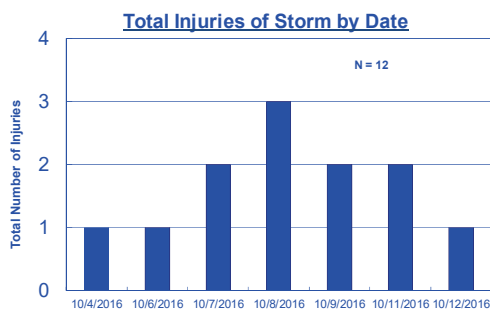
From the restoration curve for this event (below) we see that our hardening efforts are paying off. During the first days of the restoration effort with the hardened feeders we were able to restore 98.7% of our customers within 2 days. However, the back end slope is considerably flatter (and similar to historical storms) which points at opportunities to improve our execution on restoration of the single customer outages.





Safety

NextEra Energy Hurricane Matthew Restoration - Safety Performance 10/14/2016





Prior Storms Comparison

	Charley	Frances	Jeanne	Wilma	Matthew
Customers Interrupted	874,000	2,786,300	1,737,400	3,241,437	1,185,000
Pole Counts	6,878	3,757	2,227	12,419	408
Pre-Landfall Estimated CMH	220,936	531,642	1,017,043	2,059,754	214,000
Actual Applied CMH	450,328	511,670	374,664	1,317,767	230-260k

Utility Comparison

The chart below compares the utility impacts from Hurricane Matthew. It contrasts the performance of the systems and restoration efforts. Note that Matthew's highest recorded winds were felt at Cape Canaveral.

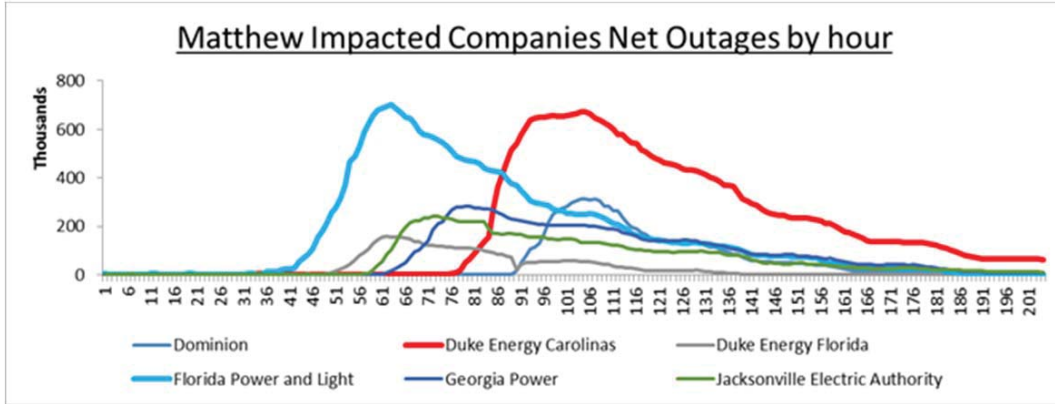
	FPL	Dominion	Duke Carolinas	Duke Florida	Georgia Power	JEA
Intensity of Direct Storm Impacts	Cat 2 - 3	Cat 1	Cat 1	TS - Cat 1	Cat 2	Cat 2 - 3
Total Reported Customers Impacted	1,185,000	462,000	1,100,000	300,000	342,000	253,725
Peak Outages	699,586	313,843	671,389	157,484	283,649	240,720
Days to restore 90% of Customers	2	3	5	3	4	5
Essentially Restored	4	5	Website indicates essentially restored at day 5 with 60k customers still showing out. Restore map still indicates assessing damage in some areas - they have significant flooding in some areas	4	5	8
Customers Served	4,800,000	2,000,000	4,000,000	1,700,000	2,250,000	447,000
Percent of customers Impacted by Matthew	25%	23%	28%	18%	15%	54%

*The data used above is information that is publicly sourced through subscription. FPL data would have been the data available through the power tracker website; we did not change any data sources in order to be consistent with the other utilities comparisons.



Hurricane Matthew

The line graph below is an indication of restoration progress using the net outages by hour for each company on the overall storm timeline.





Transmission Performance

Overall transmission performance was very good during the storm event. Equipment and conductor damage was minimal. System protection operated as expected with only one known missed-operation at this time. 2 breaker events were reported. TELCO Communications were lost at 7 stations and 5 stations lost wireless communications.

35 Transmission lines experienced 123 relay operations

39 line sections were isolated

22 Substations outages

75 BES Operations w/ 1 known missed operation at Mill Creek

Damage

0 poles down

3 phases down

1 guy wire broken

2 OHGW down

1 pole base eroded by wave action





Transmission Performance

One transmission pole was replaced due to wave action washing out the foundation

This event did not cause an interruption





Transmission Performance

39 line sections were isolated during the storm

Lines were patrolled after the storm

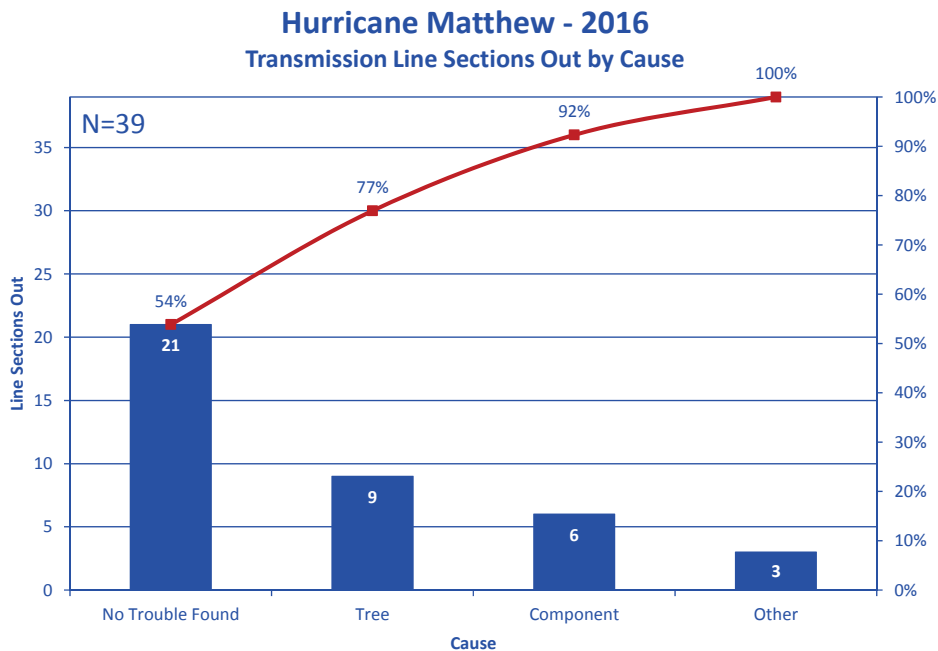
These are typically caused by vegetation and wind blown debris

Component Failures

3 phases down, 2 due to OHGW failure, 1 guy wire

2 sections de-energized to isolate St Augustine substation due to flooding

1 section de-energized to isolate a fault on a different line section due to loss of communication to a substation





Transmission Performance P&C

FPL Bulk Electric System (BES)

Experienced a total of 75 BES operations with 8 single end trips are currently under investigation as potential missed operations

BES Operations – Completed Investigations

Millcreek-Sampson 230kV Transmission Line Fault (Root Cause = High Impedance Fault)

Millcreek Line Panel failed to trip for line fault

Correct Operation – Microprocessor relays not set to trip for this high impedance fault

Remote clearing at St. Johns – Matanzas terminal

Correct Operation – Settings were verified that relay would trip for this high impedance fault

Lighthouse – Single End Trip

North Cape Terminal tripped at Lighthouse for a fault on the Delta to 624A line

Correct Operation-Slow SF6 breaker at Delta – 6W95 (Root Cause = Mechanism Lubrication)

Ormond - Breaker Failure Lockout Trip

Correct Operation - Slow oil breaker 6W84 (Root Cause = Mechanical Issue)

Event #	IR #	Time Start	Time Stop	Station	Station	KV	Notes
9	10386	10/7/16 1:32 AM	10/7/16 1:34 AM	Emerson	West	138	Single end at West
10	10387	10/7/16 1:36 AM	10/7/16 10:33 AM	Emerson	West	138	Single end at West
19	10459	10/7/16 5:39 AM	10/7/16 5:39 AM	Barna	C-5	115	Single end trip at C-5 during Cocoa Beach-South Cape relay
22	10460	10/7/16 6:06 AM	10/7/16 6:06 AM	Daytona	Volusia 1	115	Single End Trip at Daytona during Ormond /Volusia Line relay
26	10462	10/7/16 6:52 AM	10/7/16 6:52 AM	Barna	C-5	115	Single end trip during Lighthouse - North Cape line relay
28	10405	10/7/16 6:57 AM	10/7/16 6:57 AM	Norris	Volusia	230	Single end trip during Norris / Geneva
34	10413	10/7/16 7:42 AM	10/7/16 7:42 AM	Barna	C-5	115	Single end trip during Delta/624A relay
38	10464	10/7/16 8:18 AM	10/7/16 8:18 AM	Eau Gallie	Patrick	138	Single end Trip at Eau Gallie during the Cocoa Beach/Patrick line relay. Dairy/Holland park was isolate prior to this even with Indian Harbor N.O. closed



Millcreek Event

The Millcreek-Sampson 230kV Transmission Line experienced a fault during Matthew resulting in an impact to 8 distribution substations.

Millcreek-Sampson 230kV Transmission Line Fault

Millcreek Line Panel failed to trip for line fault

Remote clearing at St. Johns – Matanzas terminal

Removes feed from Pellicer – Matanzas– St. Johns 115kV

Line sections already open at time of event

Putnam – Tocoï 230kV line

Gator – St Augustine – Kacie 115kV

Durbin – Tolomato 115kV line section

Hastings – Elkton 115kV line section

Stations de-energized when line relayed at St. Johns

Gator, Riverton, Kacie, Durbin, Lewis, Tolomato, Elkton, Orangedale



Substation Performance

Overall substation performance was very good during the storm event. Equipment damage was minimal with the exception of the flood damaged equipment at St. Augustine. Even in this case the system flood monitoring performed as expected and in a fashion to minimize damage and speed restoration. System protection operated as expected. 2 breaker events were reported. TELCO Communications were lost at 7 stations and 5 stations lost wireless communications. 6 stations experienced battery loss due to extended outages. Eight (8) stations were impacted by transmission operations.

22 substations were out of service

7 substations experienced transformer lock outs

St. Augustine substation experienced flooding and was de-energized

Damage was contained to the switch motor operators

2 line switches were impacted

2 transformer circuit switcher were impacted





Substation Performance

Outage Summary

Substation	Area	County	Customer Count	Date De-energized	Date Energized	Hours	Cause
Banana River	Central	Brevard	1	10/7/2016 08:33:53	10/7/2016 14:35:33	6	Lost Communications
Crescent City	North	Putnam	1,979	10/7/2016 15:04:27	10/7/2016 16:11:13	1.1	Transmission
Delta	Central	Brevard	1	10/7/2016 14:47:00	10/7/2016 14:50:36	0.1	Transmission
Durbin	North	St Johns	4,753	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
Edgewater	North	Volusia	13,843	10/7/2016 06:36:49	10/7/2016 19:17:14	12.7	Transmission
Fleming	North	Volusia	7,334	10/7/2016 6:09:06	10/7/2016 8:38:18	2.5	Transmission Breaker Issue
				10/7/2016 11:32:12	10/7/2016 18:06:50	6.5	Transmission
Gator	North	St Johns	4,703	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
Hammond	North	Putnam	1	10/7/2016 15:04:27	10/7/2016 16:11:13	1.1	Transmission
Holland Park	Central	Brevard	5,424	10/7/2016 03:04:11	10/7/2016 11:40:18	8.6	Line Switch Motor Operator Issue
Kacie	North	St Johns	4,932	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
Lewis	North	St Johns	10,141	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
Mills	North	Nassau	5,688	10/7/2016 18:56:55	10/08/2016 03:38:32	8.67	Transmission
North Cape	Central	Brevard	1	10/7/2016 14:47:00	10/7/2016 14:50:36	0.1	Transmission
Orangedale	North	St Johns	10,236	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
							Transmission Breaker Failure
Ormond	North	Volusia	11,990	10/7/2016 6:06:52	10/7/2016 8:38:16	2.5	Transmission Breaker Failure
Riverton	North	St Johns	3,811	10/7/2016 19:07:58	10/7/2016 19:24:56	0.3	Transmission
Slag	Central	Brevard	1	10/7/2016 05:54:59	10/7/2016 17:36:22	11.7	Transmission
Spruce	North	Volusia	11,459	10/7/2016 06:36:49	10/7/2016 23:04:30	16.5	Transmission
St Augustine	North	St Johns	6,488	10/7/2016 12:53:05	10/8/2016 14:37:36	25.7	Flooding
Wright	North	Volusia	5,019	10/7/2016 13:00:34	10/7/2016 19:32:46	6.5	Transmission

Summary of Substation Outages

19-Transmission Issues

1-Equipment Issue

1-Flooding

1-Other



Substation Performance

Transformer Events

7 transformer locked-out Events:

5 feeder breaker failures

1 transformer to ground fault (GIT) - Cause unknown

1 overcurrent relay trip – Cause Unknown, under investigation

6 transformer Alarm Events:

4 gas alarms – 2 loss of Cooling

Regulator Events

1 GIR Event

1 Derby regulator experienced a GIR target, no trouble found by regulator tests, P&C will investigate

Distribution Breaker Events

7 breaker Failures

6 breakers failed and were replaced due to water intrusion in the high voltage compartment

(Aurora 3 breakers, Verena, Sistrunk, and St Augustine)

1 breaker failed due to motor issues in the low voltage compartment (Holly Hill)

Transmission Breaker Events

2 transmission breaker events

Delta 6W95 slow breaker – lubrication cleaned

Ormond 6W84 slow breaker – trip coil replaced



St. Augustine Case Study

St Augustine station flood monitor warning alarmed at 12:19 pm on 10/7

Station flood monitor emergency alarmed shortly after at 12:34 pm

System Operations de-energized substation around 12:53 pm

Only one feeder was in-service at the time of this event

Both outdoor flood monitor alarms cleared at 1:28 pm

Relay vault was not impacted

Both operating busses were energized at 14:37 on 10/8





St. Augustine Case Study

Flooding level was significant

Damage was contained to the switch motor operators

2 line switches were impacted

2 transformer circuit switches were impacted

Fault bus current transformer schemes (Transformer, Feeders, Regulators)





Distribution Performance

The investments in the distribution hardening program, pole inspection program (PIP) and smart grid have helped reduce the number and severity of outages during hurricane Matthew.

FPL's pole down count for Matthew is 408, primarily due to fallen trees. This is significantly better than previous storms. For comparison, the number of poles down for the storms in 2004 and 2005 were as follows: Charlie - 6,878; Francis - 3,757; Jeanne - 2,227; Wilma - 12,419. No poles were down on hardened feeders

The benefit of having less severe damage is evident in the faster restoration performance. Within two days of Matthew's departure from the Florida coast, FPL had restored power to 98.7% of the more than 1 million customers.

FPL's investments in the smart grid also were of benefit to FPL customers. More than 118K customers avoided an interruption as a result of FPL's automated feeder switch fleet.



Kacie Feeder Case Study

Below are pictures and a brief analysis of the concentration of pole failures on the 7.4 mile long non-harden Feeder 3742 in St. John's County. Estimated winds were approximately 65-75 mph in this location between 11am and 3pm. The poles experienced excessive loads due to trees in the lines which caused these poles to fail; they didn't fail directly because of wind.

Poles down on Wildwood Drive

There were 13 broken poles on Wildwood Drive (3.7mi). The majority of the poles were 40ft Class 3 wood poles in good condition that broke approximately 1/3 to 1/2 from the top of the pole; they were last inspected in 2015 with no strength or other rejects found. The poles broke due to large trees falling into the line. Distribution poles are naturally tapered, so it is not uncommon to have the point of maximum stress (and failure) 5ft or more above ground line for overloaded conditions (such as trees or debris in the lines), these poles broke even higher due to several factors. When a tree falls on a line, the wire experiences a sudden and very large increase in tension force in that span of wire. With the steel cross arm and triangular framing that we have on this line, these forces are transferred to the very tip of the pole. The foreign utility and guy wire attachments lower down on the pole can both restrain the pole and, like the ground, transfer some of the load from the pole. This restraint can move up the point of maximum stress (and thus failure) higher up the pole. The majority of these poles failed just above the foreign utility or guy wire. Internal defects in the pole (knots, etc.) can also cause the maximum stress location to change.





Kacie Feeder Case Study

Rail Road Crossing

Two tall wood poles over a railroad crossing were both broken; east pole very close the top of the pole and west pole near the attachments near the top 1/3 of the pole. Both poles were creosote of unknown age. Inspection of these poles show they failed near the top due to trees falling on the line and the weakness at the aged top of pole when under the impact loads of trees falling on the lines and other poles failing.



IntelliRupter Pole

One square concrete pole supported an IntelliRupter AFS switch. The IntelliRupter was damaged as a result of a pine tree falling into the feeder line and will be replaced. The concrete pole itself was not damaged and will remain in service. When the pine tree fell on the feeder lines, several of the line insulators and dead end insulators broke apart, and fell to the ground. The IntelliRupter support hardware was bent by the force, damaging the components shown. The switch will need to be replaced.



Maytown Road Lateral Case Study

The non-hardened lateral along Maytown Road through the Turnbull Hammock Conservation Area in Volusia County was seriously impacted by Hurricane Matthew on October 07, 2016. The preliminary estimated winds were around 55-65 mph and occurred between 9am and 6pm. The poles and wires experienced excessive loads due to trees in the lines or adjacent pole failures. The poles did not fail due to excessive wind.

Numerous sections of wire were down, 3 poles were broken, and 24 poles had severe leaning along the three mile section of Maytown Road. The restoration effort required five poles which were replaced with stronger poles set deeper, FPL wire down and other damage was repaired and restored. Pull-offs and services to homes were restored as quickly as possible. The line section was re-energized at approximately 6:30am on October 12, 2016.

The failed poles were 40ft Class 4 or 5 wood poles. Two were owned by AT&T and one was owned by FPL. The line was last inspected in 2011.

The poles that were leaning the most had soft soil foundations. The rain from Hurricane Matthew saturated the soils so that the foundations failed before the poles did when the trees came down and broke the wire.





Maytown Road Lateral Case Study

The poles that failed had varying factors that caused the failure. All failed at or just above ground line. The root cause of the pole failures were the tree failures.

The AT&T pole with a pull-off to a home failed due to trees coming down on the lateral and on the pull-off to the home.

One AT&T pole that failed was in process of being replaced. The new pole had been installed and some but not all utilities had transferred their attachments to the new pole. The new pole did not fail. The old pole failed; it had significant ground line corrosion and had been reinforced

The FPL pole failed in-line due to being pulled along the line when wire broke due to tree failures. This pole was in good condition and broke just above ground line as would be expected.

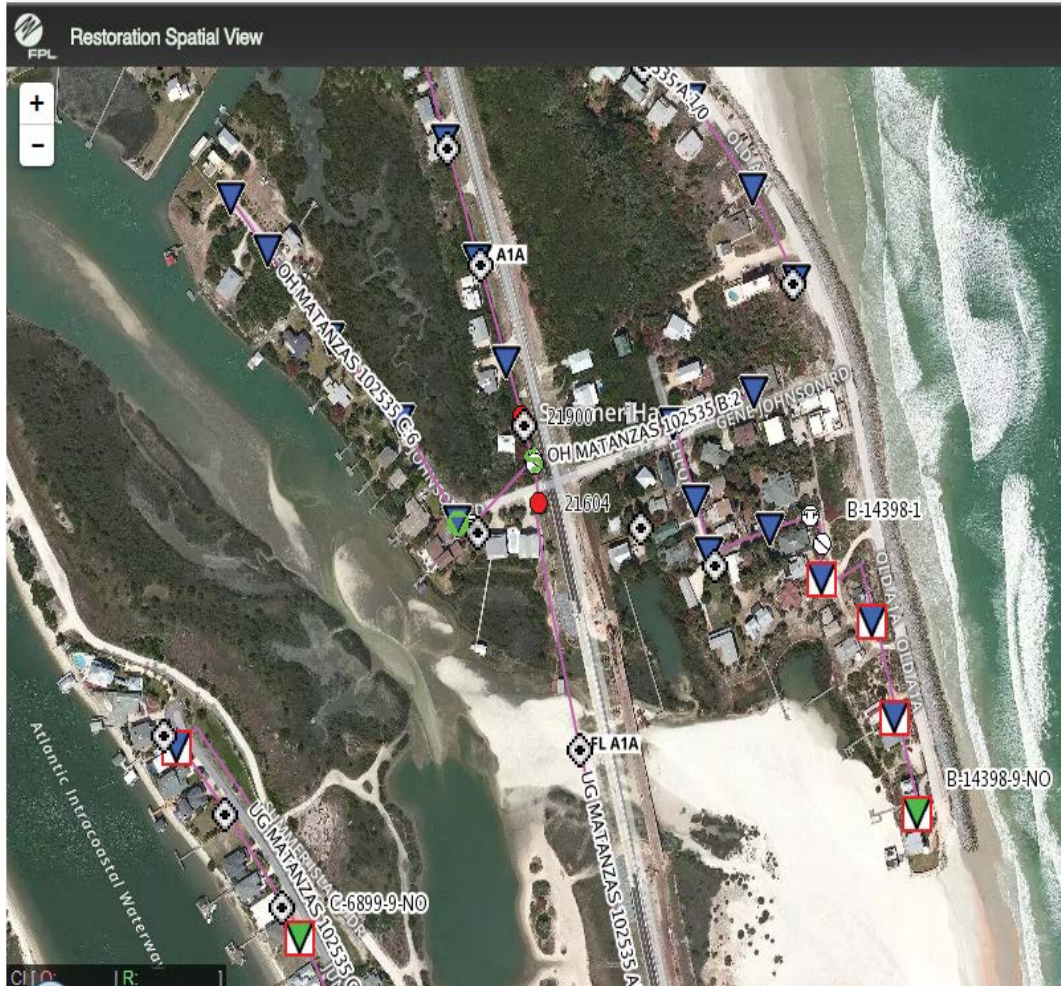
Overall, the structures performed well given the loading placed on them by the tree failures.





Matanzas Inlet Case Study

Matanzas Inlet is located just south of St. Augustine. The pad mounted equipment experienced severe effects of waves and scouring which resulted in the catastrophic failures of the equipment shown below. This type of failure can lead to extended restoration times.





Matanzas Inlet Case Study





Riverton Feeder Case Study

Riverton 5761 experienced heavy winds and related tree damage. There were 4 areas each with multiple spans of Hendrix cable down or broken, 4 damaged/down poles (veg related), 20+ locations of vegetation and ~5 locations of broken Hendrix brackets/spacers. 12 line crews were engaged (around 50 line personnel from three different companies) and a sufficient amount of vegetation crews. This case is on SR 13 - scenic road along the St. John's River





Forensics Performance

Broken poles

Hardened Feeder	0
Non Hardened Poles	408
FPL poles	294*
ATT poles	114*

**Based on the following pole sampling from staging sites:*

Site	FPL Poles	ATT Poles	Total Poles	% ATT
St Augustine	23	4	27	15%
Daytona	6	7	13	54%
Total	29	11	40	28%

East Coast	800,000	200,000	1,000,000	20%
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Number of Lateral outages

Total number of lateral outages	= 3807
Re-fuse Percentage	= 32.4%

Transmissions & Substations

There was minimal forensic damage investigation required for T&S during this storm event. The majority of activity centered on the St. Augustine Substation detailed in other portions of this report.

Conclusion

Hardened feeders performed as expected with no poles down. There was pole damage related to direct tree strikes. For this event Hardened feeders performed statistically better than non-Hardened feeders.



Distribution Forensics Background

FPL's Storm Forensic Organization was formed after the 2004-2005 active storm seasons to help evaluate Distribution infrastructure performance during extreme wind weather events.

The data collected serves to meet FPL commitments to the FPSC which include annual summary reporting of infrastructure performance during hurricane events. The field forensic teams were created to investigate affected areas and collect damage information to analyze performance of:

Hardened Feeders

Overhead Feeders

Overhead vs. Underground Laterals

Note: Forensic investigations exclude locations under safety, property damage or other special investigation team.

Matthew Activation

Based on the projected path and intensity of Matthew the Forensics Team was pre-activated but not pre-positioned to perform investigations in the affected areas. When the storm passed but prior to dissipation the team was directed to the most affected areas and data was collected by the team. All Hardened feeders impacted and not related to substation outages were patrolled.

Hardened Feeders

The primary objective of hardening is to reduce restoration times by minimizing the number of pole failures during extreme wind weather events. Pole failures typically lead to extended restoration times and longer outages. As a result, FPL forensic investigators use pole failure rates as the primary measurement criteria to evaluate performance of hardened vs. non-hardened feeders within the impacted areas. Feeder field forensic data was collected to conduct root cause analysis and failure mode of previously hardened feeders that locked out during the storm. Data used for analysis was provided by TCMS.

Overhead Feeders

Investigation of selected overhead feeders impacted by extreme wind events is an annual reporting requirement to the FPSC. Inspection locations are defined based on selected routes within the path of the storm. The objective of inspections is to collect sample data on selected feeder locations in order to evaluate infrastructure performance during extreme wind events.

Field data from ESDA patrols, TCMS and other sources will be utilized.

Overhead vs. Underground Performance



The investigation and performance of overhead vs. underground infrastructure during extreme wind events is an annual reporting requirement to the FPSC. Forensic investigators examine selected underground or overhead lateral facilities that were affected within the path of the storm. The objective of these inspections is to collect sample data from overhead or underground damage locations in order to evaluate and compare infrastructure performance of overhead and underground facilities during extreme wind event.

Field data from ESDA patrols, TCMS and other sources will be utilized.

Defining Storm Affected Areas

The emergency preparedness department performs the storm tracking activities from forecast to actual storm path. This information is available to the GIS group Technology Coordinator and is used to identify the storm affected area. Prior to a storm event, the Forensic Leads and the Technology Coordinator will be in close contact to execute the below plan based on the latest possible forecast or pre-storm plan. After the storm has passed, the Forensics Team executes the pre-storm plan unless the actual event was significantly different; at which time a new plan based on the actual storm path will be developed.

During Matthew, the affected areas encompassed FPL's Dade, East, North and West Regions in the following Management Areas: Central Dade, North Dade, South Dade, West Dade; Boca Raton, Central Broward, North Broward, South Broward, West Palm; Brevard, Central Florida, North Florida and Treasure Coast; and Manasota, Naples, Toledo Blade.



System Performance

Hardened Feeders

Forecast

The up to 107 mph winds experienced during Matthew slightly exceeded some of the extreme wind zone ratings of 105-145 mph within the affected areas. Based on these wind speeds, minimal to modest pole and equipment damage was expected during this event as a result of wind.

Statistical Comparison

For this event Hardened feeders performed 31.6% better than non-hardened feeders

(See Statistical analysis below)

Conclusions

Hardened feeders performed as expected with no pole damage.

Data shows there was a statistical difference in performance between hardened and non-hardened feeder outages.

Random Overhead Feeders

Forecast

Based on the wind speeds projected during Matthew, moderate pole damage was expected during this event as a result of tress and flying debris.

Interruption Summary of Affected Area

Non-Hardened Feeders 280 of 2031 (13.4%)

Forensic Analysis

No Random Overhead Feeder field analysis was performed during Matthew.



Overhead vs. Underground Performance

Based on the wind speeds experienced, minimal to moderate pole damage was expected during this event as a result of wind driven debris.

Forensic Analysis

Statistical Overhead vs. Underground Performance field analysis was performed.

Forensics Performance

Pole Performance

With formal deployment of the Overhead vs. Underground Performance Forensics, there is a valid sample to determine performance.

The winds experienced during Matthew were less than the NESC 250 C and NESC 250 B construction standards. Based on these wind speeds, minimal pole damage was expected during this event as a result of wind.

Conclusions

The System performed as expected with minimal pole and equipment damage. The damage reported was related primarily to vegetation.

Recommendations

Continue follow up work through Pole Inspection.

Smart Grid

AFS device availability was reduced during Matthew.

No Smart Grid Device damage exceptions occurred on the Hardened Feeders during the patrols

AFS Performance noted below:

- o 118K Customer Interruptions avoided during the storm
- o 90% Overall availability

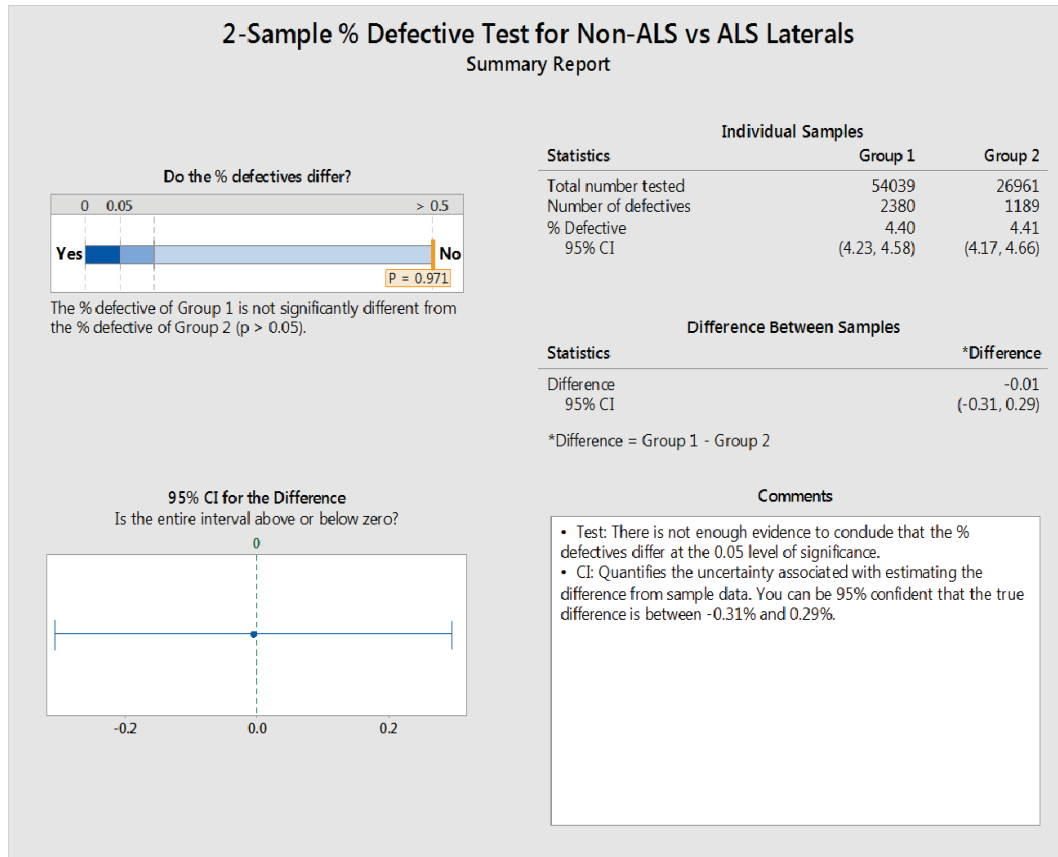
ALS Performance noted below:

- o ALS Laterals did not perform statistically better than Non-ALS Laterals



Forensics Performance

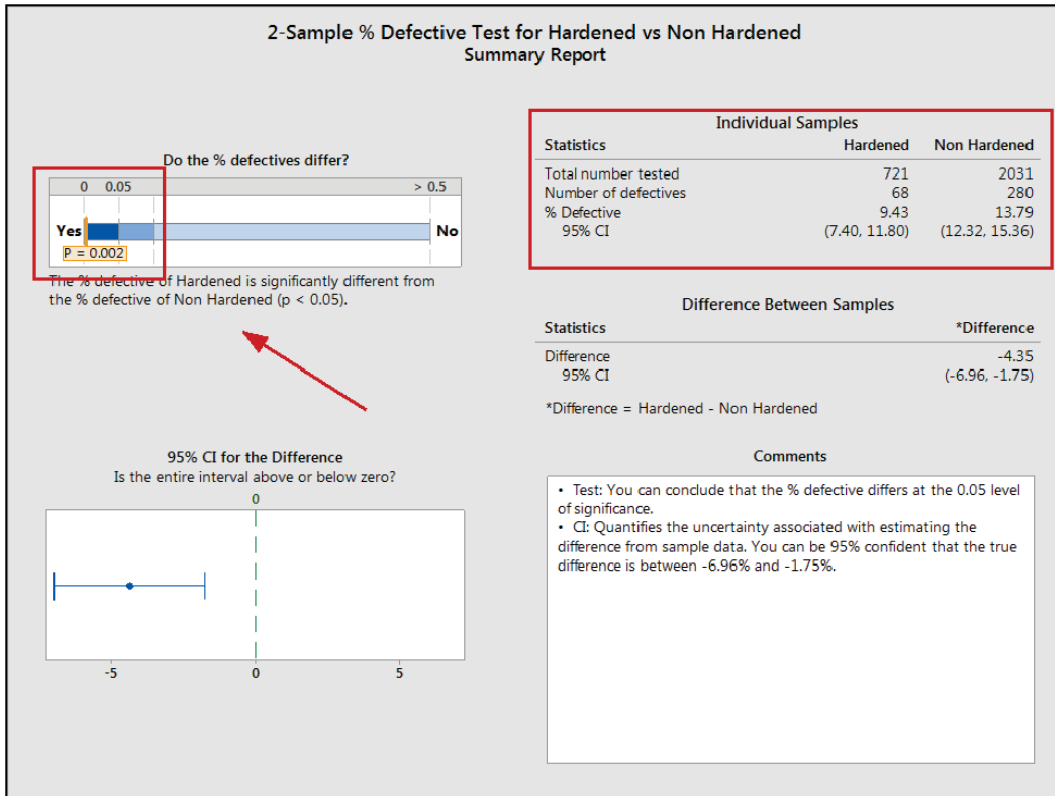
Statistical Analysis





Forensics Performance

Statistical Analysis





Weather

Hurricane Matthew Update

Issued: Wednesday, October 5, 2016 at 02:00pm EDT

New:

- Landfall chances in the Cape Canaveral area have increased.
- A Hurricane Warning is in effect for areas from North of Golden Beach to the Flagler/Volusia county line (Broward County northward through Volusia County along the east coast), including Lake Okeechobee.
- A Hurricane Watch is in effect from the Flagler/Volusia county line to Fernandina Beach (northern Flagler County northward through Nassau along the east coast).
- A Tropical Storm Warning is in effect from Golden Beach southward along the Florida east coast (Miami/Dade County) and then northward along the Florida west coast to Chokoloskee including Florida Bay.

Discussion:

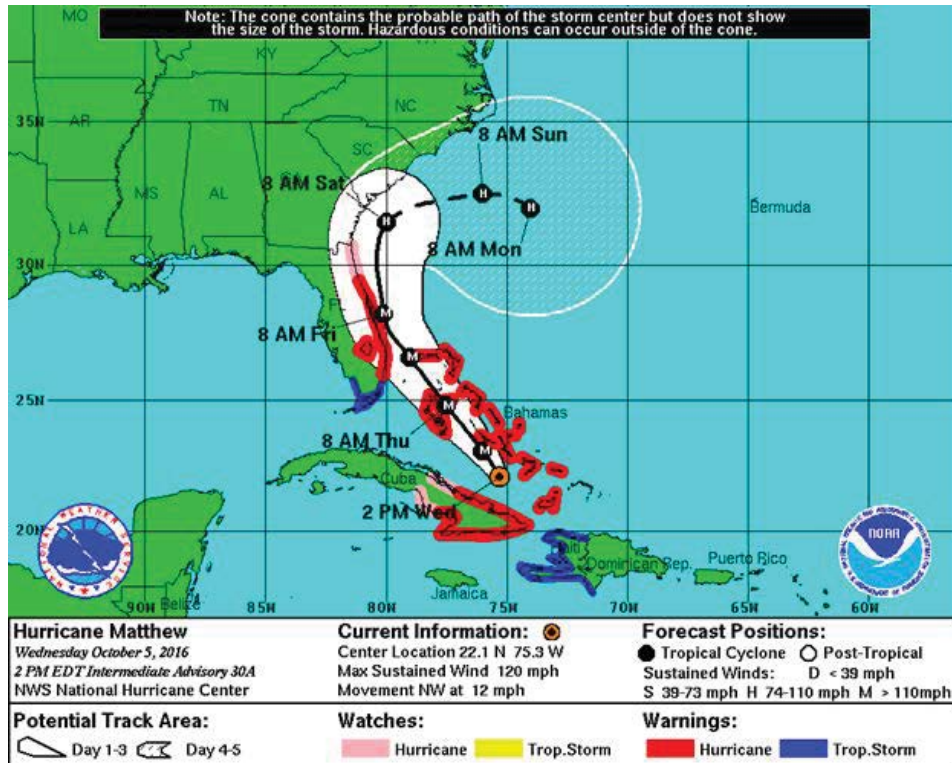
- Hurricane Matthew is located about 70 miles south of Long Island Bahamas or about 400 miles southeast of Miami.
- Maximum sustained winds are near 120 mph with higher gusts. Matthew is a category 3 hurricane on the Saffir-Simpson Hurricane Wind Scale. Some strengthening is forecast during the next couple of days, and Matthew is expected to remain at category 3 or stronger while it moves through the Bahamas and approaches the east coast of Florida.
- Matthew is moving toward the northwest near 12 mph, and this motion is expected to continue during the next 24 to 48 hours. On this track, Matthew will be moving across the Bahamas today and tomorrow, and is expected to be very near the east coast of Florida by Thursday evening.
- Hurricane force winds extend outward up to 45 miles from the center and tropical storm force winds extend outward up to 175 miles from the center.
- When a hurricane is forecast to take a track roughly parallel to a coastline, as Matthew is forecast to do near Florida, it becomes very difficult to estimate impacts this far in advance. For example, only a small deviation of the track to the left of the forecast could bring the core of a major hurricane onshore, while a small deviation to the right could keep all of the hurricane force winds offshore. It will likely take another day for the potential impacts of Matthew in Florida to clarify. Currently, the model consensus points toward a solution of a forecast track through the Bahamas and then land falling Matthew near Cape Canaveral on Friday morning.
- Matthew remains a potentially dangerous storm for the Florida peninsula. Tropical cyclone impact timing is forecast to be between Thursday and Friday with outer bands probably reaching the peninsula late tonight or early Thursday morning. Assuming



Hurricane Matthew

Weather

Matthew remains just off the Florida east coast, sustained winds of 55-90 mph with gusts to 110 mph are possible with the stronger bands along the Florida east coast during the period. If Matthew landfalls in Florida then stronger winds are likely near the land falling area.





Weather

Hurricane Matthew Update

Issued: Friday, October 7, 2016 at 02:00pm EDT

- Matthew is tracking near the Florida east coast from Volusia County northward through today.
- A Hurricane Warning is in effect from Cocoa Beach northward along the east coast.
- A Tropical Storm Warning is in effect from Sebastian Inlet to Cocoa Beach.

Discussion:

- Hurricane Matthew is located about 60 miles southeast of Jacksonville Beach.
- Maximum sustained winds are near 115 mph with higher gusts. Matthew is a category 3 hurricane on the Saffir-Simpson Hurricane Wind Scale. Although weakening is forecast during the next 48 hours, Matthew is expected to remain a hurricane until it begins to move away from the United States on Sunday.
- Matthew is moving toward the north northwest near 12 mph, and this general motion is expected to continue today. A turn toward the north is expected tonight or Saturday. On this forecast track, the center of Matthew will continue to move near or over the coast of northeast Florida and Georgia through tonight, and near or over the coast of South Carolina on Saturday.
- Hurricane force winds extend outward up to 60 miles from the center and tropical storm force winds extend outward up to 185 miles from the center.
- Matthew will continue to track near the Florida east coast today. When a hurricane is forecast to take a track roughly parallel to a coastline, as Matthew is forecast to do along the Florida east coast, it becomes very difficult to specify impacts at any one location. Only a small deviation of the track to the west of the forecast could bring the core of a major hurricane onshore within the hurricane warning area in Florida. Modest deviations to the east could keep much of the hurricane-force winds offshore.
- Storm surge of generally 1-3 feet with isolated 6 foot surges possible from Merritt Island northward remains possible today.



Hurricane Matthew

Weather





Appendix

1. Restoration Guidance

Matthew Restoration Guidance

(October 6, 2016)

Objective:

The purpose of the Matthew Restoration Guidance is to expedite restoration of service to largest number of customers while minimizing rework and providing the highest possible level of safety.

Approach:

The overall approach contains 3 steps.

- Restore feeders to one feeder switch beyond where a significant number of customers can be energized on laterals.
- Restore laterals with moderate lengths up to ~2000' which can be completed relatively quickly with a reasonable amount of work.
- Continue along the feeder / lateral by line section to restore the highest number of customers able to accept power for the effort expended.
 - a. Customers unable to safely accept power should have their service made safe and if the service is down, coiled and left on the pole.

Poles, Framing and Fusing:

- Poles should be installed as close as possible, or in their existing location, match or exceed the existing pole class and be of the same height. Class 2 is the minimum pole class for feeders. Class 3 for laterals. Observe setting depths requirements by class.
- Conductor should match or if not possible exceed the size of the existing conductor. Conductor is 568 minimum for feeders and 1/0A for laterals.
- Framing should be modified vertical E-5.0.0 for accessible areas and Crossarm I-46.0.0 for inaccessible areas. See page 25 and 33-44 of the restoration guidebook for details. If these standards cannot be met it is acceptable to match the existing framing.
- Open wire secondary should be reused or replaced with service wire if it will speed the restoration.



- Fusing should follow the I-19.0.0 guidelines on page 29 of the restoration guidebook for transformers. If ALS is not available then lateral fusing should be 65KS for OH and 65-80K for underground. DO NOT OVERFUSE.

End of Report

QUESTION:

For Hurricanes Hermine, Matthew, Irma, Maria, and Nate, please provide the name, frequency, and description of non-Emergency Operations Centers related coordination efforts with local governments before, during, and after restoration, including the following.

- a. Storm preparation
- b. Critical infrastructure
- c. Tree trimming, planting or relocation of trees
- d. Hardening and underground projects
- e. Shared facilities
- f. Other

RESPONSE:

Outside of the extensive Emergency Operations Center functions, Customer Service (CS) and External Affairs (EA) employees meet with county emergency management leadership on an annual basis to review storm plans and allow the counties to designate critical infrastructure functions.

On a regular, daily basis, EA managers and CS advisors work with local officials and governmental customers to address a wide variety of interests and issues related to electric service. Because these communications occur so frequently and take place in the normal course of work performed by FPL employees, the Company does not keep records identifying the particular subjects addressed, the name or names of the customers with whom EA managers and CS advisors interact, or the dates or frequency with which these communications occur. Many of the issues addressed in these ongoing communications have storm preparation and restoration implications, including but not limited to under grounding, hardening of FPL's facilities, vegetation management, "Right Tree Right Place" principles, and preparations for possible outage events.

During a storm event, EA managers also serve as a conduit for local elected stakeholders to provide feedback and input to restoration efforts. These communications include requests for information and requests for action.

Following restoration, these communications shift to provide lessons learned that may help the local governments to prepare for future weather events. Additionally, following restoration post-Hurricane Irma, FPL EA Managers and CS advisors have made a number of presentations to local governmental entities addressing storm preparations, critical infrastructure functions, vegetation management, hardening and underground projects, and other matters related to preparation and restoration activities.

QUESTION:

Please complete the following tables on county and state Emergency Operations Centers staffing for Hurricanes Hermine, Matthew, Irma, Maria, and Nate.

Staffing for County Emergency Operations Centers		
Number of Utility Personnel	Function	Total Man-Hours

Staffing for State Emergency Operations Center		
Number of Utility Personnel	Function	Total Man-Hours

RESPONSE:

Staffing for County Emergency Operations Centers (EOC)		
Number of Utility Personnel	Function	Total Man-Hours
11	EOC Rep (Hermine)	265
47	EOC Rep (Matthew)	2,159
51	EOC Rep (Irma)	7,426

Staffing for State Emergency Operations Center (SEOC)		
Number of Utility Personnel	Function	Total Man-Hours
1	SEOC/ESF 12 Rep (Hermine)	12
2	SEOC/ESF 12 Rep (Matthew)	184
4	SEOC/ESF 12 Rep (Irma)	299

The Emergency Operations Centers were not staffed for Hurricanes Nate (limited impact and quick restoration) or Maria (did not impact FPL).

QUESTION:

Please provide the following information for utility interconnections with customer-owned solar generation that did not operate as designed and consistent with the tariff during the extreme weather events that occurred in 2015 through 2017.

- a. The number of failures.
- b. A description of the cause or causes of such failures.
- c. Possible failure remediation and associated cost.
- d. Discuss whether the failures contributed to an increase or decrease in the utility's service restoration time and, if possible, provide an estimate of the duration impact.
- e. Discuss whether the failures contributed to an increase or decrease in the utility's service restoration costs and, if possible, provide an estimate of the restoration cost impact.

RESPONSE:

- a. FPL has no direct knowledge of the number of failures, if any, of customer-owned solar generation as the Company does not have any direct monitoring equipment on customer-owned solar generation.
- b. FPL has no direct knowledge of the cause or causes of failures associated with customer-owned solar generation.
- c. Because FPL has no direct knowledge of the cause or causes of failures associated with customer-owned solar generation, the Company is not able to address possible failure remediation or associated cost.
- d. Customer-owned solar generation had no impact on FPL's restoration time. Our restoration process does not include any separate or unique processes for restoration of customers who have customer-owned solar generation.
- e. Customer-owned solar generation had no impact on FPL's restoration costs. Our restoration process does not include any separate or unique processes for restoration of customers who have customer-owned solar generation.

QUESTION:

Please provide the following information for utility interconnections with customer-owned solar generation that operated as designed and consistent with the tariff during the extreme weather events that occurred in 2015 through 2017.

- a) Discuss whether these interconnections contributed to an increase or decrease in the utility's service restoration time and, if possible, provide an estimate of the duration impact.
- b. Discuss whether these interconnections increased or decreased the utility's service restoration costs and, if possible, provide an estimate of the restoration cost impact.

RESPONSE:

- a) Customer-owned solar generation had no impact on FPL's restoration time.
- b) Customer-owned solar generation had no impact on FPL's restoration costs.

QUESTION:

Without compromising safety, are there changes to the utility's interconnection with customer-owned solar generation that would enable the customer's facilities to be energized by its solar generation should the utility be unable to provide electric service due to a future storm damaging utility infrastructure?

- a) If yes, please provide the following information:
- Please describe the suggested changes to the utility's interconnection.
 - If the utility is not pursuing the interconnection changes please explain why.

RESPONSE:

No changes to utility interconnection with customer-owned generation are required to enable the customer's facilities to be energized by its solar generation should the utility be unable to provide electric service due to a future storm damaging utility infrastructure. However, changes on the customer's side of the meter can be made to enable the customer's facilities to be energized by its solar generation should the utility be unable to provide electric service due to a future storm damaging utility infrastructure. For a description of those changes, please see FPL's response to Staff's Second Data Request Nos. 8 and 9.

- a. No change to the utility's interconnection is required to enable customers to isolate from the grid and operate their customer-owned solar generation system.

QUESTION:

Without compromising safety, please describe potential changes to a customer's facilities that the customer can implement to enable the customer's facilities to be energized by its solar generation should the utility be unable to provide electric service due to a future storm event that damages utility infrastructure. Include in your response whether the utility makes it a practice to inform the customer of such options.

RESPONSE:

Solar Photovoltaic Systems are required to comply with IEEE 1547 and use a UL 1741 listed inverter for safety reasons. This is to prevent back-feed and energizing the electrical system in the event of a loss of power, which could result in harm to utility personnel conducting repairs.

Without compromising safety, for the customer's facilities to be energized using their solar generation at a time when the utility is unable to provide electric service, the customer would need to isolate their system from the utility, preferably by means of an isolation switch. The isolation switch would be an important feature of this modification as it would best protect against an inadvertent back-feed into the electrical system and would therefore be the best protection for utility personnel conducting repairs. The customer would also need a means to power their inverter such as a UL 1741 battery backup system. This would enable the customer to balance the household loads and PV output, and to ensure proper voltage and frequency is served to the home's appliances and prevent damage to their equipment.

FPL does inform customers how they can operate their solar generation during a grid outage if the appropriate customer equipment (e.g. specialized inverter or battery system) is installed. The information is located in FPL's Net Metering Guidelines (<https://www.fpl.com/clean-energy/net-metering/guidelines.html>). The customer must comply with the National Electric Code and all jurisdictional codes.

QUESTION:

Without compromising safety, please describe any potential changes to rules or tariffs pertaining to utility interconnections with customer-owned solar generation that would enable the customer's facilities to be energized by its solar generation should the utility be unable to provide electric service due to a future storm event that damages utility infrastructure.

RESPONSE:

As stated in response to Staff's Second Data Request No. 8, customers would need to utilize the required IEEE 1547 & UL 1741 listed inverter and an isolation switch and obtain a UL 1741 battery backup system. Also, to enhance grid reliability to all customers, it would be helpful for the utility to have the ability to directly monitor the customer-owned solar generation. This would require a second production meter. These requirements (battery back-up and second production meter) might result in potential changes to rules or tariffs pertaining to utility interconnections with customer-owned solar generation.

QUESTION:

Please provide the following information for utility interconnections with utility-scale solar generation that did not operate as designed during the extreme weather events that occurred in 2015 through 2017.

- a) The number of failures.
- b) A description of the cause or causes of such failures.
- c) Possible failure remediation and associated cost.
- d) Discuss whether the failures contributed to an increase or decrease in the utility's service restoration time and, if possible, provide an estimate of the duration impact.
- e) Discuss whether the failures contributed to an increase or decrease in the utility's service restoration costs and, if possible, provide an estimate of the restoration cost impact.

RESPONSE:

No operating issues were experienced with utility interconnections of utility-scale solar generation during the extreme weather events that occurred in 2015 through 2017.

QUESTION:

Please provide the following information for utility interconnections with utility-scale solar generation that operated as designed during the extreme weather events that occurred in 2015 through 2017.

- a) Discuss whether these interconnections contributed to an increase or decrease in the utility's service restoration time and, if possible, provide an estimate of the duration impact.
- b) Discuss whether these interconnections increased or decreased the utility's service restoration costs and, if possible, provide an estimate of the restoration cost impact.

RESPONSE:

Utility-scale solar generation interconnections had no impact on the utility's service restoration time and no impact on the utility's service restoration costs.