Matthew R. Bernier
Associate General Counsel
Duke Energy Florida, LLC.

July 18, 2018

VIA ELECTRONIC FILING

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

Re: *Application for limited proceeding for recovery of incremental storm restoration costs related to Hurricanes Irma and Nate, by Duke Energy Florida, LLC; Docket No. 20170272-EI*

Dear Ms. Stauffer:

Please find enclosed for electronic filing, on behalf of Duke Energy Florida, LLC ("DEF"), DEF's Request for Confidential Classification filed in connection with DEF's Response to OPC's Second Request for Production of Documents (11-15), filed June 27, 2018.

The filing includes the following:

- DEF's Request for Confidential Classification
- Slipsheet for confidential Exhibit A
- Redacted Exhibit B (two copies)
- Exhibit C (justification matrix), and
- Exhibit D (affidavit of Jason Cutliffe)

Please return DEF's confidential Exhibit A (document no. 04441-2018), filed with DEF's Notice of Intent to Request Confidential Classification on June 27, 2018.

Thank you for your assistance in this matter. Please feel free to call me at (850) 521-1428 should you have any questions concerning this filing.

Respectfully,

s/Matthew R. Bernier

Matthew R. Bernier
Matthew.Bernier@duke-energy.com

MRB/at
Enclosures

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for limited proceeding for recovery of incremental storm restoration costs related to Hurricanes Irma and Nate by Duke Energy Florida, LLC	Docket No. 20170272-EI Dated: July 18 2018

DUKE ENERGY FLORIDA, LLC'S
REQUEST FOR CONFIDENTIAL CLASSIFICATION

Duke Energy Florida, LLC, ("DEF" or "Company"), pursuant to Section 366.093, Florida Statutes (F.S.), and Rule 25-22.006, Florida Administrative Code (F.A.C.), submits this Request for Confidential Classification for certain information provided in DEF's Response to the Office of the Public Counsel's ("OPC") Second Request for the Production of Documents (Nos. 11-15), filed on June 27, 2018. In support of this Request, DEF states:

1. The information provided in DEF's Response to OPC's Second Request for Production of Documents (Nos. 11-15), specifically question 14, contains "proprietary confidential business information" under Section 366.093(3), Florida Statutes.

2. The following exhibits are included with this request:

(a) Sealed Composite Exhibit A is a package containing an unredacted copy of all the documents for which DEF seeks confidential treatment. Composite Exhibit A is being submitted separately in a sealed envelope labeled "CONFIDENTIAL." In the unredacted version, the information asserted to be confidential is highlighted in yellow.

(b) Composite Exhibit B is a package containing two copies of redacted versions of the documents for which the Company requests confidential classification. The specific information for which confidential treatment is requested has been blocked out by opaque marker or other means.

(c) Exhibit C is a table which identifies by page and line the information for which DEF seeks confidential classification and the specific statutory bases for seeking confidential treatment.

(d) Exhibit D is an affidavit attesting to the confidential nature of information identified in this request.

3. As indicated in Exhibit C, the information for which DEF requests confidential classification is “proprietary confidential business information” within the meaning of Section 366.093(3), F.S. Specifically, the information at issue in DEF’s Response to OPC’s Second Request for the Production of Documents, Question No. 14 relates to correspondence between DEF and Accenture Consulting relating to a pole forensics report which includes employee personnel information. DEF must ensure that sensitive business information such as employee contact information, unrelated to compensation, duties, qualifications, or responsibilities, are kept confidential, the disclosure of which would impair the Company’s to contract on favorable terms. *See* § 366.093(3)(f), F.S.; Affidavit of Jason Cutliffe at ¶ 3. Accordingly, such information constitutes “proprietary confidential business information” which is exempt from disclosure under the Public Records Act pursuant to Section 366.093(1), F.S.

4. Furthermore, the responsive correspondence also reflects contractual vendor costs of Accenture Consulting relating to a pole forensics analysis and report. DEF must ensure that sensitive business information such as contractual vendor invoice costs, are kept confidential, the disclosure of which would impair the Company’s efforts to contract for goods and services on favorable terms. *See* § 366.093(3)(d), F.S.; Affidavit of Jason Cutliffe at ¶ 3. Public disclosure of the confidential

information would violate the confidentiality provisions in DEF's contract with Accenture Consulting and it would impair DEF's ability to contract for similar services on competitive and favorable terms. If other third parties such as competitors are aware of the invoice dollar values submitted by Accenture Consulting, they may offer DEF less competitive contractual terms in future contractual negotiations. Id. Accordingly, such information constitutes "proprietary confidential business information" which is exempt from disclosure under the Public Records Act pursuant to Section 366.093(1), F.S.

5. The information identified as Exhibit "A" is intended to be and is treated as confidential by the Company. *See* Affidavit of Jason Cutliffe at ¶ 4. The information has not been disclosed to the public, and the Company has treated and continues to treat this information as confidential. Id.

5. DEF requests that the information identified in Exhibit A be classified as "proprietary confidential business information" within the meaning of section 366.093(3), F.S., that the information remain confidential for a period of at least 18 months as provided in section 366.093(4) F.S., and that the information be returned as soon as it is no longer necessary for the Commission to conduct its business.

WHEREFORE, for the foregoing reasons, DEF respectfully requests that this Request for Confidential Classification be granted.

RESPECTFULLY SUBMITTED this 18th day of July, 2018.

s/Matthew R. Bernier

DIANNE M. TRIPLETT
Deputy General Counsel
Duke Energy Florida, LLC.

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St. Petersburg, FL 33701
T: 727.820.4692
F: 727.820.5041
E: Dianne.Triplett@duke-energy.com

MATTHEW R. BERNIER
Associate General Counsel
Duke Energy Florida, LLC
106 East College Avenue
Suite 800
Tallahassee, Florida 32301
T: 850.521.1428
F: 727.820.5041
E: Matthew.Bernier@duke-energy.com

Duke Energy Florida, LLC
Docket No.: 20170272
CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished via electronic mail this 18th day of July, 2018 to all parties of record as indicated below.

s/Matthew R. Bernier
Attorney

Kyesha Mapp Office of General Counsel Florida Public Service Commission 2540 Shumard Oak Blvd. Tallahassee, FL 32399-0850 kmapp@psc.state.fl.us	James Brew / Laura Wynn Stone Law Firm 1025 Thomas Jefferson St., N.W. Suite 800 West Washington, DC 20007 jbrew@smxblaw.com law@smxblaw.com
J. R. Kelly / C. Rehwinkel Office of Public Counsel c/o The Florida Legislature 111 West Madison Street, Room 812 Tallahassee, FL 32399 kelly.jr@leg.state.fl.us rehwinkel.charles@leg.state.fl.us	Robert Scheffel Wright / John T. LaVia, III c/o Gardner Law Firm 1300 Thomaswood Drive Tallahassee, FL 32308 schef@gbwlegal.com jlavia@gbwlegal.com
Jon C. Moyle, Jr. / Karen A. Putnal Moyle Law Firm, P.A. 118 North Gadsden Street Tallahassee, FL 32301 jmoyle@moylelaw.com kputnal@moylelaw.com	George Cavros, Esq. Southern Alliance for Clean Energy 120 E. Oakland Park Blvd., Suite 105 Fort Lauderdale, FL 33334 george@cavros-law.com

Exhibit A

“CONFIDENTIAL”

(submitted under separate cover)

Exhibit B

REDACTED
(two copies)

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Thursday, April 12, 2018 5:15 PM
To: Bonner, Larry G
Subject: Accepted: [External] Pole Forensics Report

Categories: Save File, PQR&I

*** Exercise caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. ***

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Tuesday, April 17, 2018 12:15 PM
To: Bonner, Larry G; Supplier Services@duke-energy.com
Cc: Deric, Miki; Bermejo, Lucas E.
Subject: RE: Accenture: Pole Forensics January 2018 Invoice

Categories: Save File, PQR&I

Thanks Larry!

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accenture consulting

From: Bonner, Larry G [mailto [redacted]]
Sent: Tuesday, April 17, 2018 12:14 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>; Supplier Services@duke-energy.com <SupplierServices@duke-energy.com>
Cc: Deric, Miki <miki.deric@accenture.com>; Bermejo, Lucas E. <lucas.e.bermejo@accenture.com>
Subject: [External] RE: Accenture: Pole Forensics January 2018 Invoice

I will inquire today and get back with you.

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Monday, April 16, 2018 3:30 PM
To: Supplier Services@duke-energy.com
Cc: Bonner, Larry G; Deric, Miki; Bermejo, Lucas E.
Subject: RE: Accenture: Pole Forensics January 2018 Invoice

Good afternoon,

Our records show that the following invoice (#1100372943) is overdue. Could you provide an update on when this invoice will be processed? Also there is another invoice (#1100383869) that is due next week. Could you look into this one as well?

If you have any questions, please feel free to reach out to me.

Open Receivables

Contract	Invoice #	WMU	Invoiced	Due	Due Date	Days Overdue
Pole Forensics	1100372943	Pole Forensics	[redacted]		3/31/2018	16
Pole Forensics	1100383869	Pole Forensics			4/26/2018	(10)

1 of 1 Go

Thanks for your help,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

From: Bermejo, Lucas E.
Sent: Wednesday, February 14, 2018 12:50 PM
To: Supplierservices (Supplierservices@duke-energy.com) <Supplierservices@duke-energy.com>
Cc: [redacted]; Wagaman, Justin B. <justin.b.wagaman@accenture.com>; Deric, Miki <miki.deric@accenture.com>
Subject: Accenture: Pole Forensics January 2018 Invoice

*****Highly Confidential - To be Used by Authorized Personnel Only*****

Hello,

Attached please find January 2018 invoice for Accenture's Pole Forensics project and its PDF.

Please let us know if you have any questions/concerns.

Regards,

Lucas Bermejo
Accenture Business Services Buenos Aires
Client Financial Management *Analyst*

Defensa 390, C1065AAF
Buenos Aires
Telephone: *(54-11) 4516-5810*

Bangalore • Buenos Aires • Chennai• Chicago • Dalian • Dublin • Manila • Mumbai • Prague • Pune

Before printing, think about the environment

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Wednesday, May 23, 2018 7:10 PM
To: Bonner, Larry G
Subject: RE: Invoices

Categories: PQR&I, Save File

This EXTERNAL email is originating from a third-party provider that conducts business on behalf of Duke Energy. Please continue to be vigilant when handling email.

Larry,

I took a look in our system and there are no open invoices so I believe they have cleared on our end. All work has been invoiced so I think we are good to go.

Thanks for your help getting those outstanding invoices paid!

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, May 23, 2018 12:54 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Invoices

Hi Justin,

I processed all of the invoices that were submitted. Can you verify that you have submitted invoices for all of the work, and that you guys have been paid?

Thanks,

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

REDACTED

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Thursday, May 24, 2018 9:47 AM
To: Bonner, Larry G
Subject: RE: Invoices

Categories: PQR&I, Save File

This EXTERNAL email is originating from a third-party provider that conducts business on behalf of Duke Energy. Please continue to be vigilant when handling email.

That's excellent news! Definitely let us know if the opportunity arises.

I hope you enjoy your Memorial Day weekend,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

From: Bonner, Larry G [mailto [redacted]
Sent: Thursday, May 24, 2018 9:41 AM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] RE: Invoices

You are welcome. BTW, it seems that there was considerable interest in the report that we did. It is my understanding that there is interest in us continuing this type of report out.

I'll keep you guys informed.

Have a good day

Larry

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Wednesday, May 23, 2018 7:10 PM
To: Bonner, Larry G
Subject: RE: Invoices

Larry,

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Thanks for your help getting those outstanding invoices paid!

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, May 23, 2018 12:54 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Invoices

Hi Justin,

I processed all of the invoices that were submitted. Can you verify that you have submitted invoices for all of the work, and that you guys have been paid?

Thanks,

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Wednesday, March 28, 2018 10:15 AM
To: Bonner, Larry G; Deric, Miki
Subject: RE: Status of Final Report

Categories: Save File, PQR&I

*** Exercise caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. ***

Larry,

I must have misunderstood. The last email you sent on the 14th had, what we thought was, the final report. I didn't see any comments or redlines so I thought you were sharing the final report with us based on the edits you and I made over the phone. Was there something you were looking for from us?

Sorry for the confusion,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, March 28, 2018 9:45 AM
To: Deric, Miki <miki.deric@accenture.com>; Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Status of Final Report

Good Morning,

Can you advise me on the status of the final report?

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Friday, April 06, 2018 11:04 AM
To: Bonner, Larry G
Subject: RE: Status of Final Report
Attachments: Duke FL Pole Forensics Support Report FINAL v06-00 2018-04-06.pptx

Categories: Save File, PQR&I

Larry,

Per your request, here is the final report for the pole forensics support. We reviewed the notes and determined that it was good information that didn't need to be separated from the slide deck like you and I originally discussed yesterday. We also removed any mention of draft and the client attorney privilege statements on each slide.

If you have any further requests, please let me know.

It was a pleasure working with you on this effort and I hope to work with you again soon.

We appreciate the time and dedication you and your team put in to supporting this effort.

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Thursday, April 5, 2018 3:04 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] RE: Status of Final Report

Sorry for the confusion. Yes. I just wanted you to look it over and remove the "Draft Analysis" and any other preliminary markings.

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Wednesday, March 28, 2018 10:15 AM
To: Bonner, Larry G; Deric, Miki
Subject: RE: Status of Final Report

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Larry,

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Sorry for the confusion,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, March 28, 2018 9:45 AM
To: Deric, Miki <miki.deric@accenture.com>; Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Status of Final Report

Good Morning,

Can you advise me on the status of the final report?

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

www.accenture.com

DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

accentureconsulting

TABLE OF CONTENTS

EXECUTIVE SUMMARY

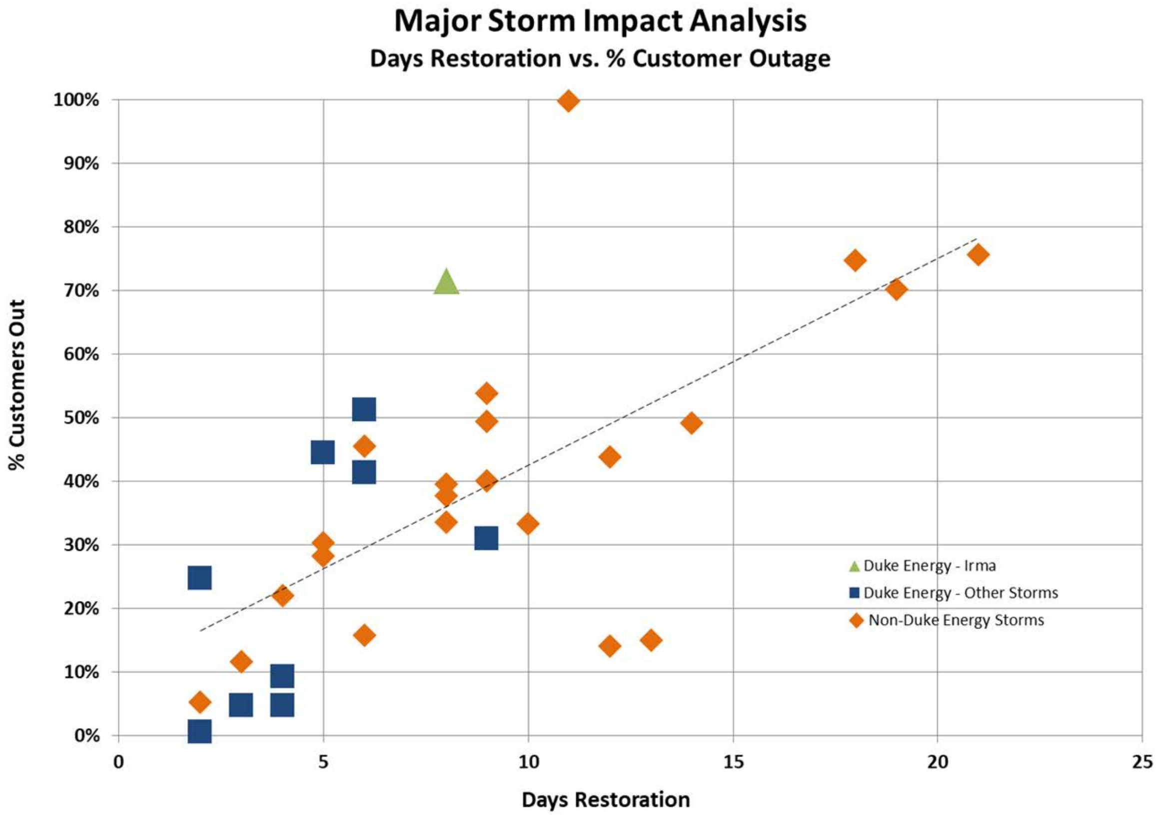
accentureconsulting

EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging "storm benchmark database" compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

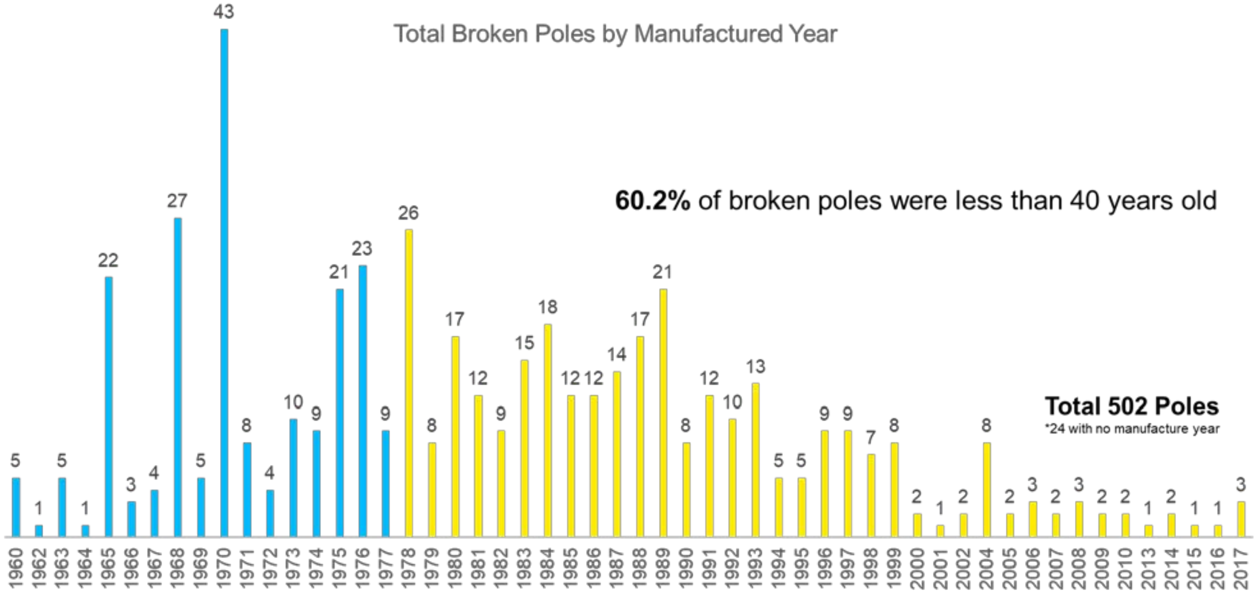
EXECUTIVE SUMMARY – BENCHMARK

- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



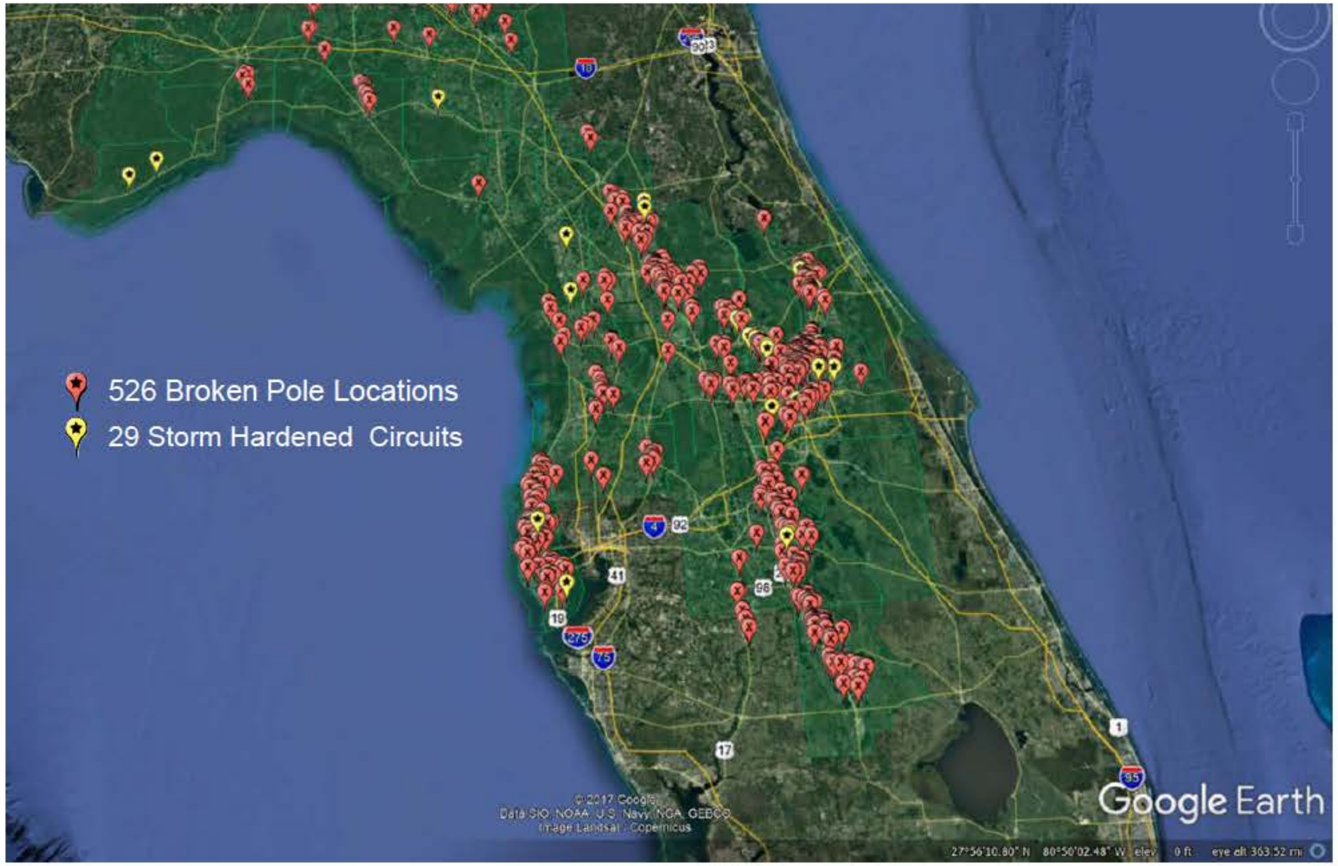
EXECUTIVE SUMMARY – FORENSIC

- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



EXECUTIVE SUMMARY – SYSTEM HARDENING

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.



OVERVIEW/ PURPOSE

OVERVIEW/PURPOSE

- Duke Energy Florida ("Duke FL") conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture's storm benchmarking database to compare against Duke FL's response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL's hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance
- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL's restoration efforts versus other utility companies captured in Accenture's storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	1982
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

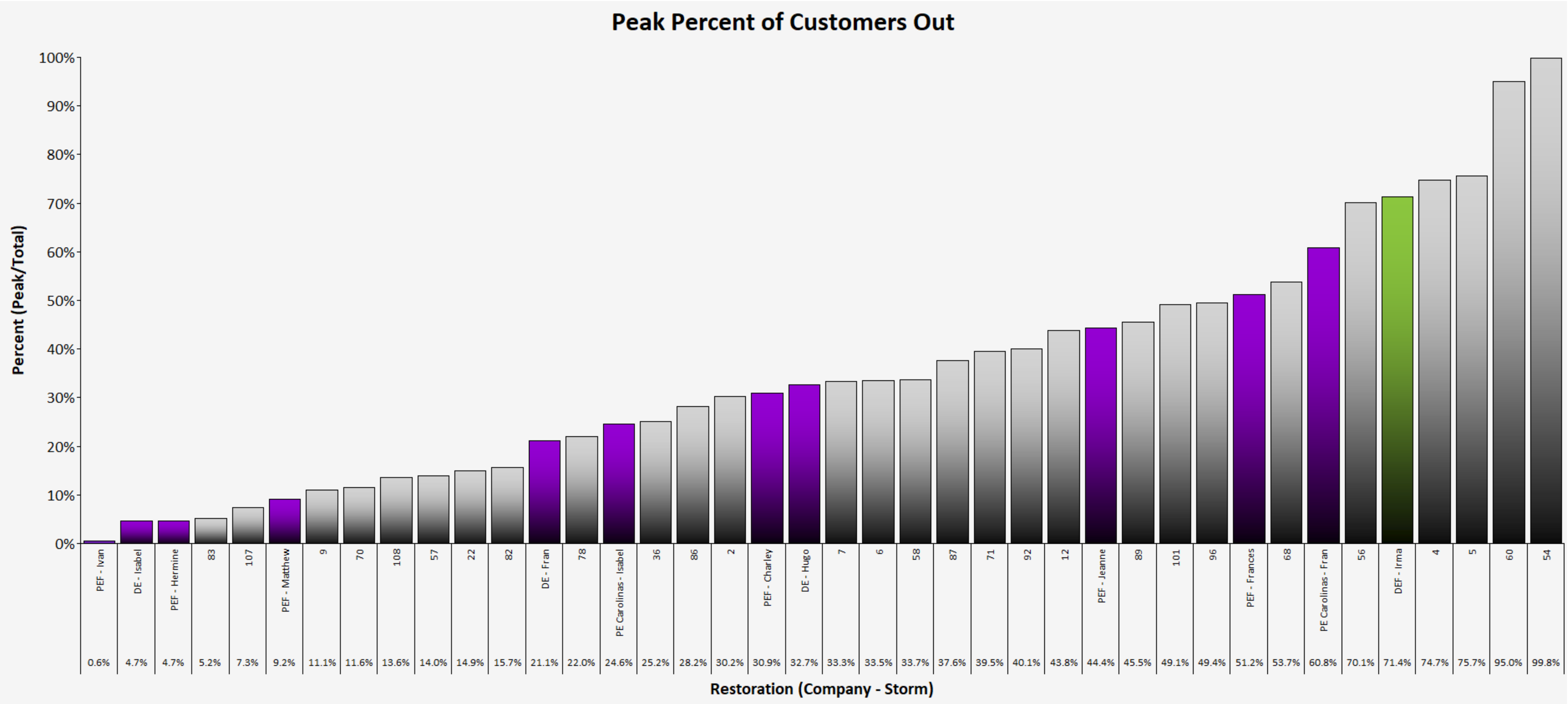
Restoration Duration	
Restoration Duration (# Days)	8 days

Restoration Costs	
Total Restoration Cost	$500M - $550M

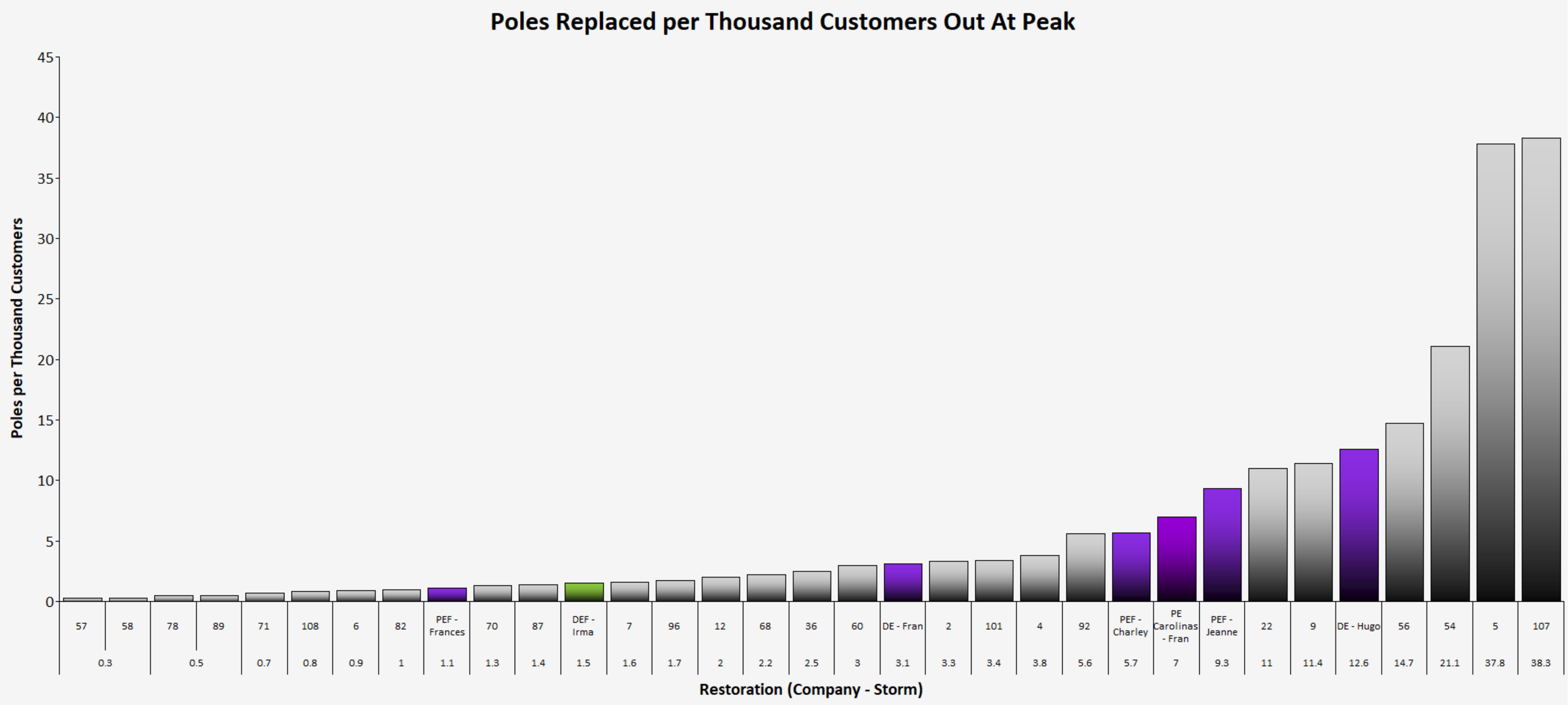
Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

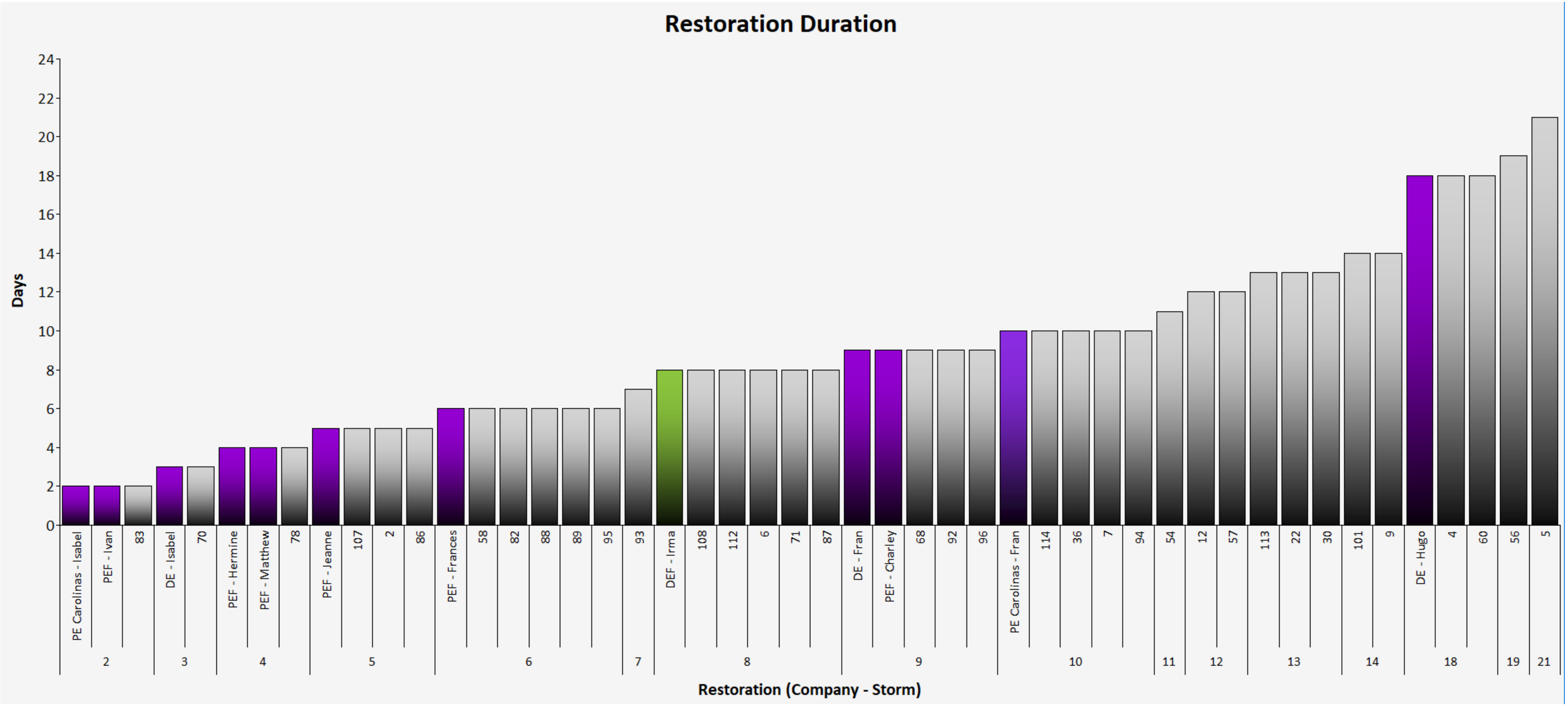
BENCHMARK RESULTS



BENCHMARK RESULTS



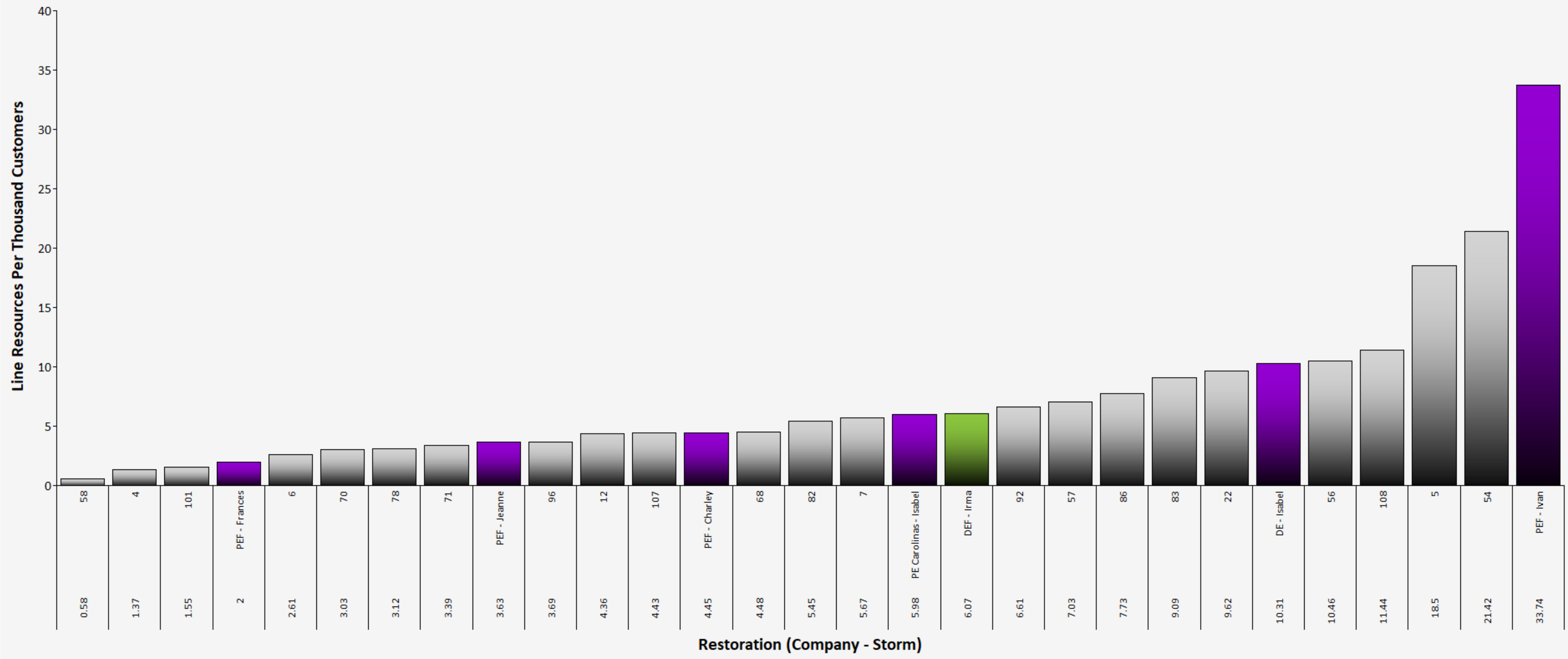
BENCHMARK RESULTS



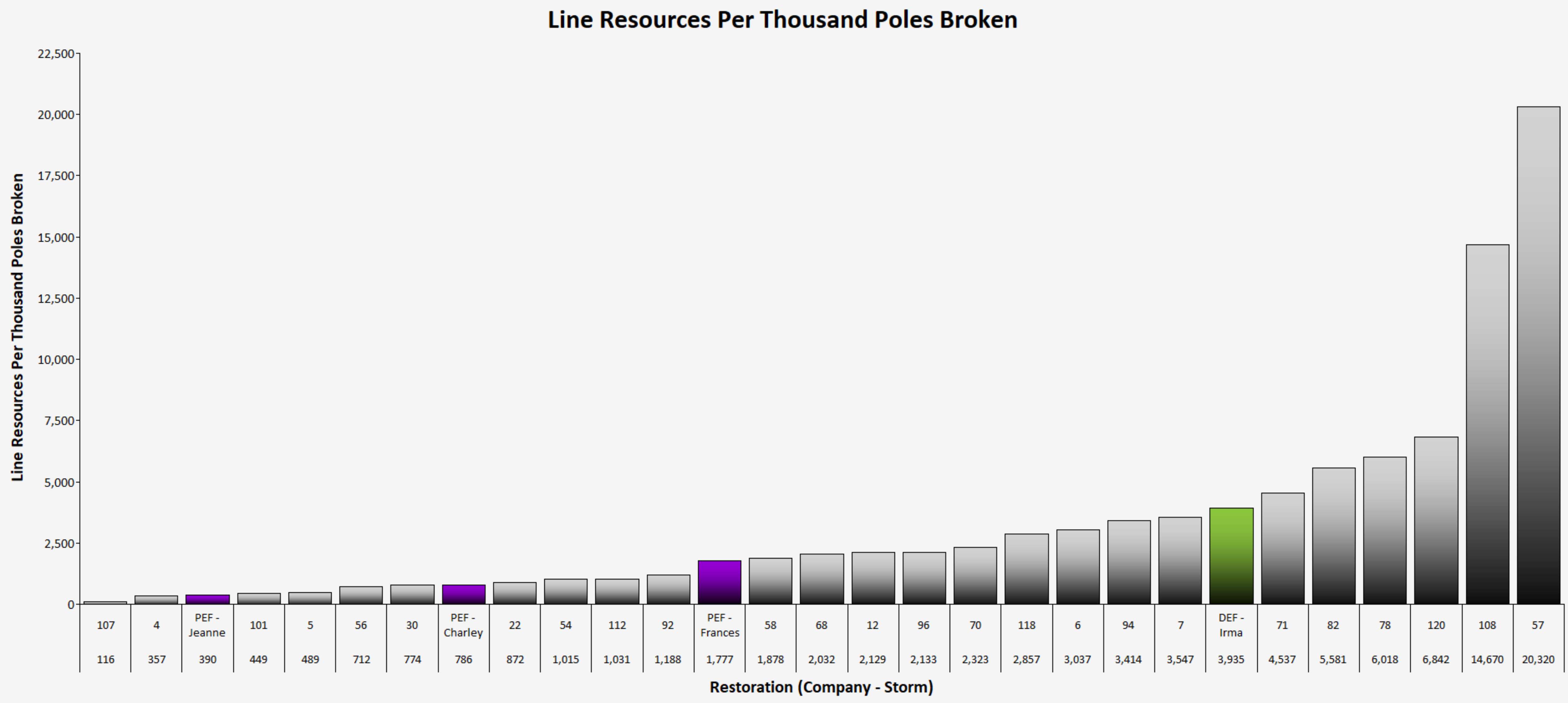
20170272-DEF-OPC-POD 2-14-000032

BENCHMARK RESULTS

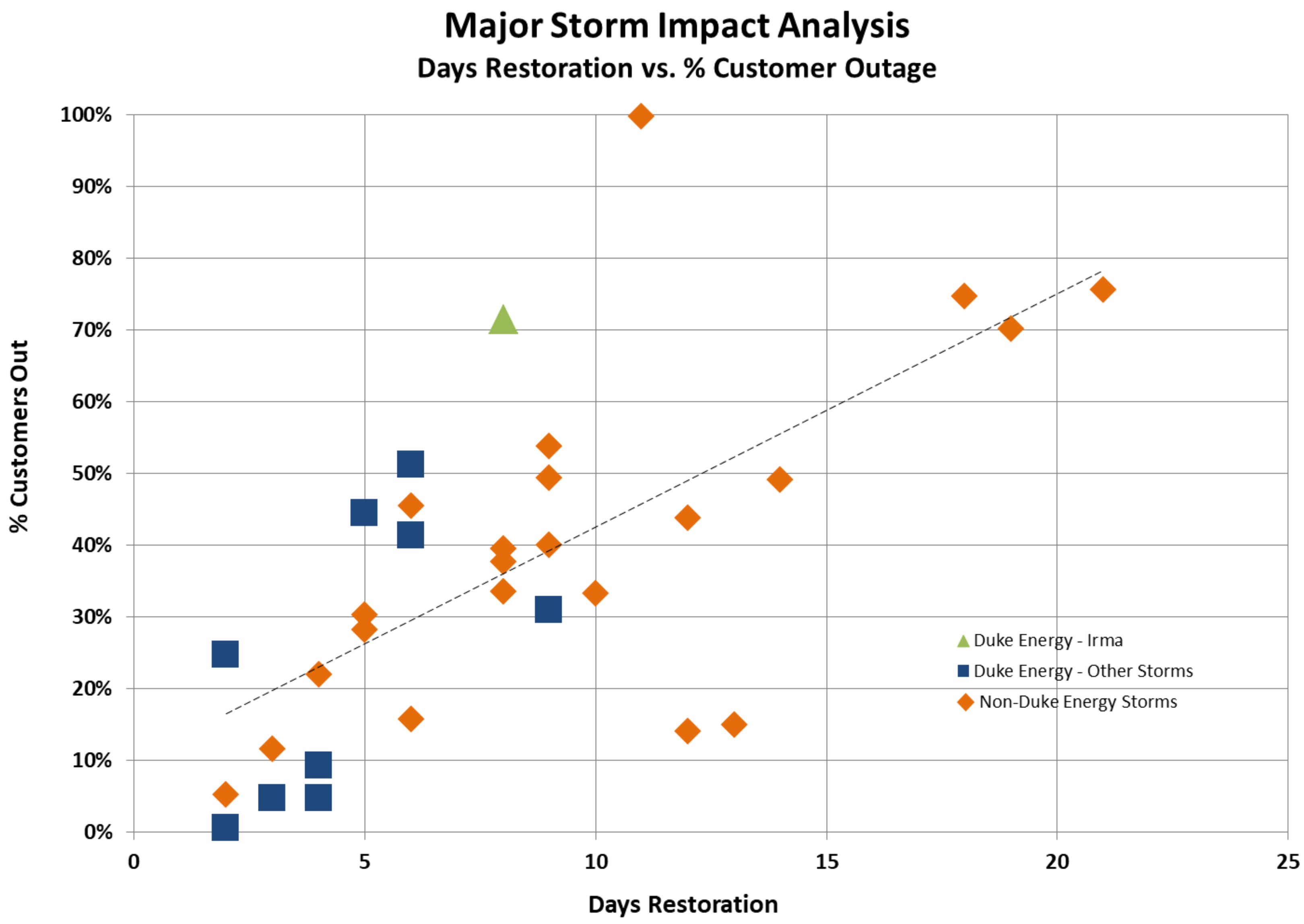
Total Line Resources Per Thousand Customers Out At Peak



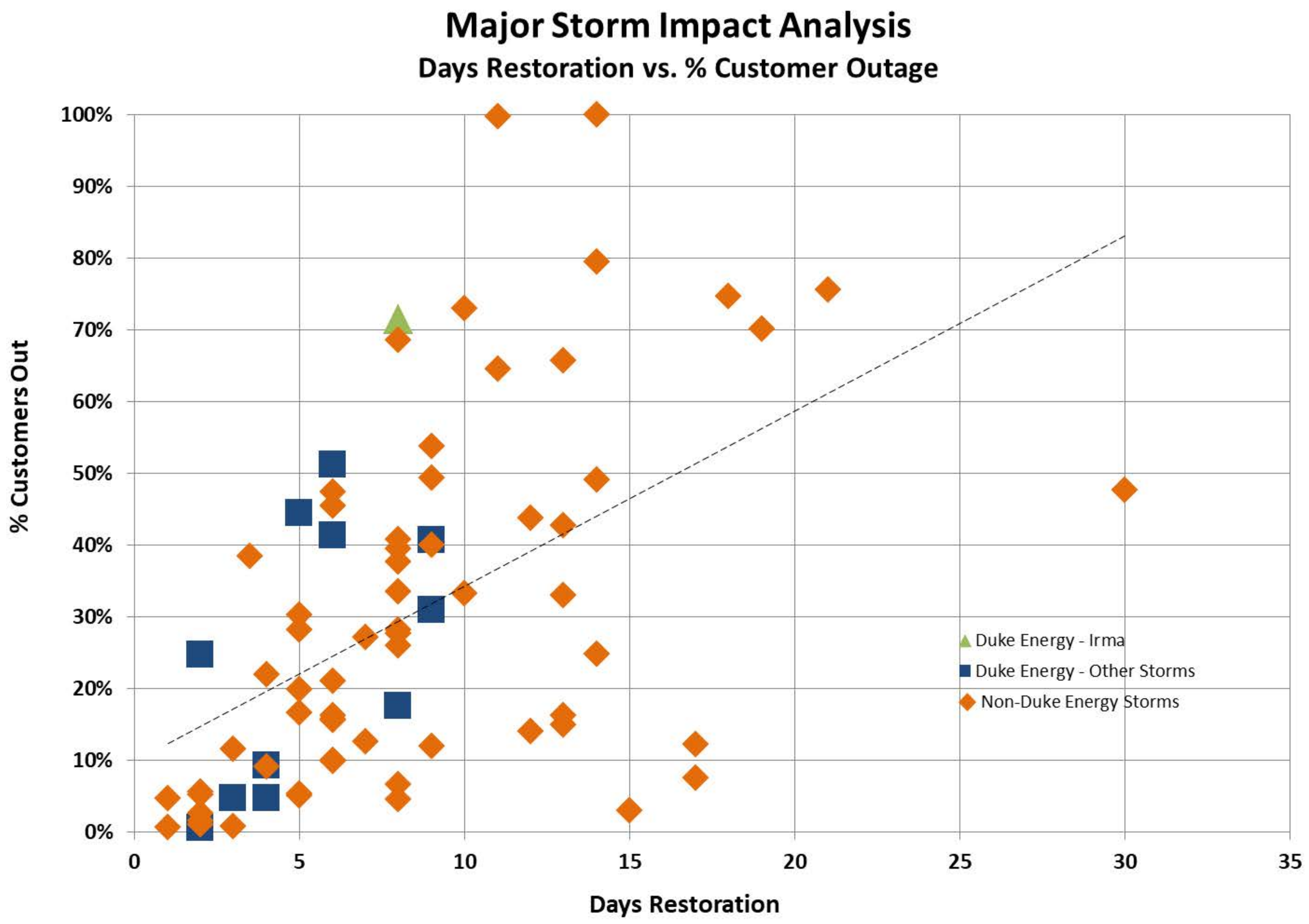
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

DUKE ENERGY FLORIDA

FORENSICS ANALYSIS

accenture consulting

METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 1,841 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

Broken Poles Included in Forensic Analysis

1,841 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

Pole Inventory – Duke Florida

1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS

20170272-DEF-OPC-POD 2-14-000041

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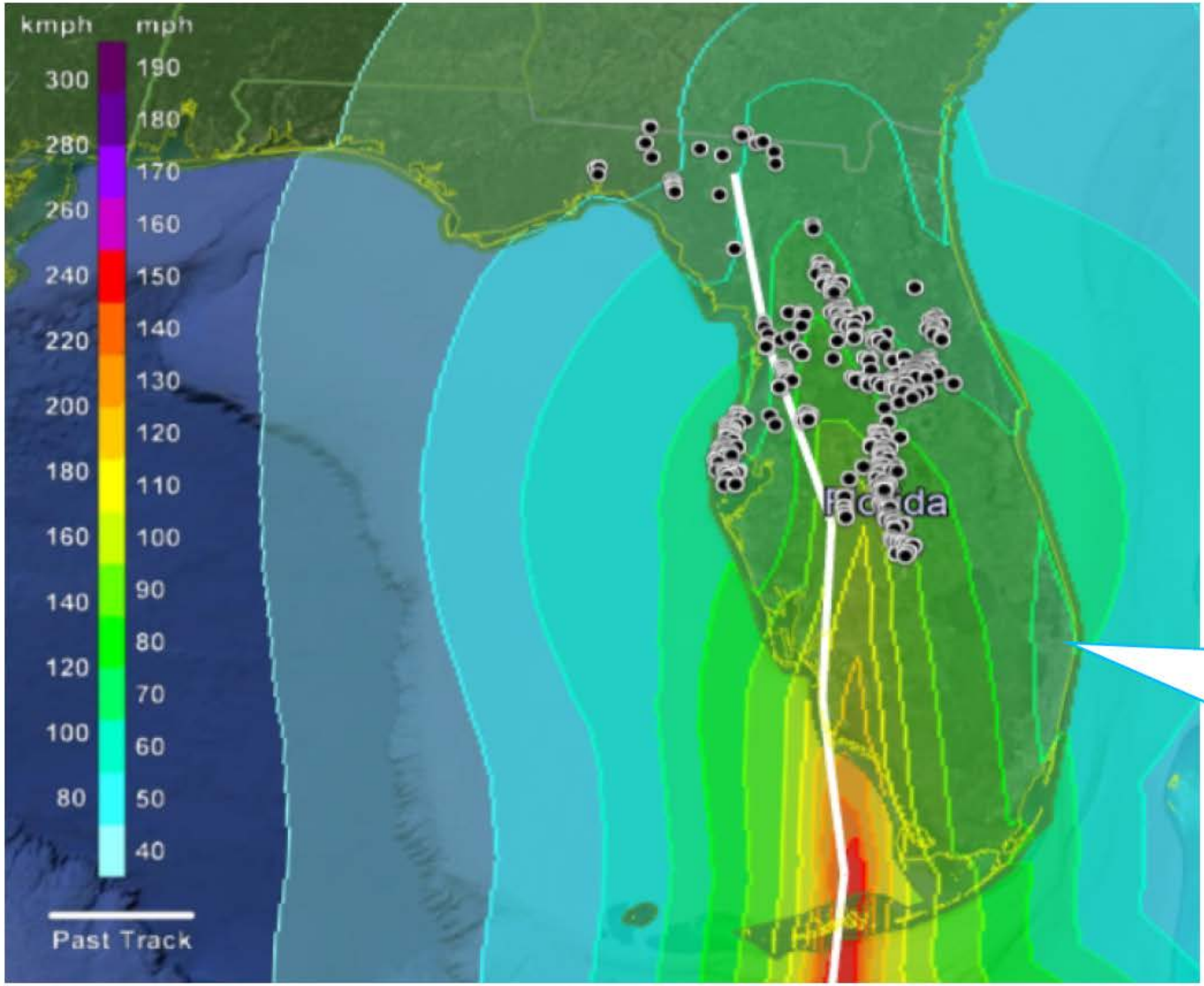
FLORIDA



https://data.humdata.org/dataset/hurricane-irma-windspeed

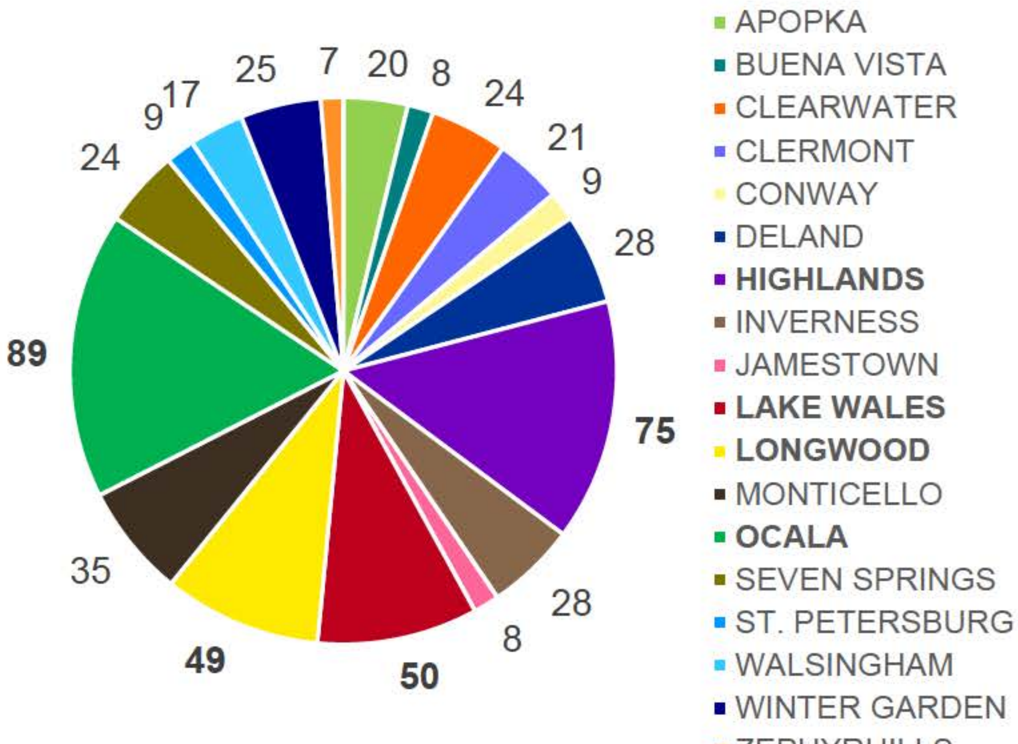
526 Broken Poles

Irma Path
9/11 12am – 12pm

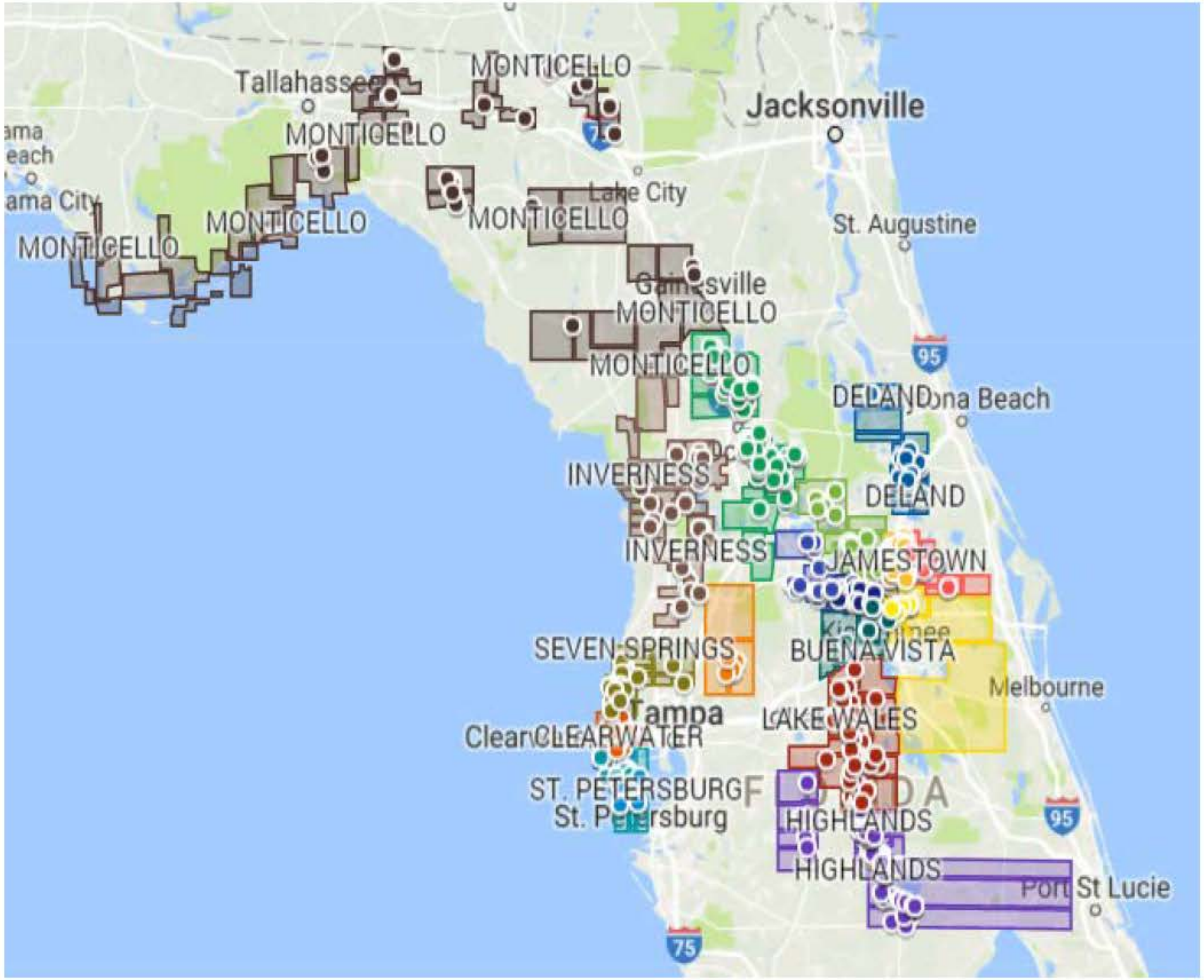
BROKEN POLE VISUALIZATIONS

20170272-DEF-OPC-POD 2-14-000042

Broken Poles By OP Center

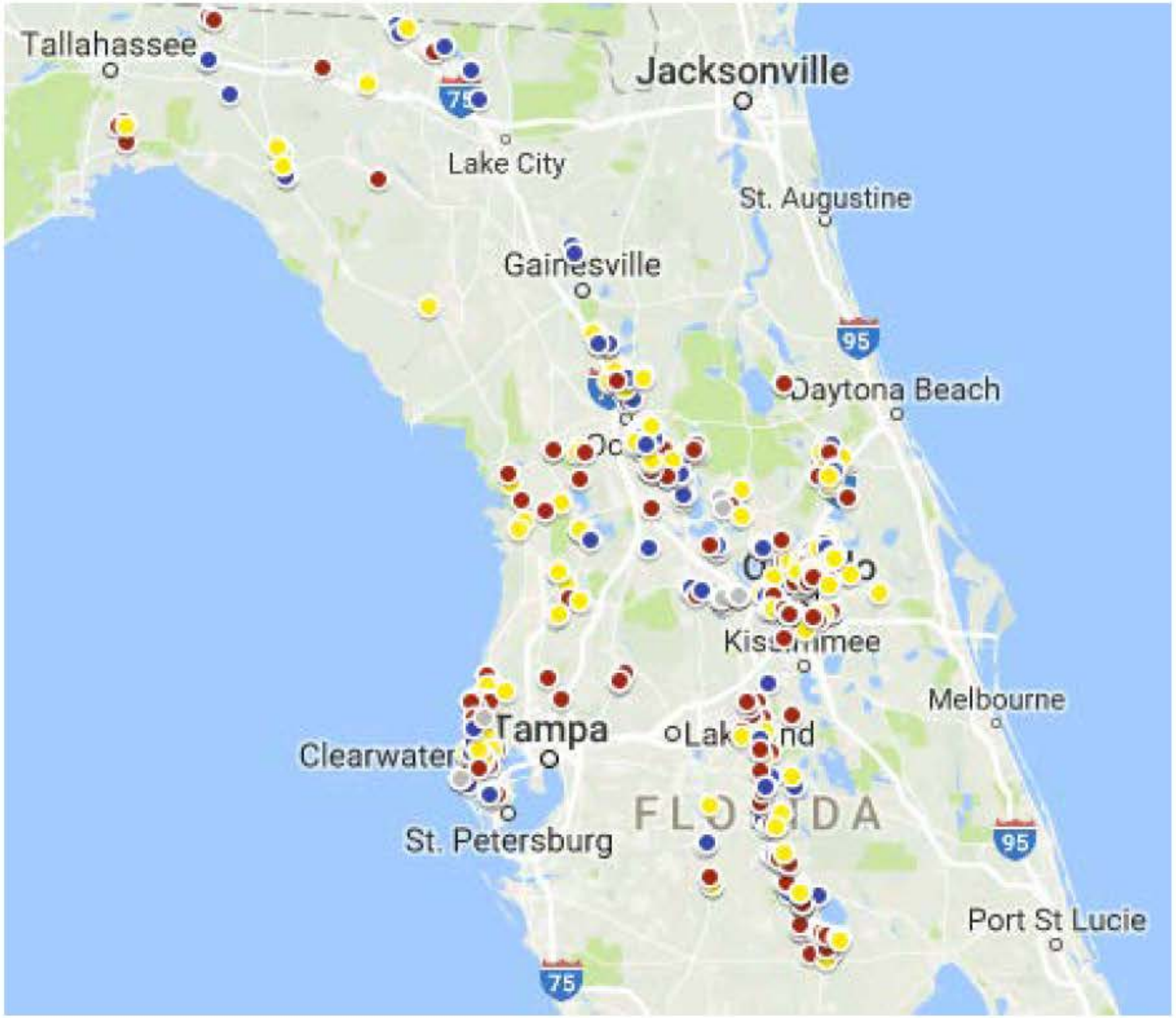


Total 526 Poles

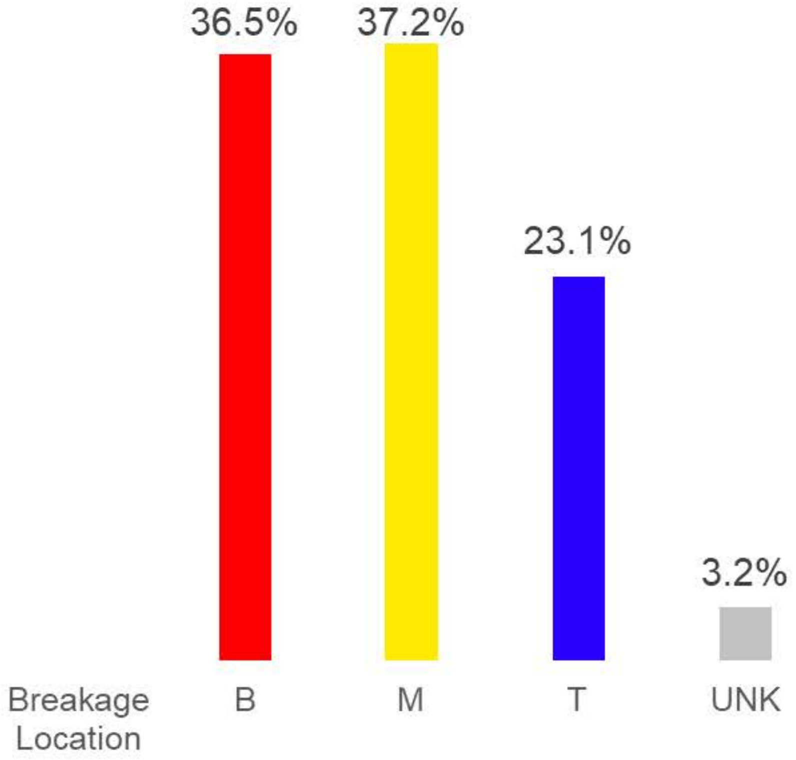


50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS



- **37.2%** of poles broke in the middle



Total 471 Poles

***66 poles that broke at the bottom did not have reject status information**

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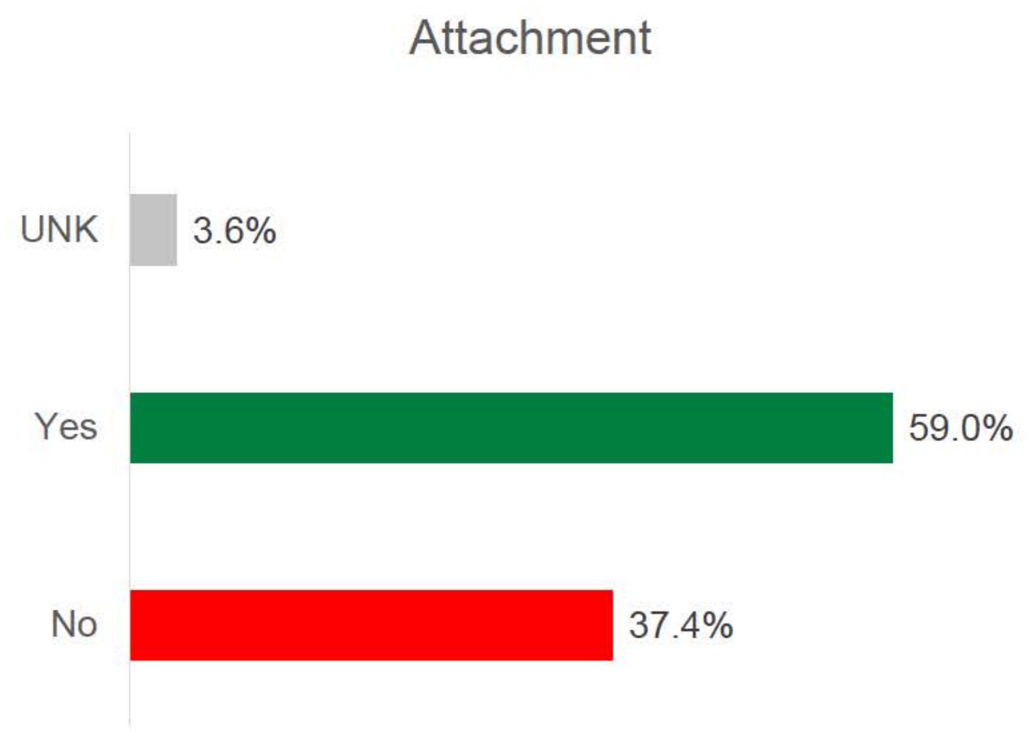
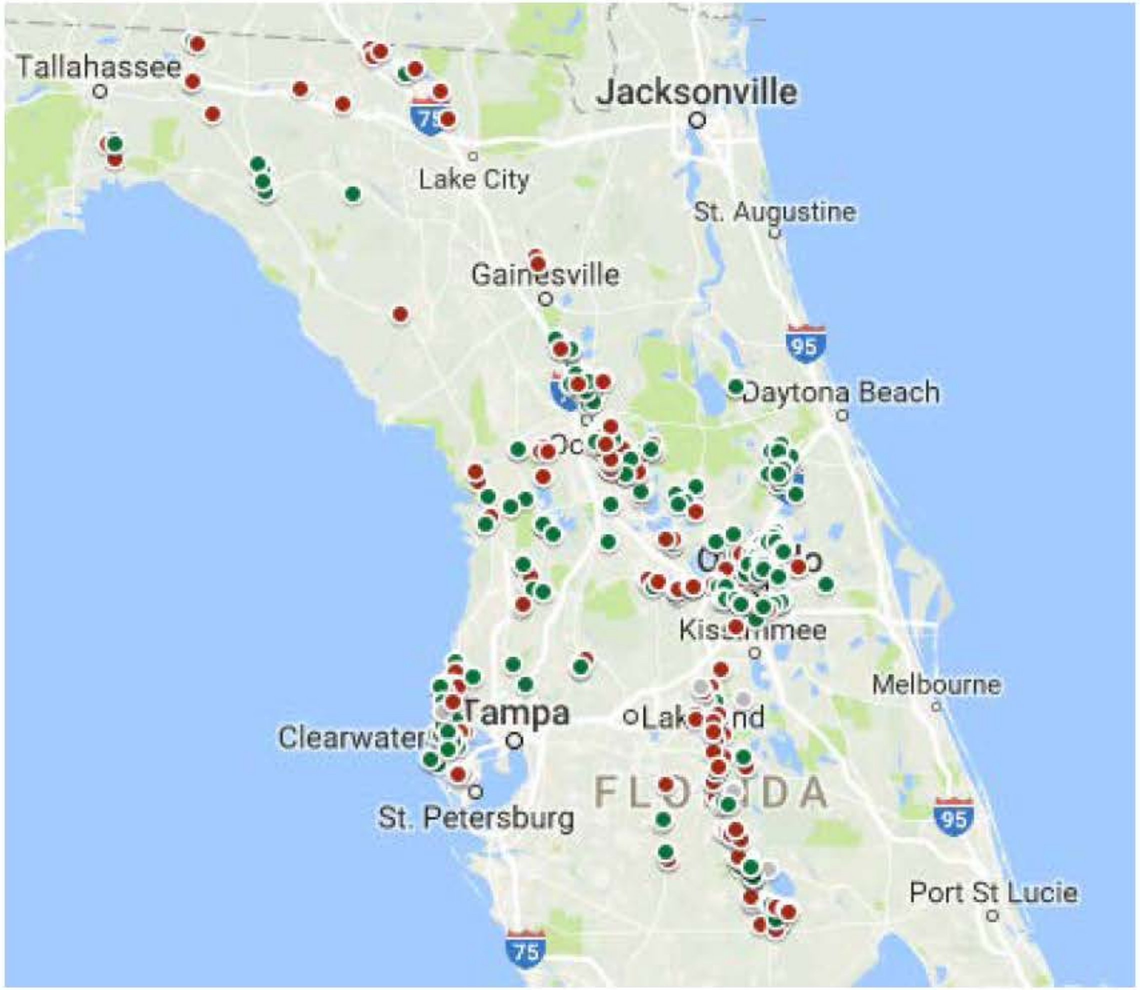
BROKEN POLE VISUALIZATIONS

59% of broken poles had an attachment

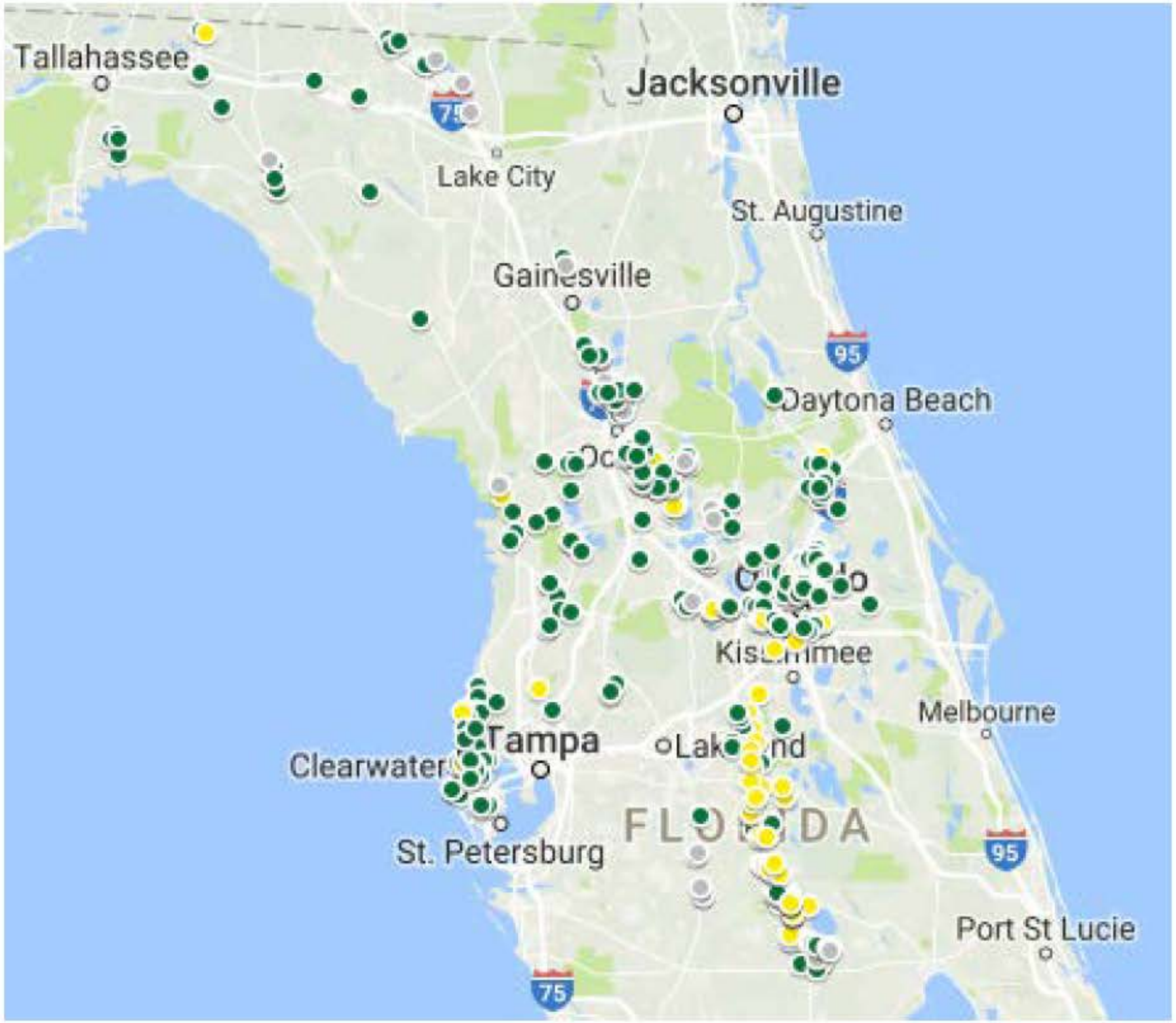


Total 471 Poles

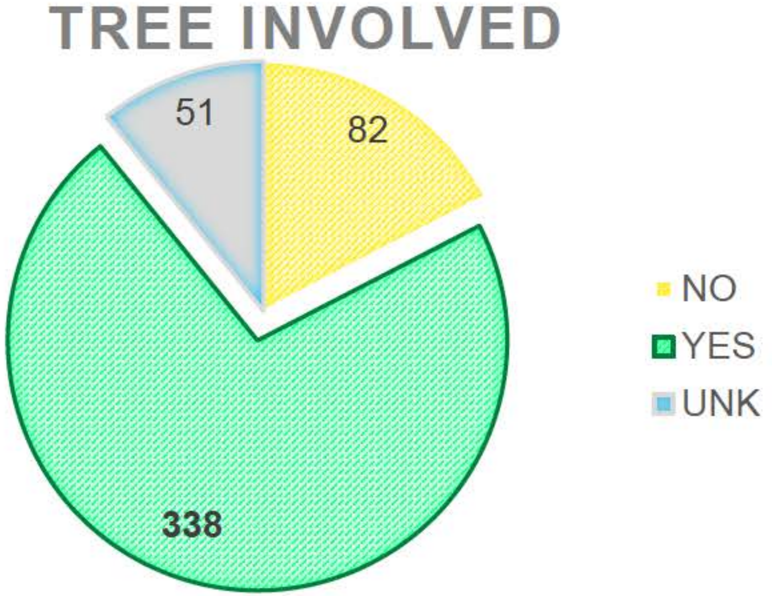


DUKE ENERGY. FLORIDA

BROKEN POLE VISUALIZATIONS

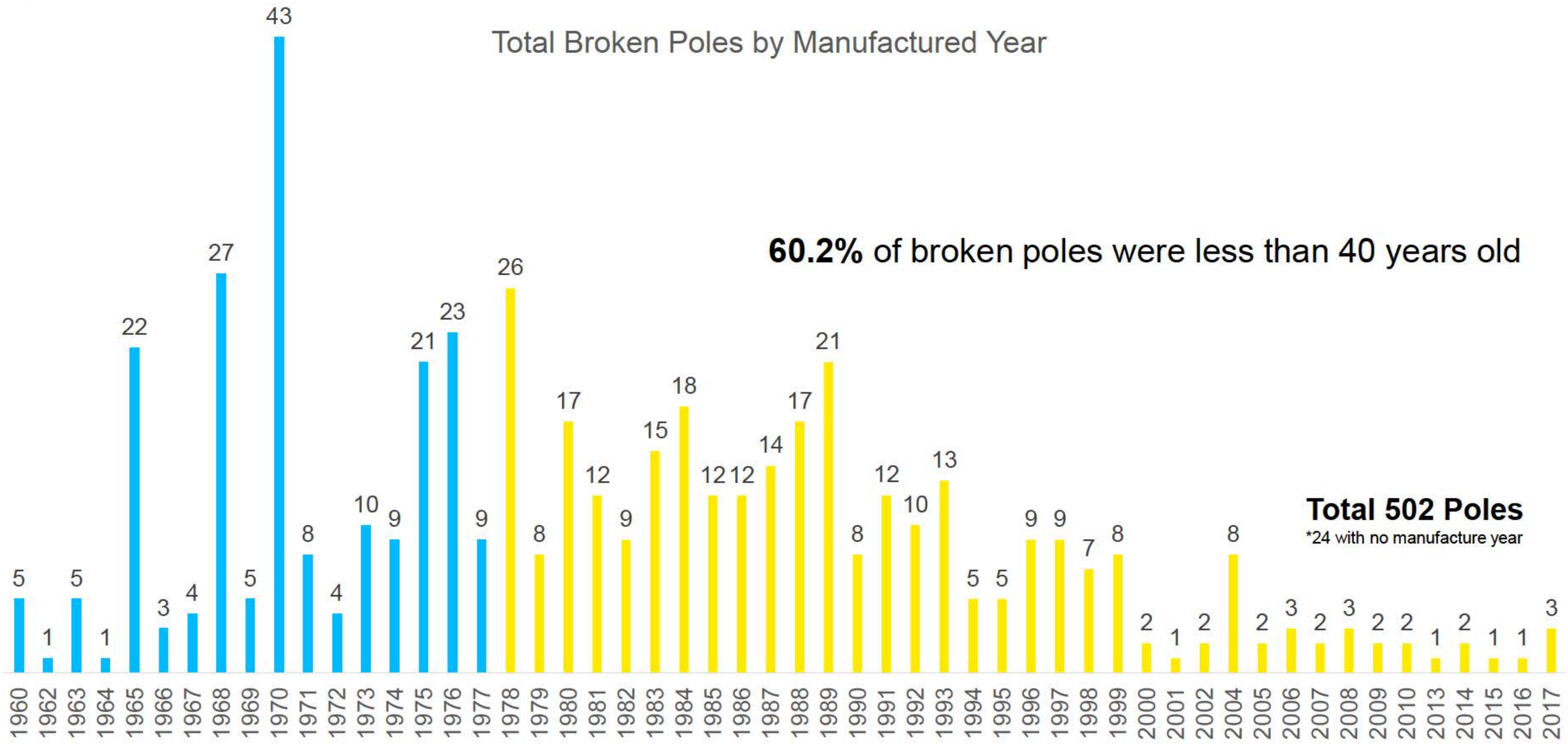


71.8% of broken poles had a tree involved

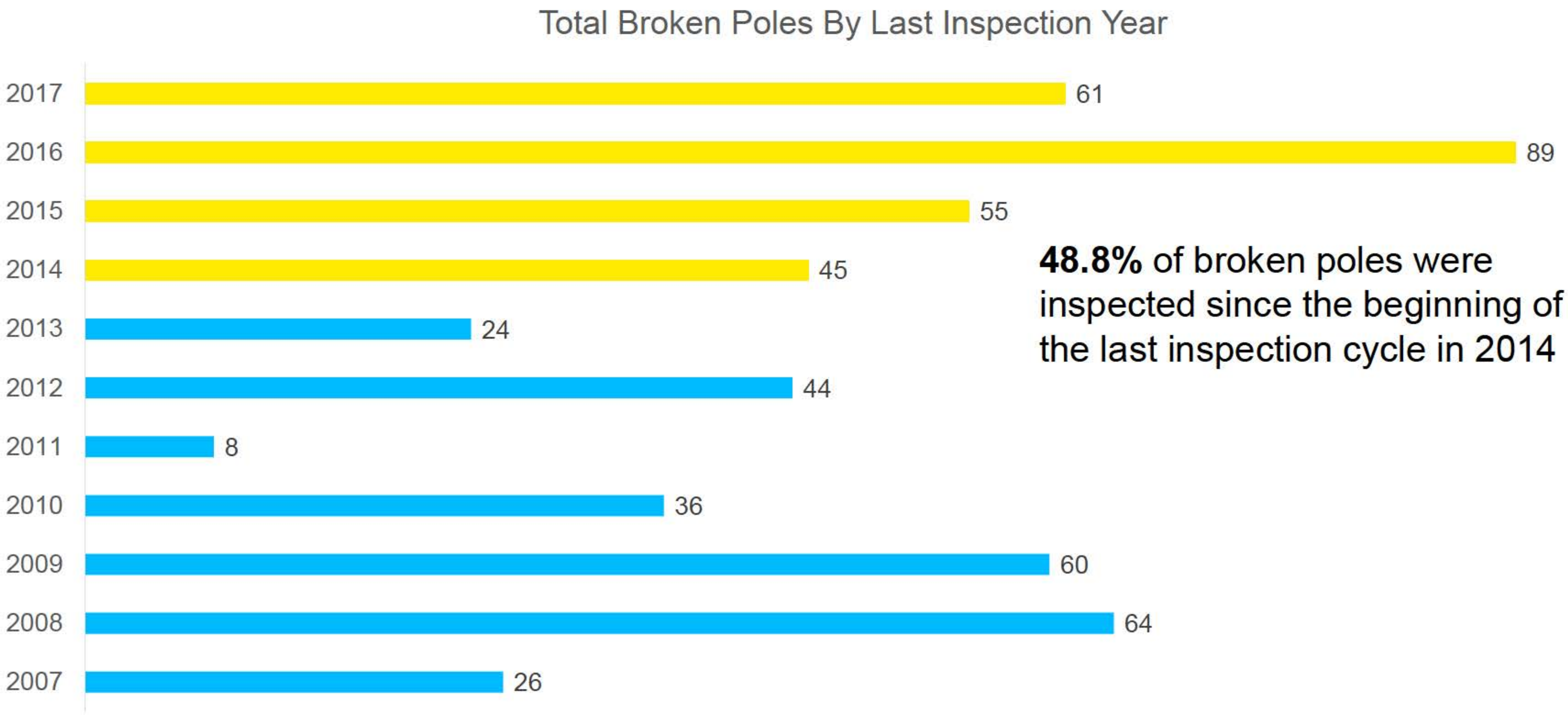


Total 471 Poles

BROKEN POLE VISUALIZATIONS



BROKEN POLE VISUALIZATIONS



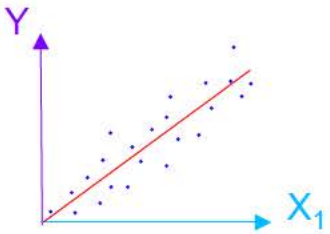
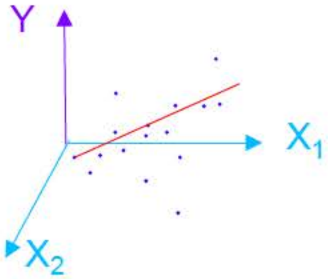
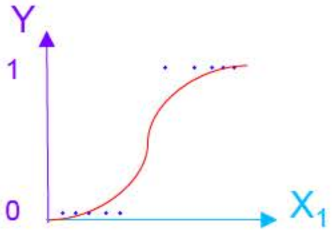
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression	Model Design	Why we use it
Simple Linear Regression 	Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression 	Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression 	$\text{Log}\left(\frac{Y}{1-Y}\right)$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

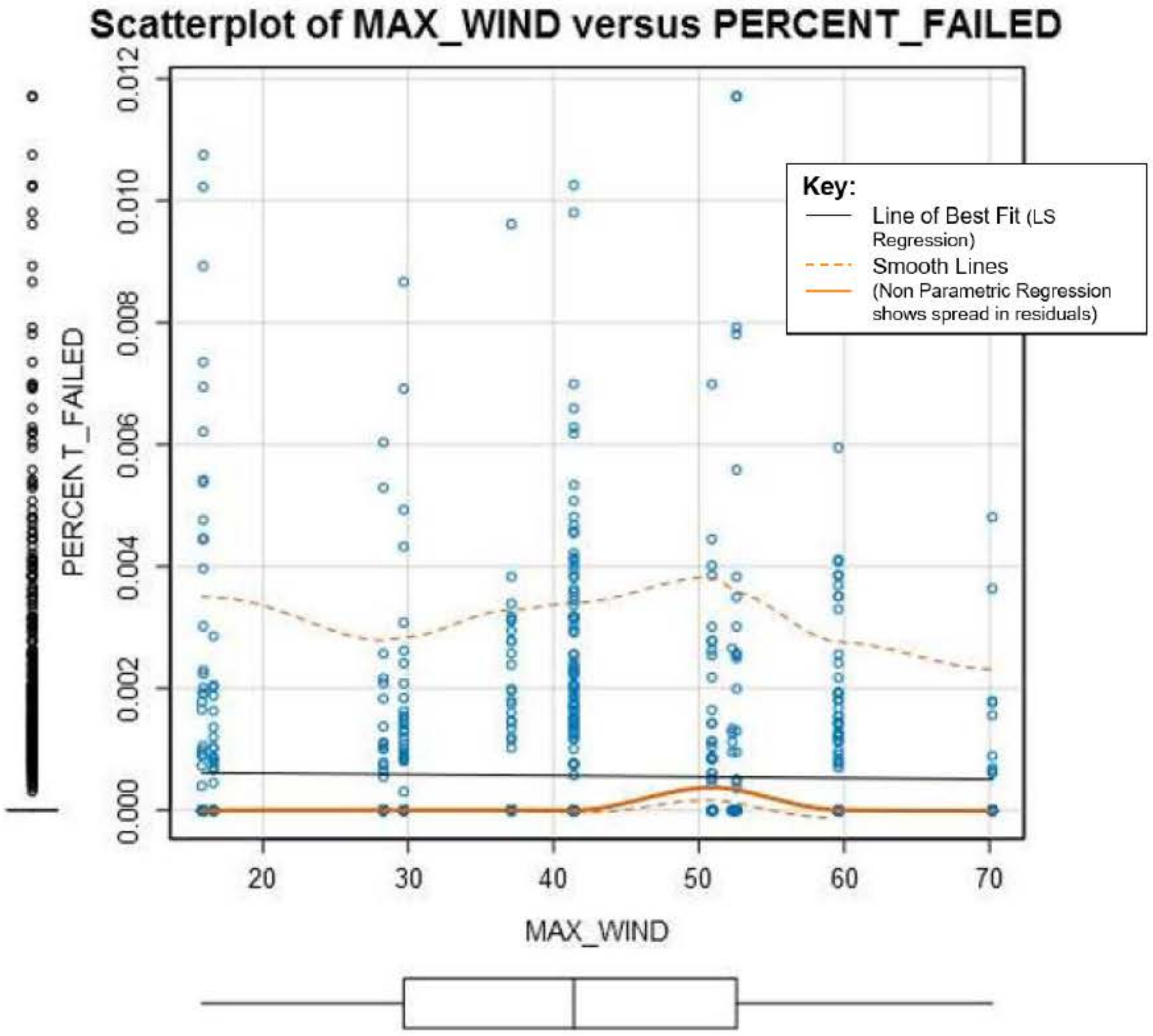
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: MAX GUST

Data Summary

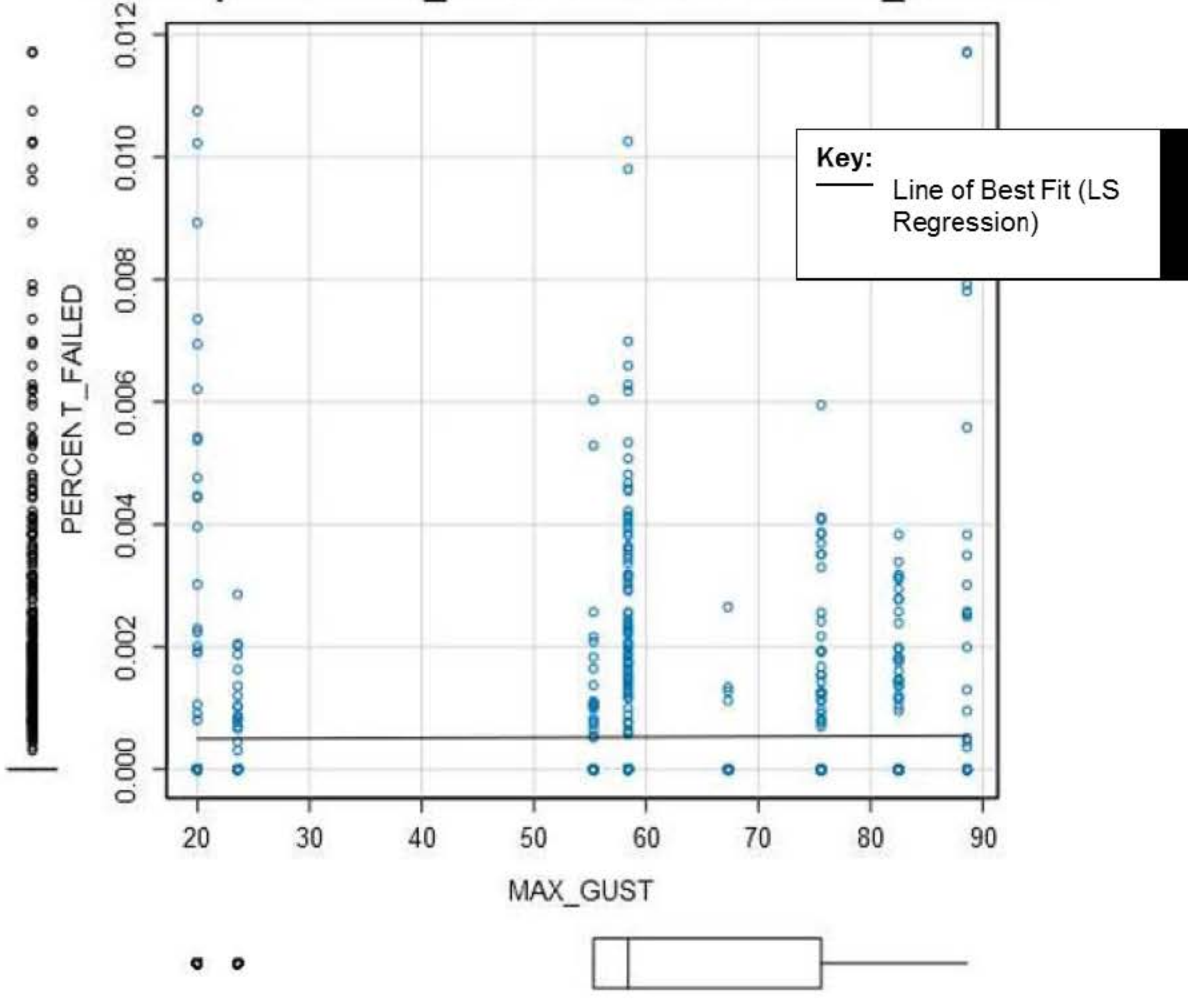
Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111

- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of MAX_GUST versus PERCENT_FAILED



SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

Data Summary

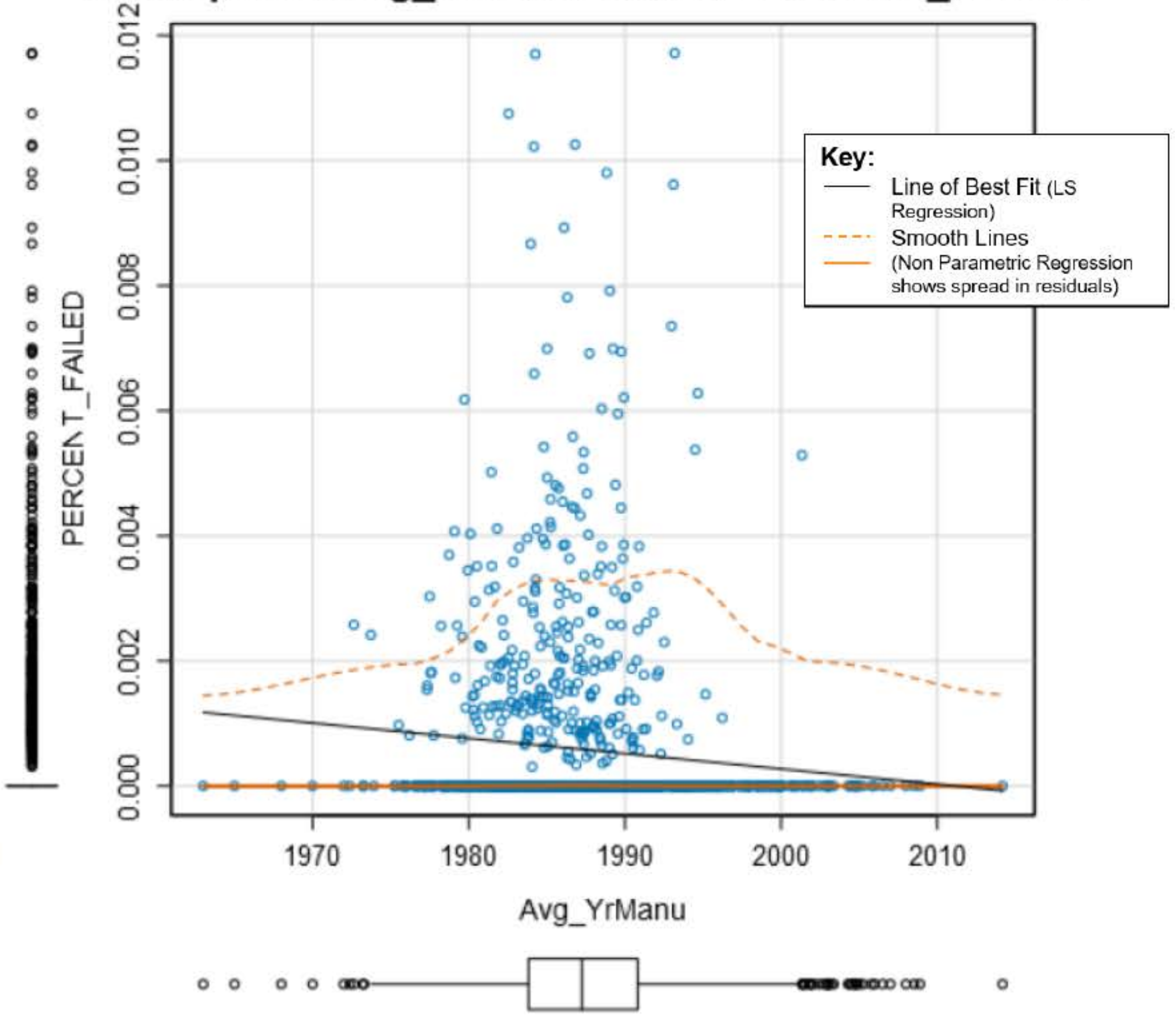
Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.

Scatterplot of Avg_YrManu versus PERCENT_FAILED



*Note: This analysis does not consider reinforcement of older poles.

SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

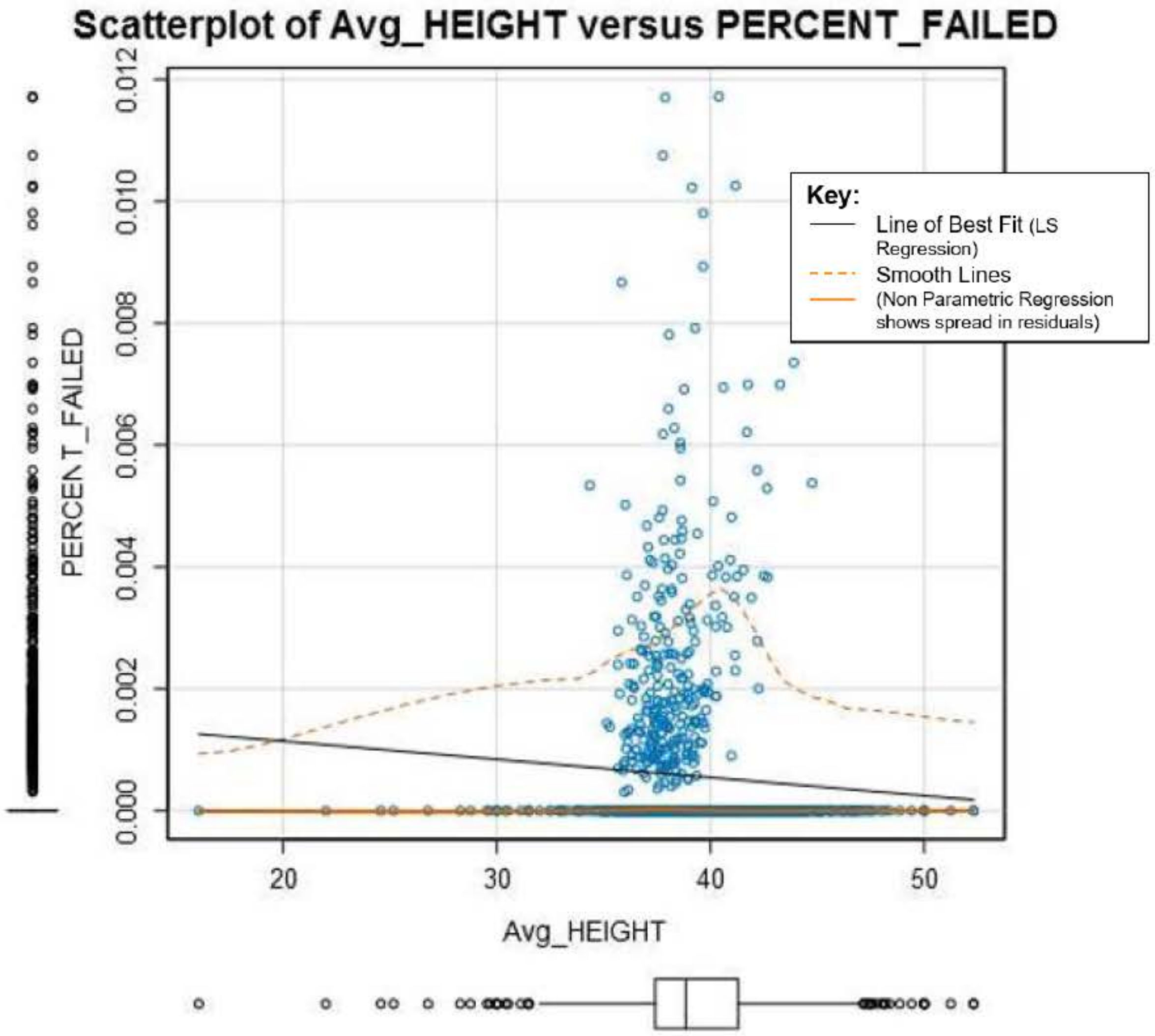
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.



SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

Data Summary

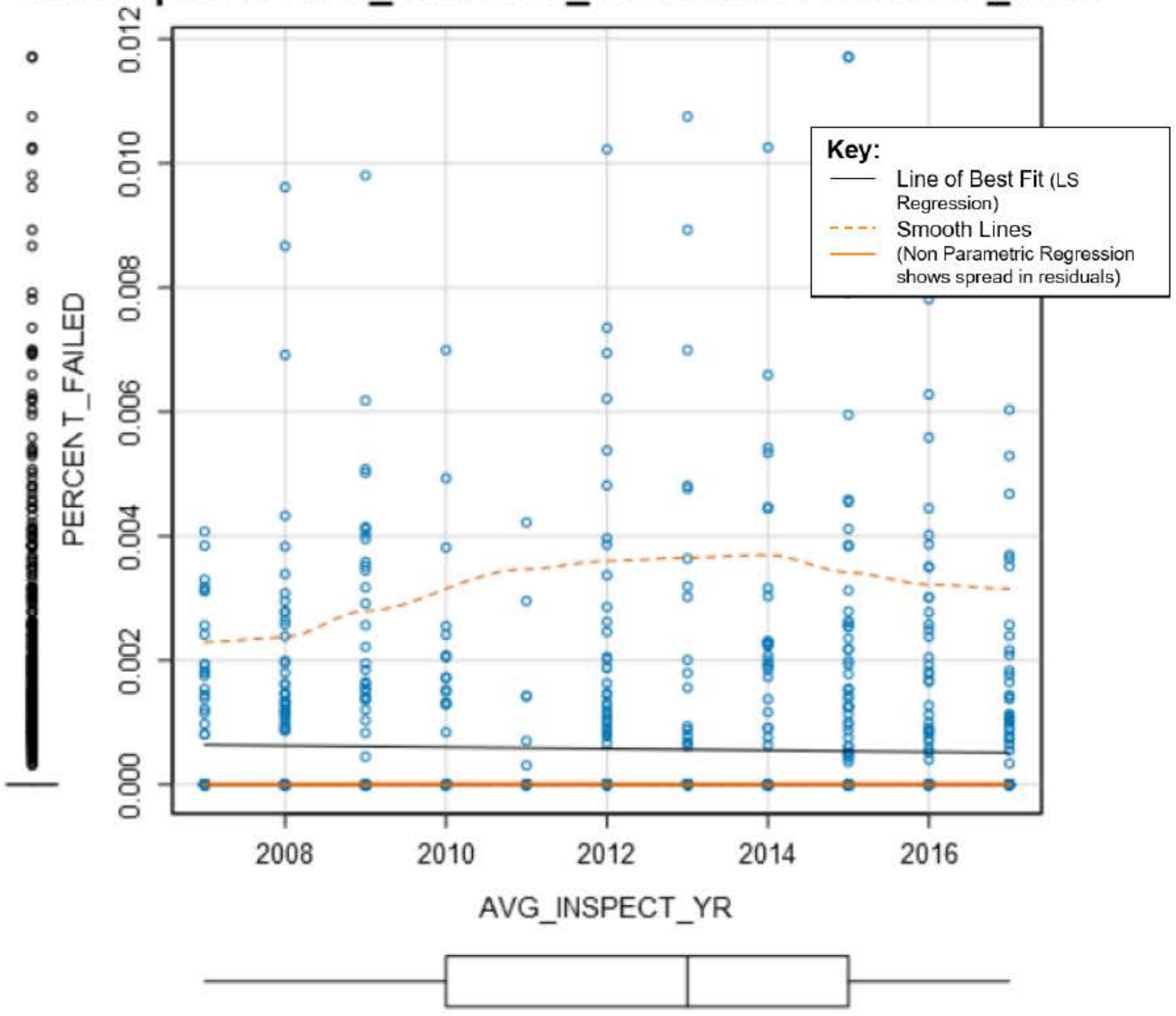
Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of AVG_INSPECT_YR versus PERCENT_FAIL



SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

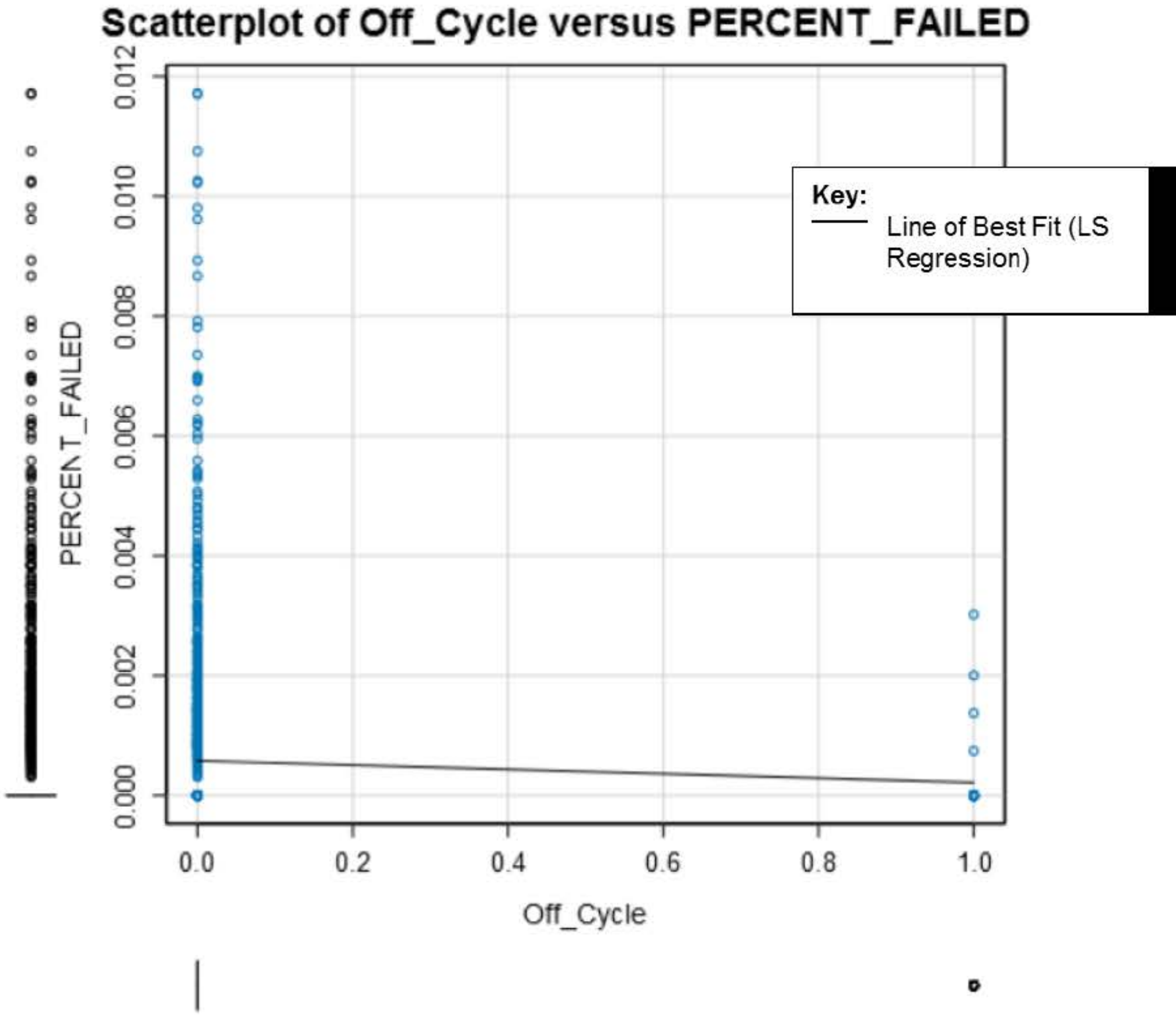
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates ($P=0.0025<0.05$). Circuits that have newer poles on average are also associated with a lower percent failure rates ($P=0.00051<0.05$).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates ($P=0.003<0.05$). Circuits that have newer poles on average are associated with a lower percent failure rates ($P=0.00002<0.05$).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.

- Circuits with a taller average pole height were more likely to have a lower pole failure rate.

- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.

- Circuits with older poles were associated with higher pole failure rates.

- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.

- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.

- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

STORM HARDENING

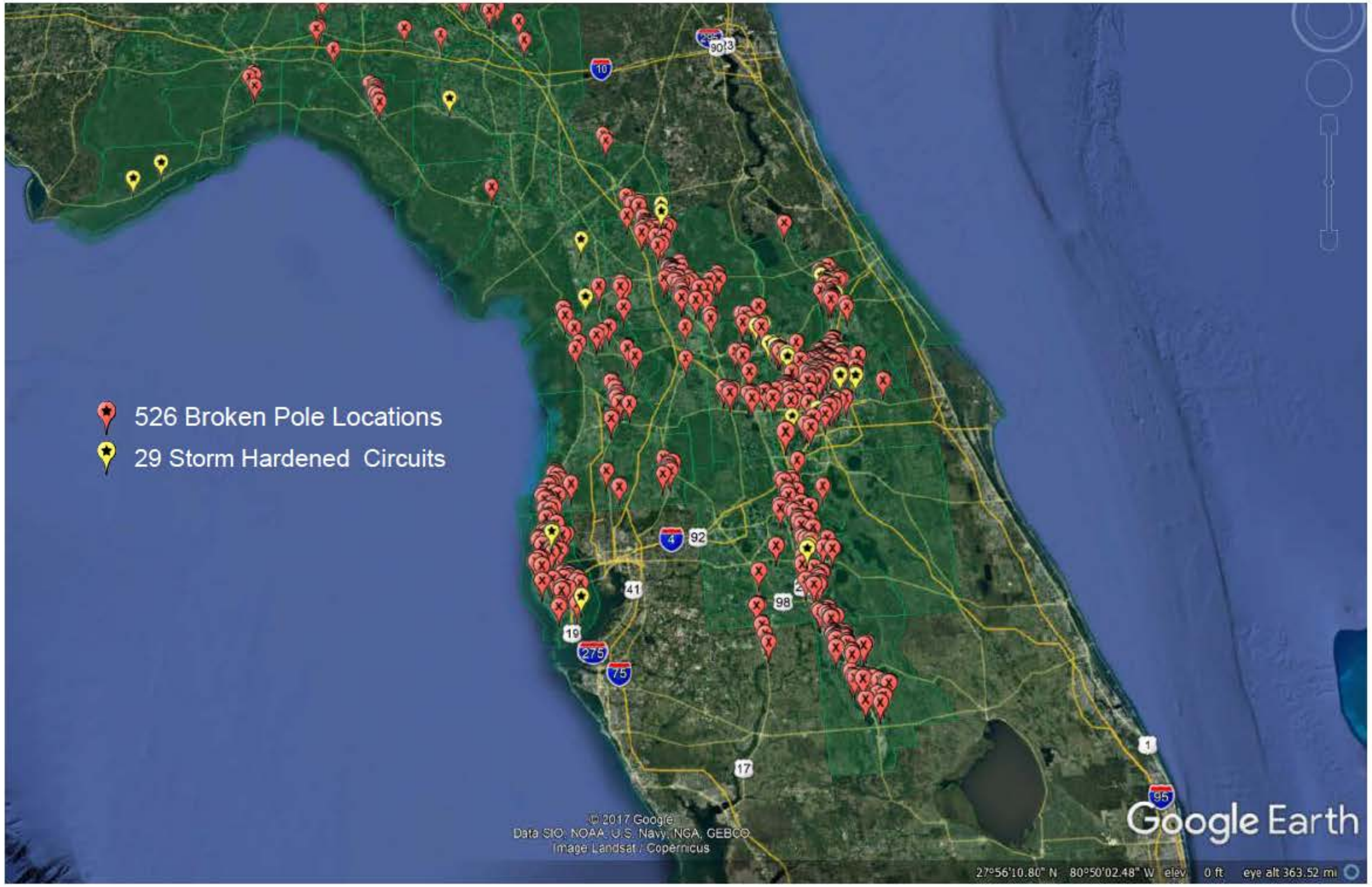
accentureconsulting

METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

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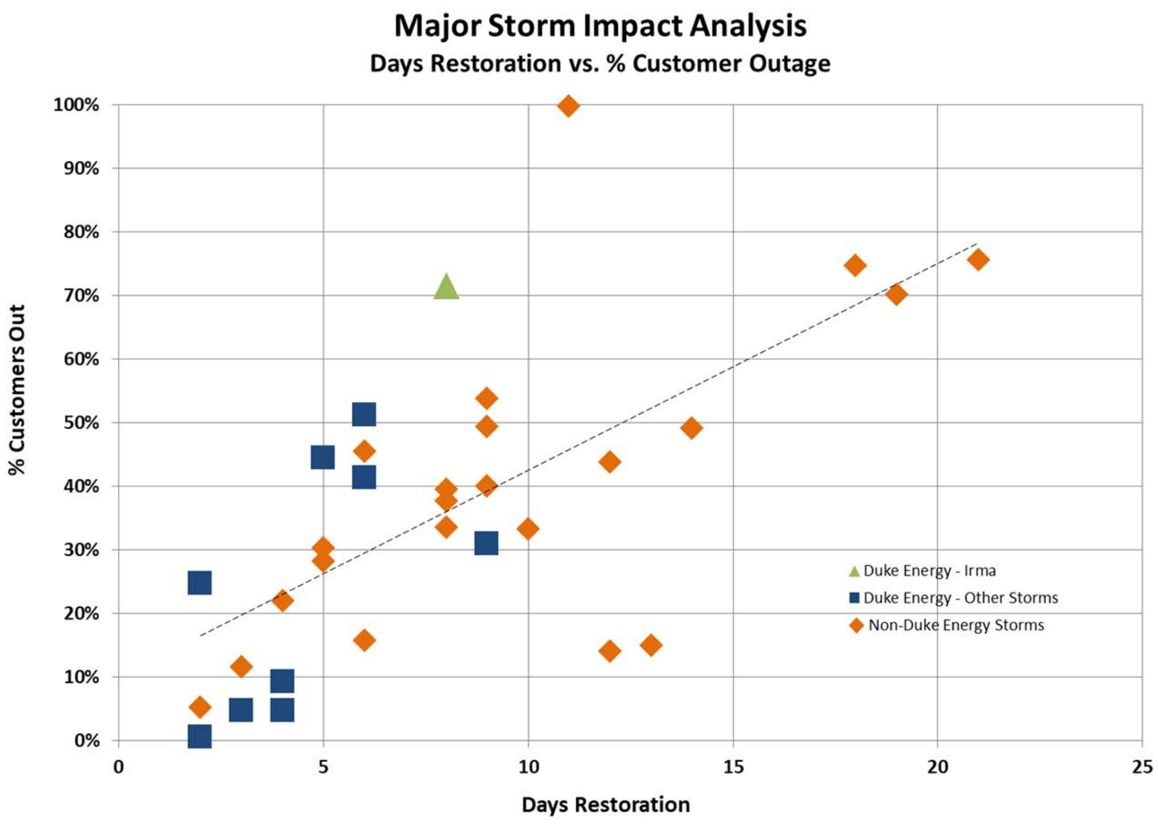
EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging “storm benchmark database” compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

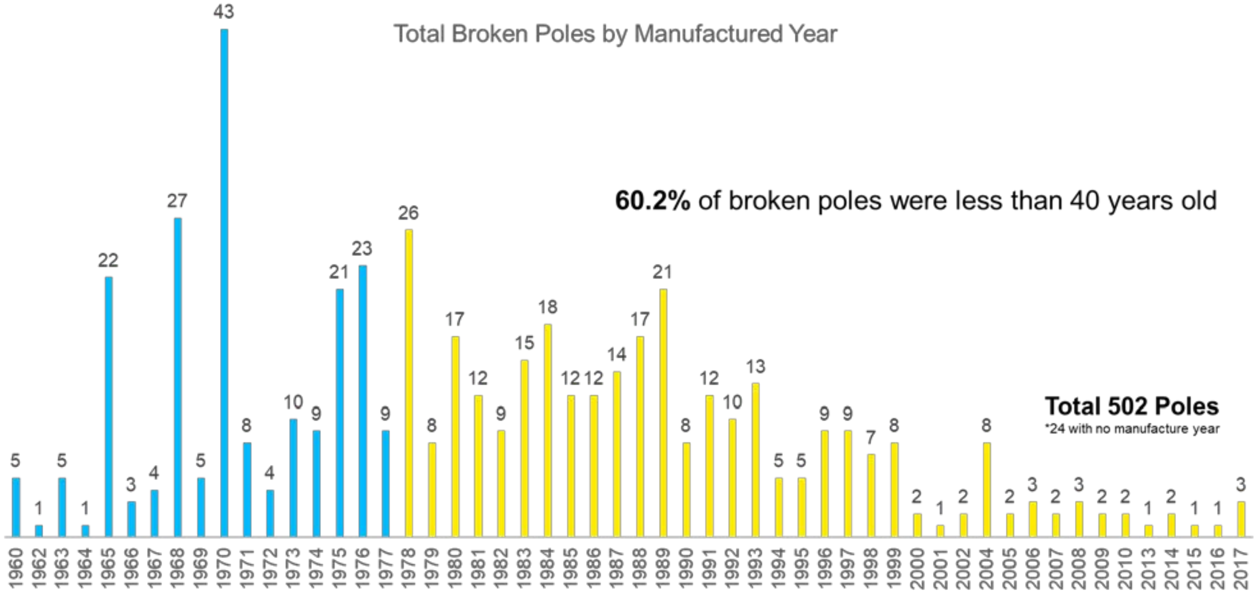
EXECUTIVE SUMMARY – BENCHMARK

- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



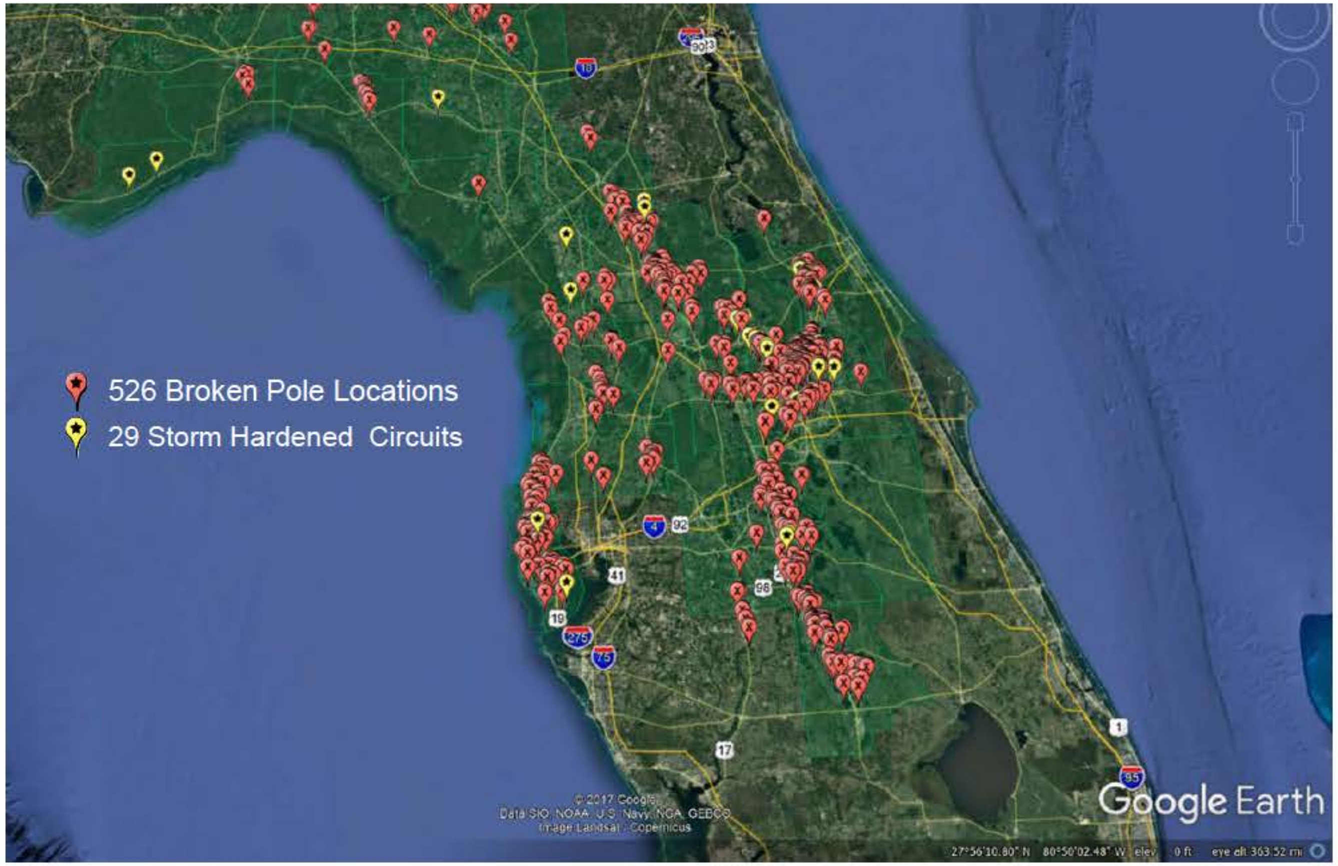
EXECUTIVE SUMMARY – FORENSIC

- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



EXECUTIVE SUMMARY – SYSTEM HARDENING

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.



OVERVIEW/ PURPOSE

OVERVIEW/PURPOSE

- Duke Energy Florida (“Duke FL”) conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture’s storm benchmarking database to compare against Duke FL’s response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL’s hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

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METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance

- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL’s restoration efforts versus other utility companies captured in Accenture’s storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	2,271
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

Restoration Duration	
Restoration Duration (# Days)	8 days

Restoration Costs	
Total Restoration Cost	$500M - $550M

Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

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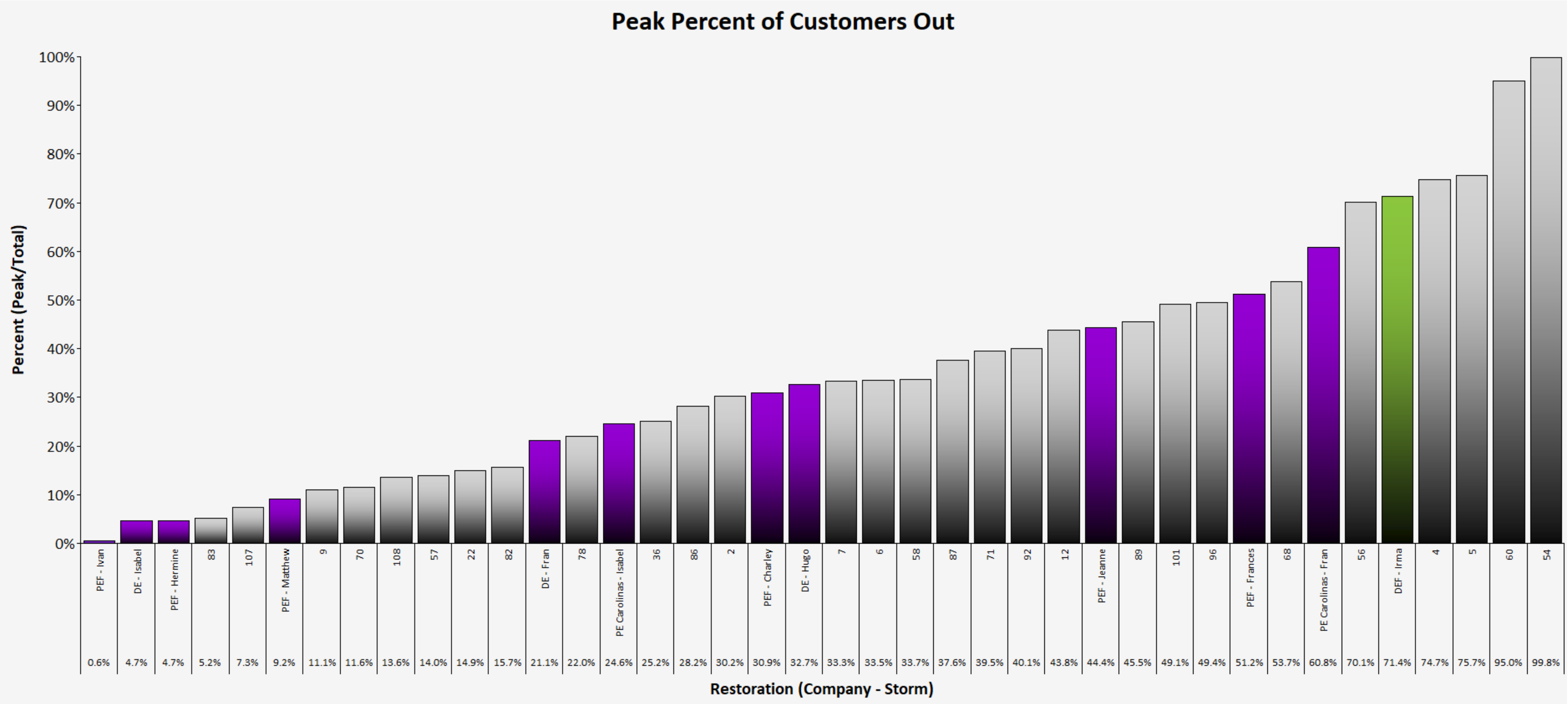
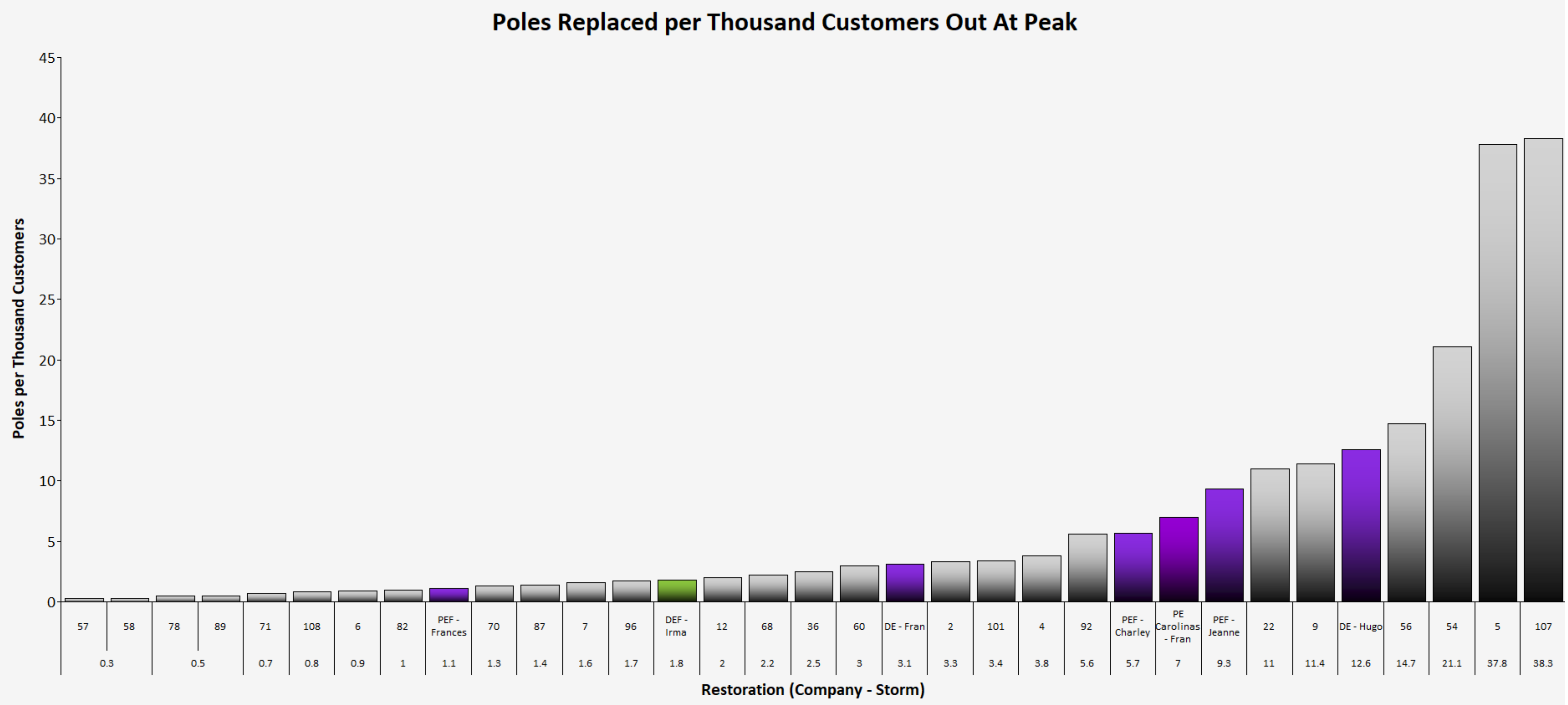
BENCHMARK RESULTS



BENCHMARK RESULTS

20170272-DEF-OPC-POD 2-14-000080



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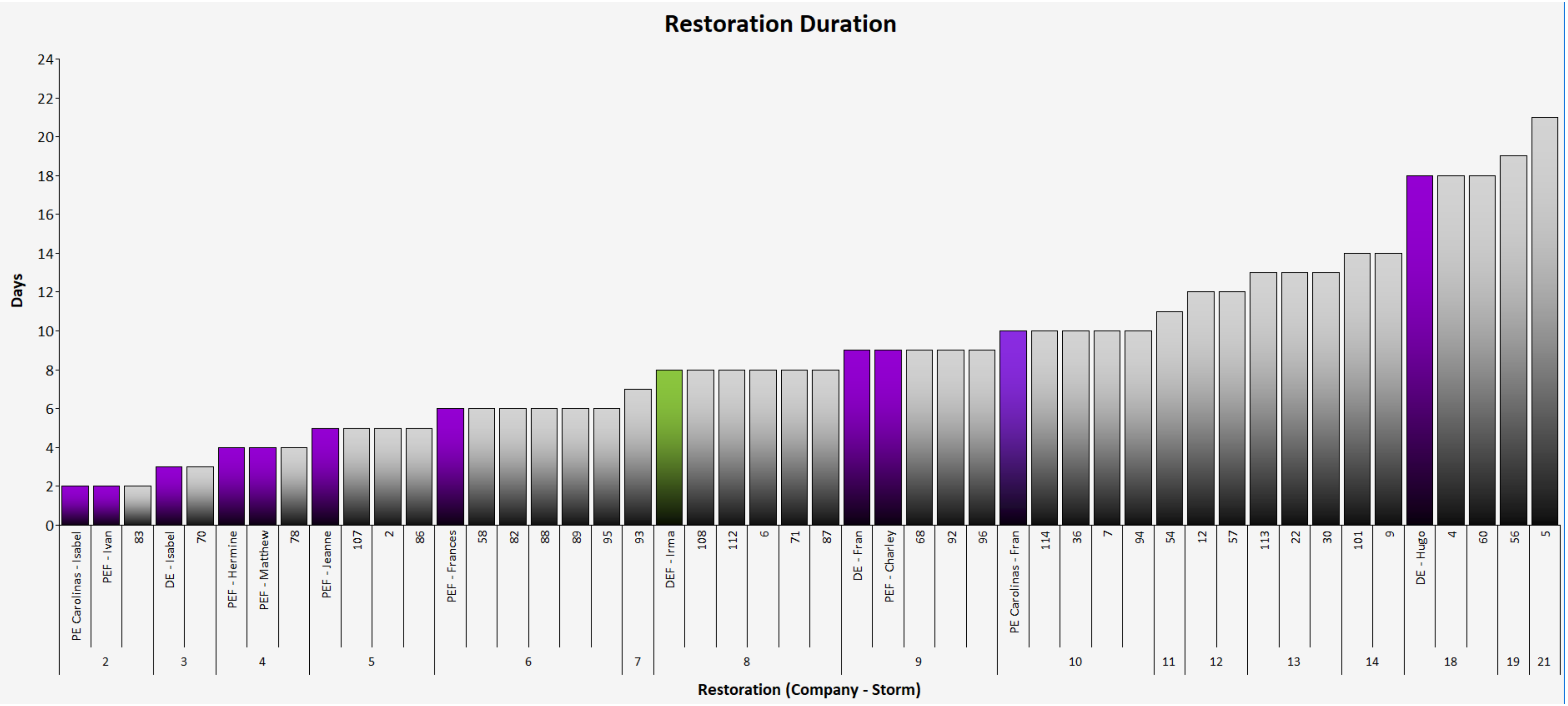
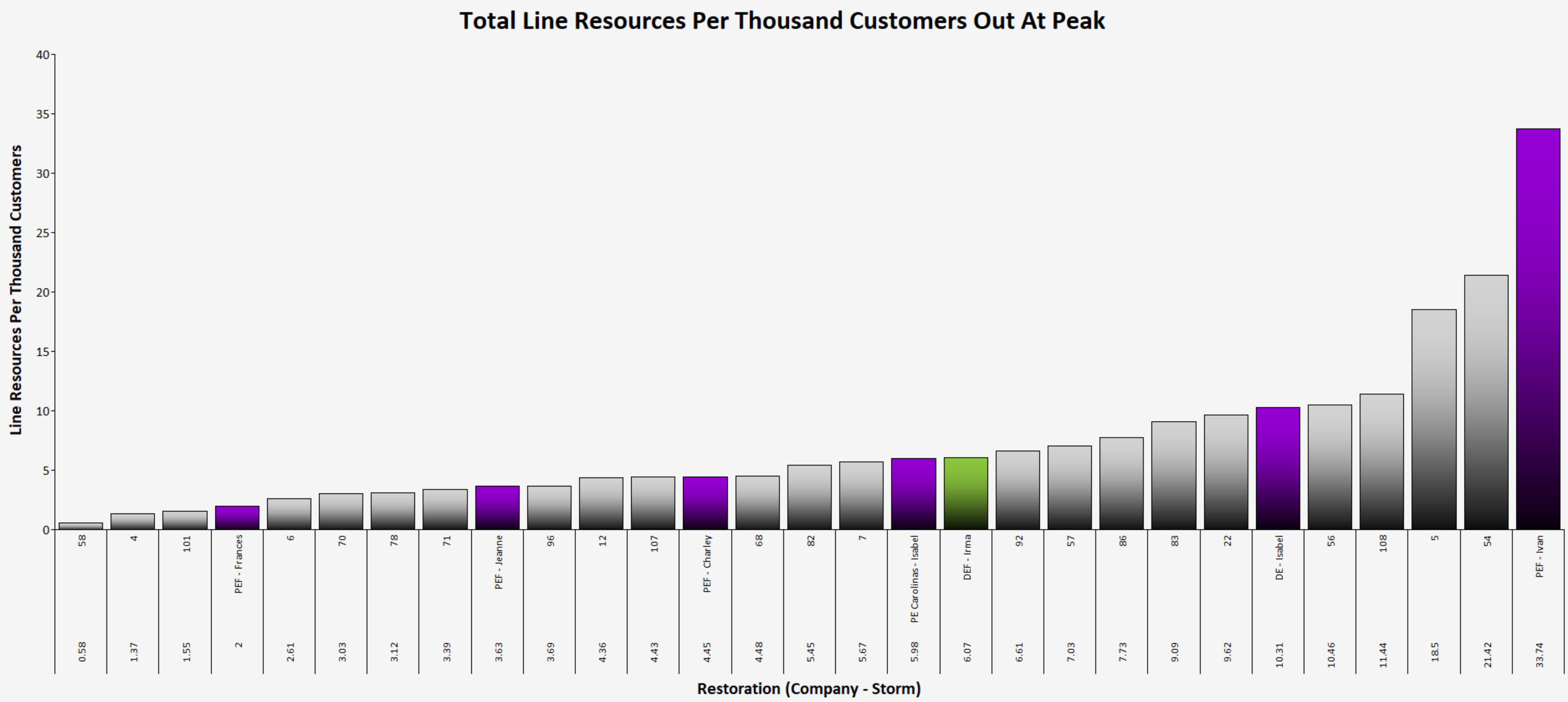
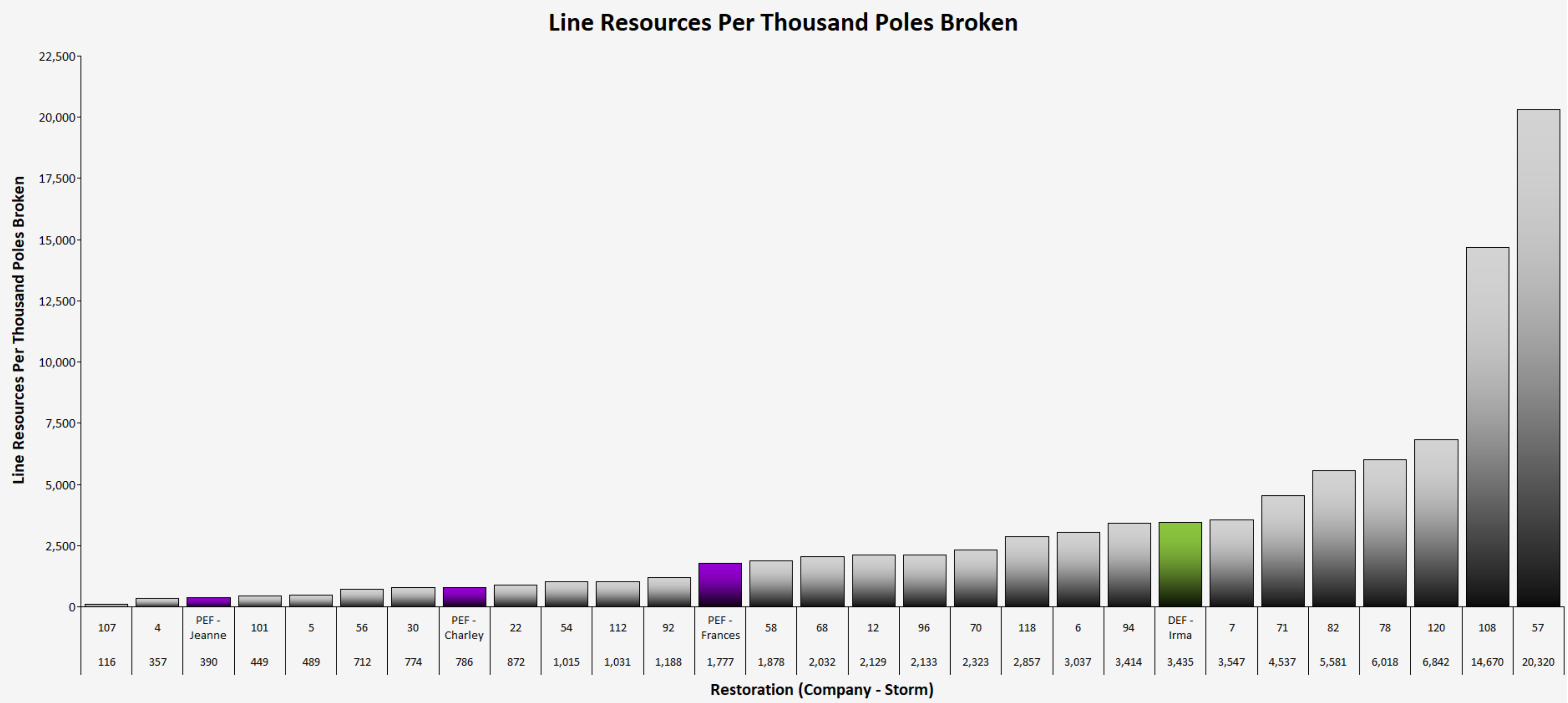
BENCHMARK RESULTS



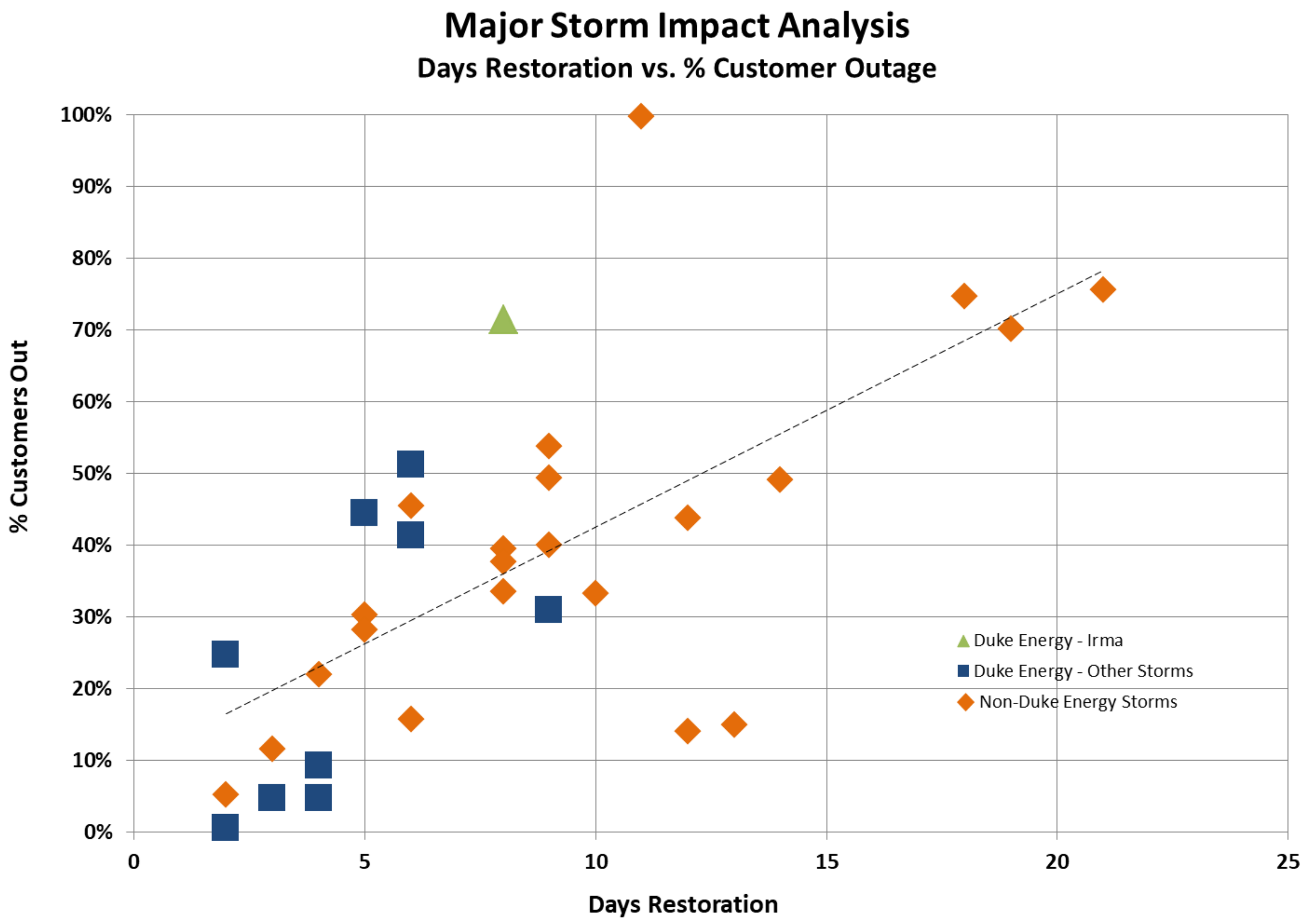
BENCHMARK RESULTS



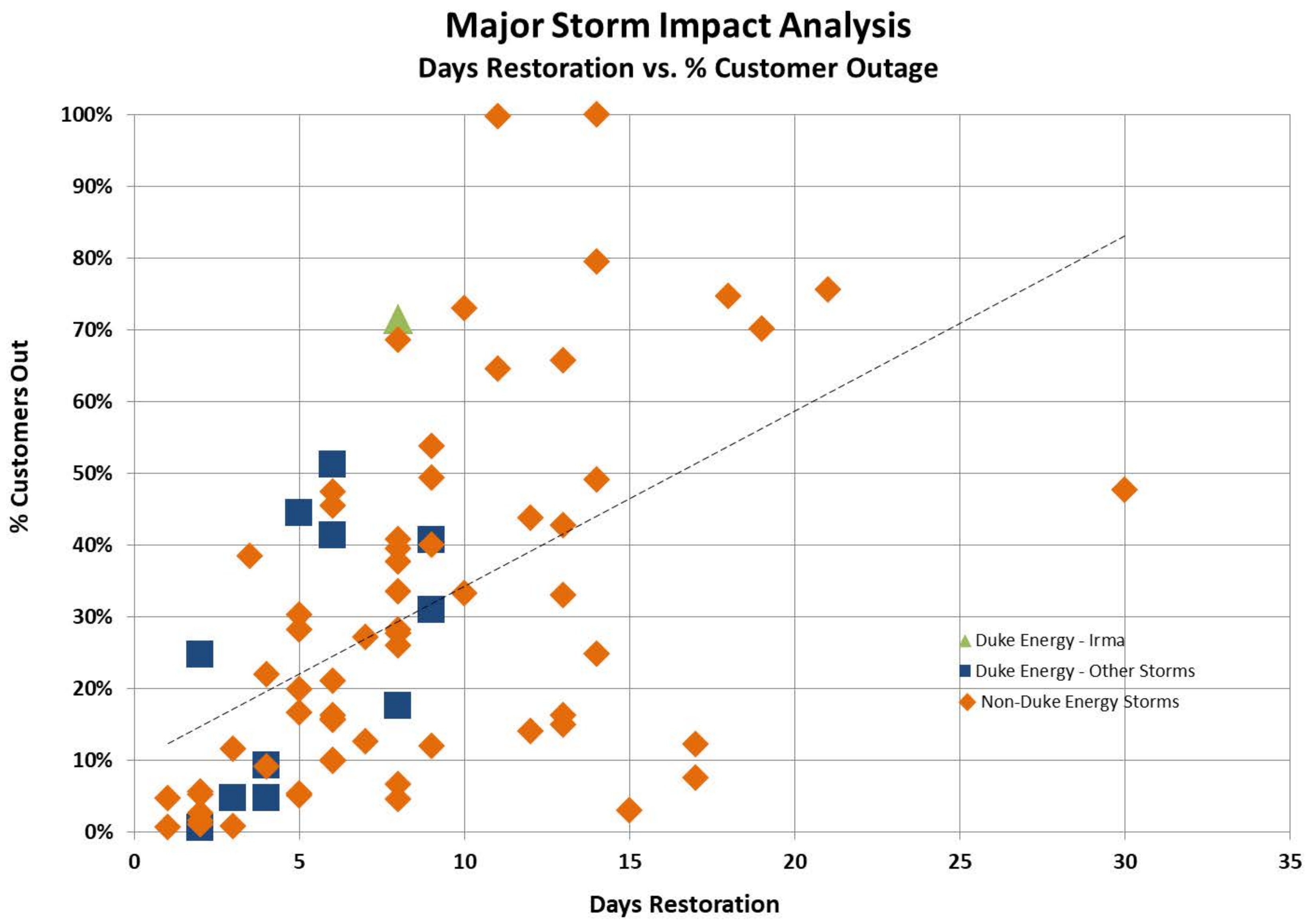
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

FORENSICS ANALYSIS

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METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 2,130 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

Broken Poles Included in Forensic Analysis

2,130 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

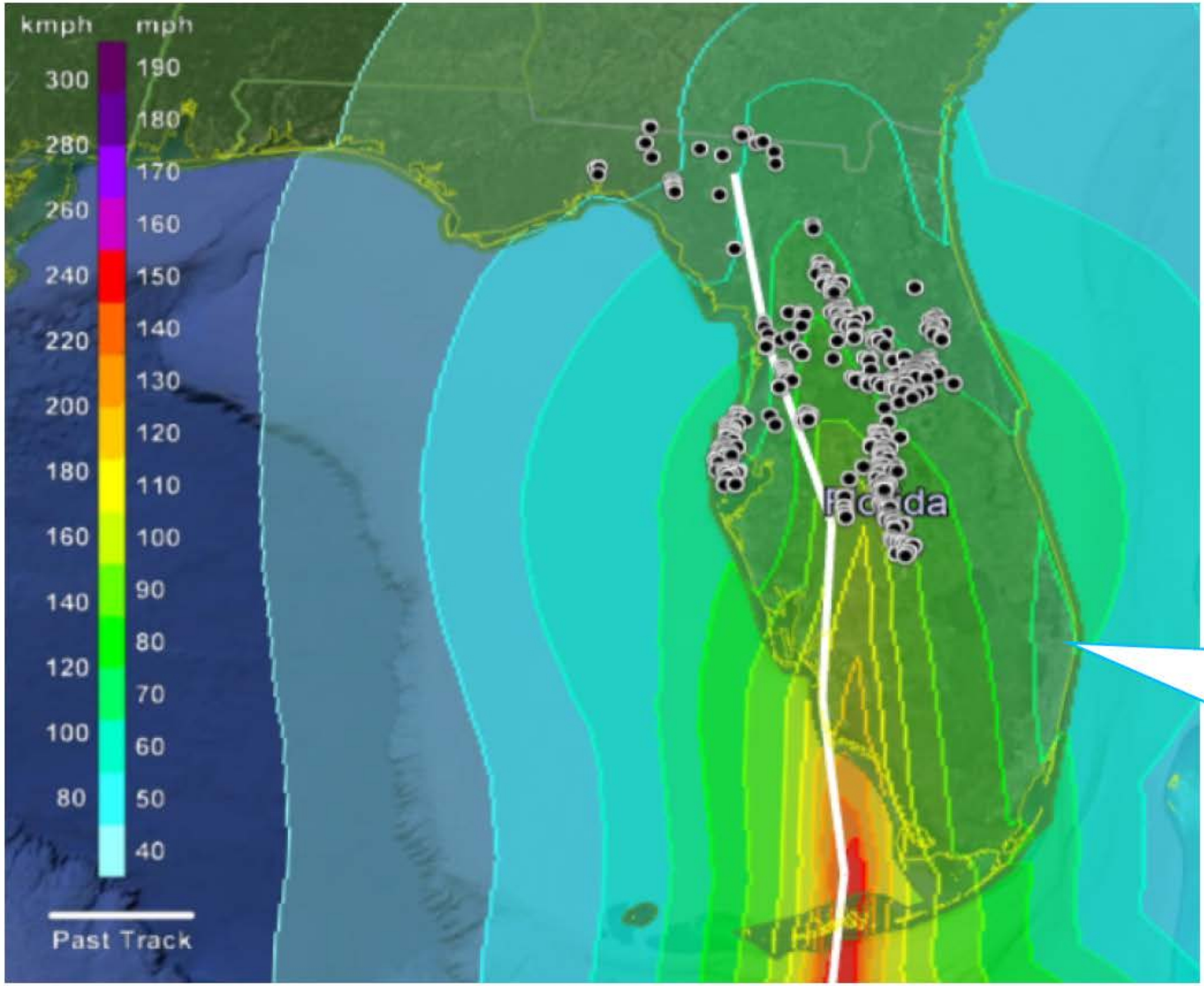
Pole Inventory – Duke Florida

1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS

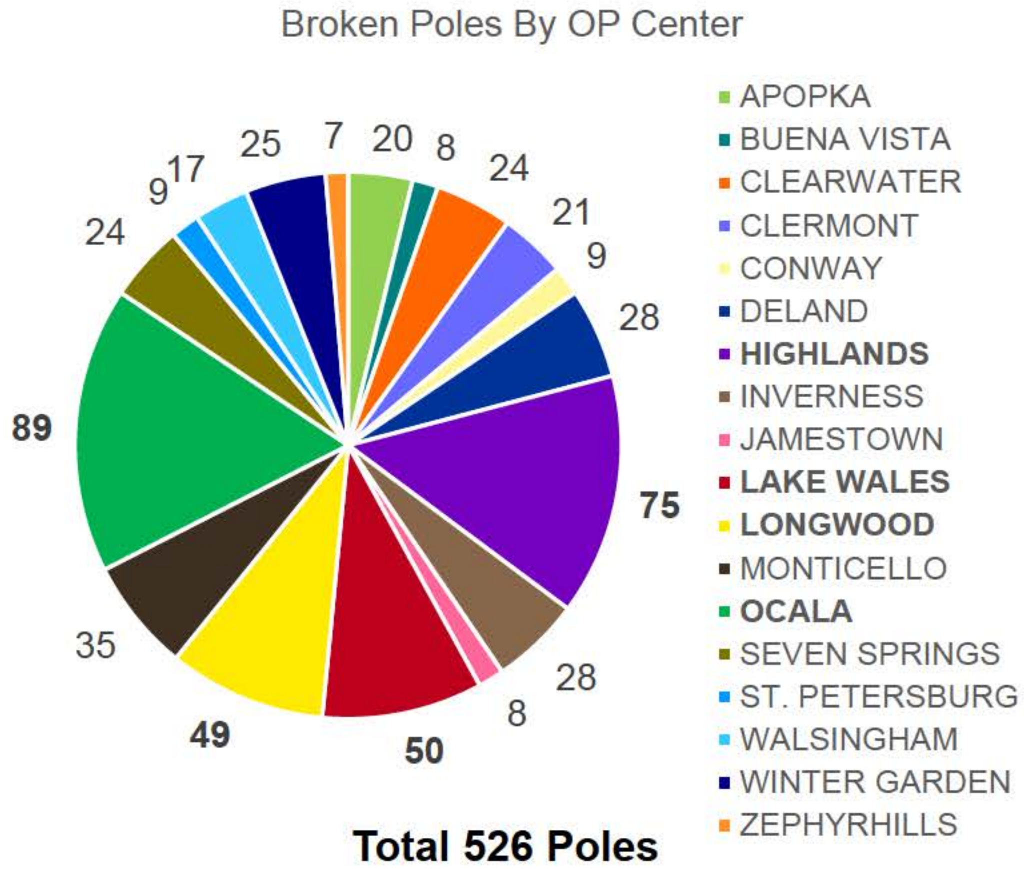


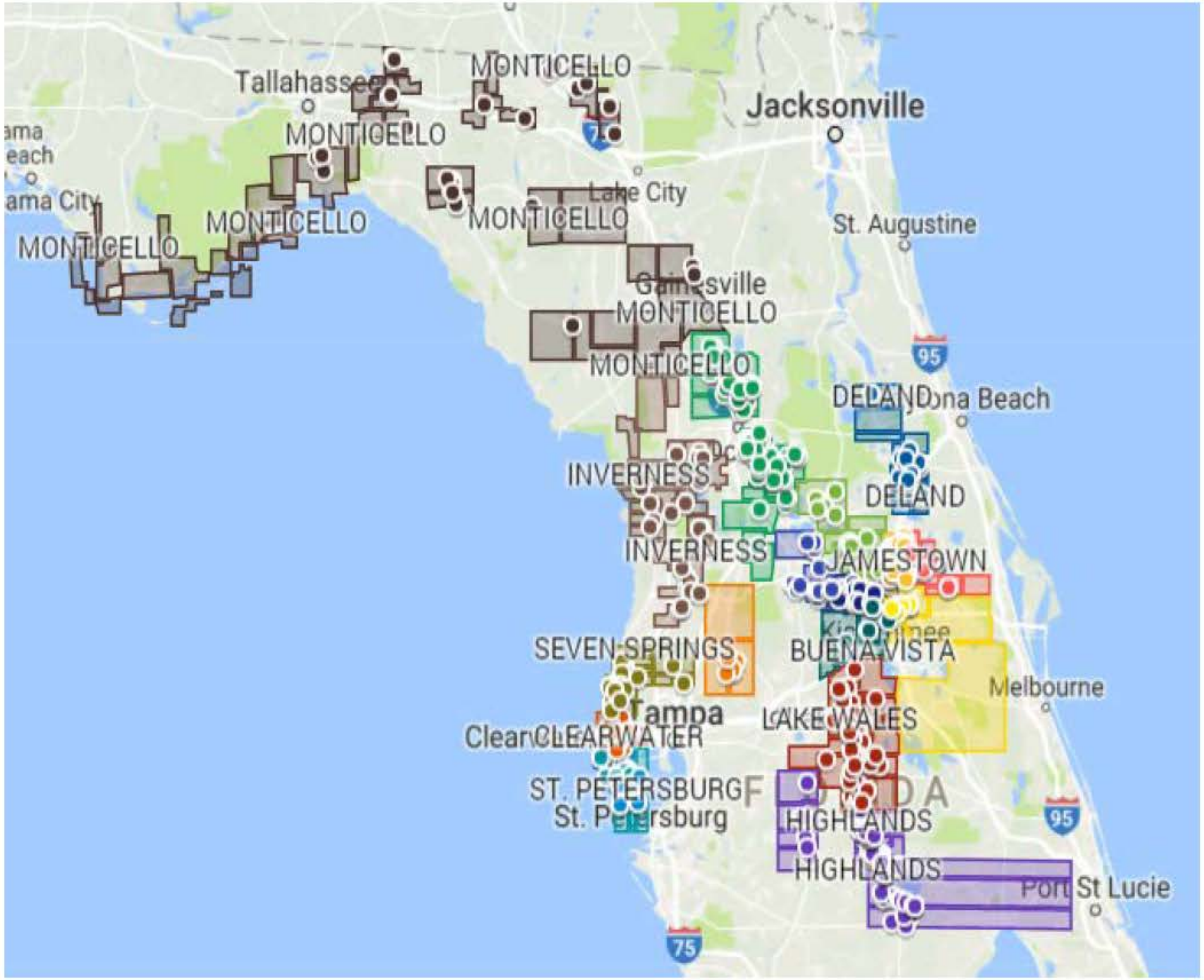
https://data.humdata.org/dataset/hurricane-irma-windspeed

526 Broken Poles

Irma Path
9/11 12am – 12pm

BROKEN POLE VISUALIZATIONS





50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS

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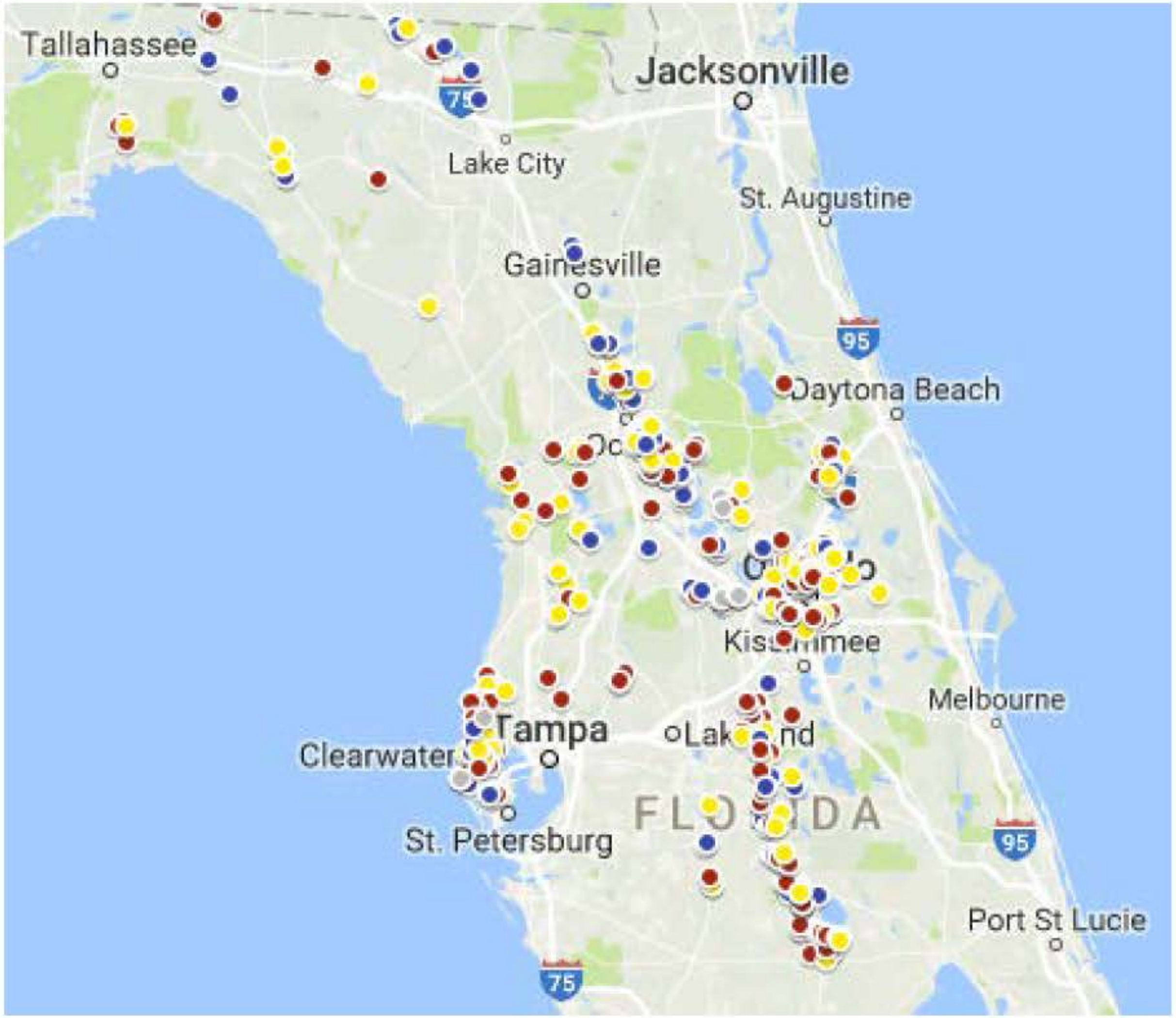
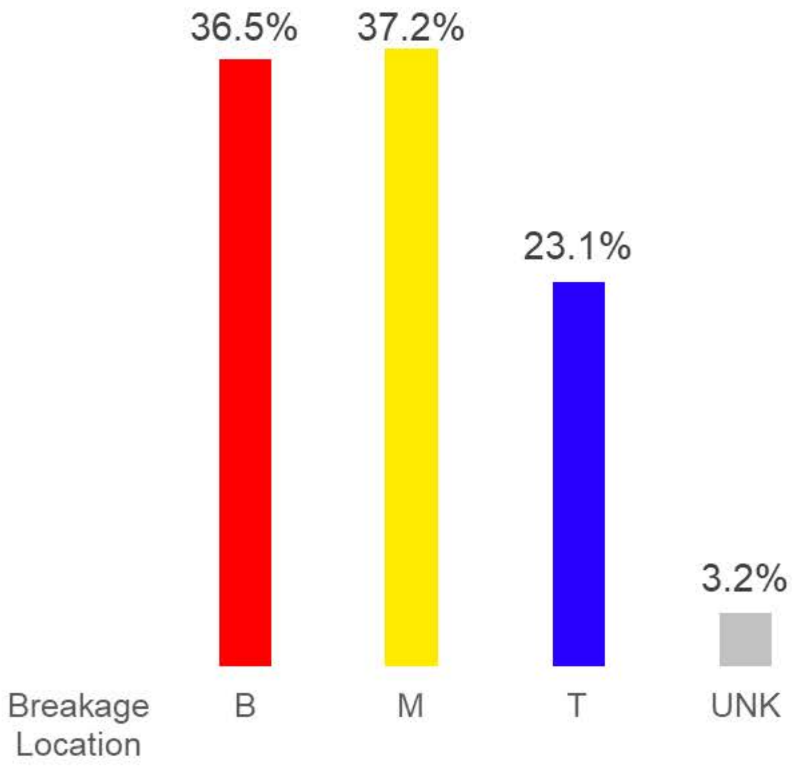


- **37.2%** of poles broke in the middle



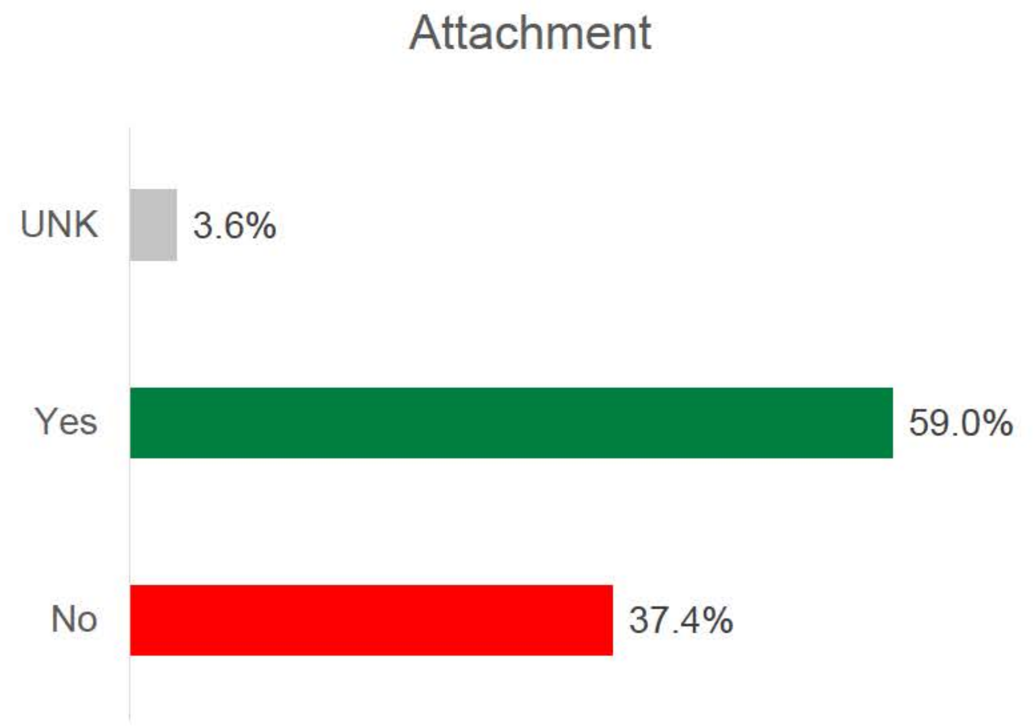
Total 471 Poles

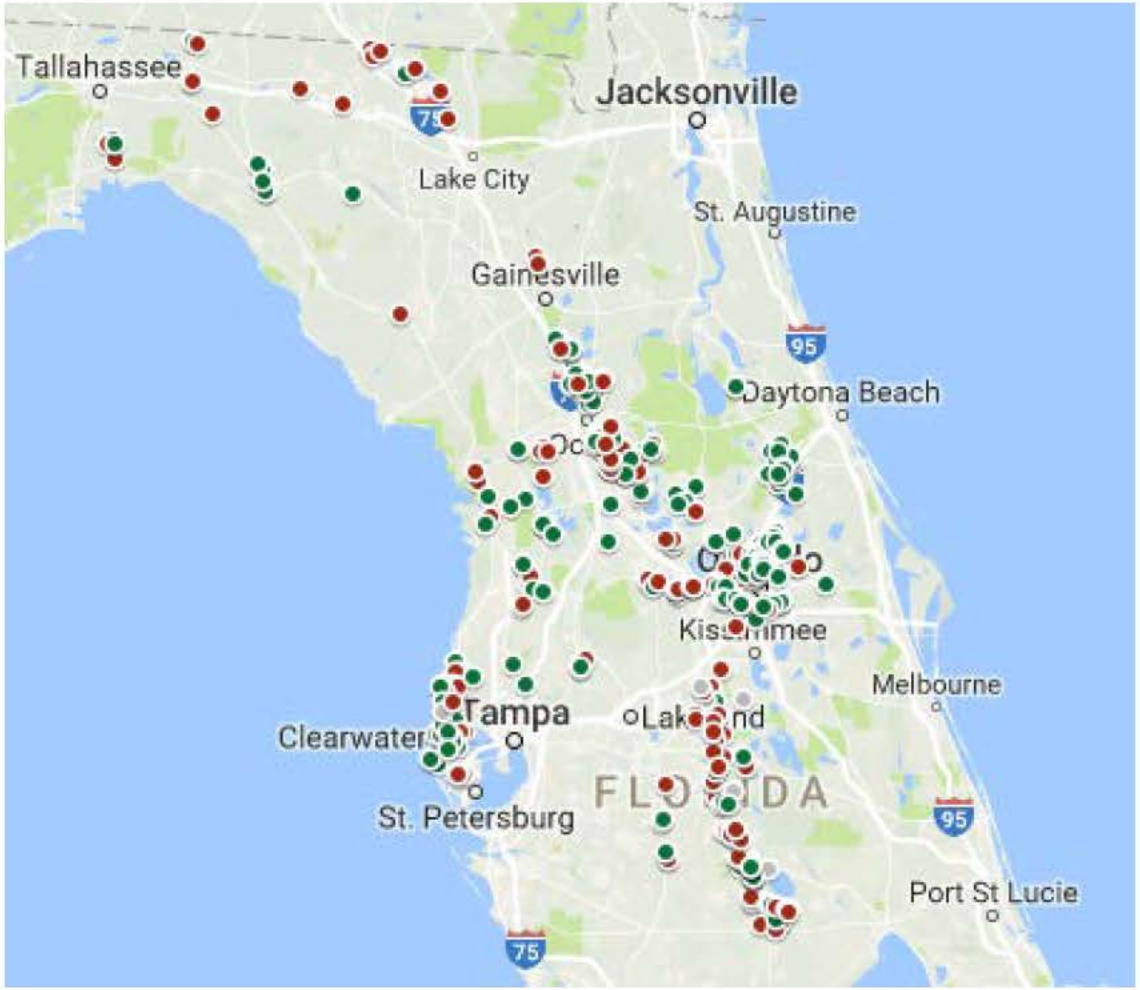
***66 poles that broke at the bottom did not have reject status information**

BROKEN POLE VISUALIZATIONS

20170272-DEF-OPC-POD 2-14-000094

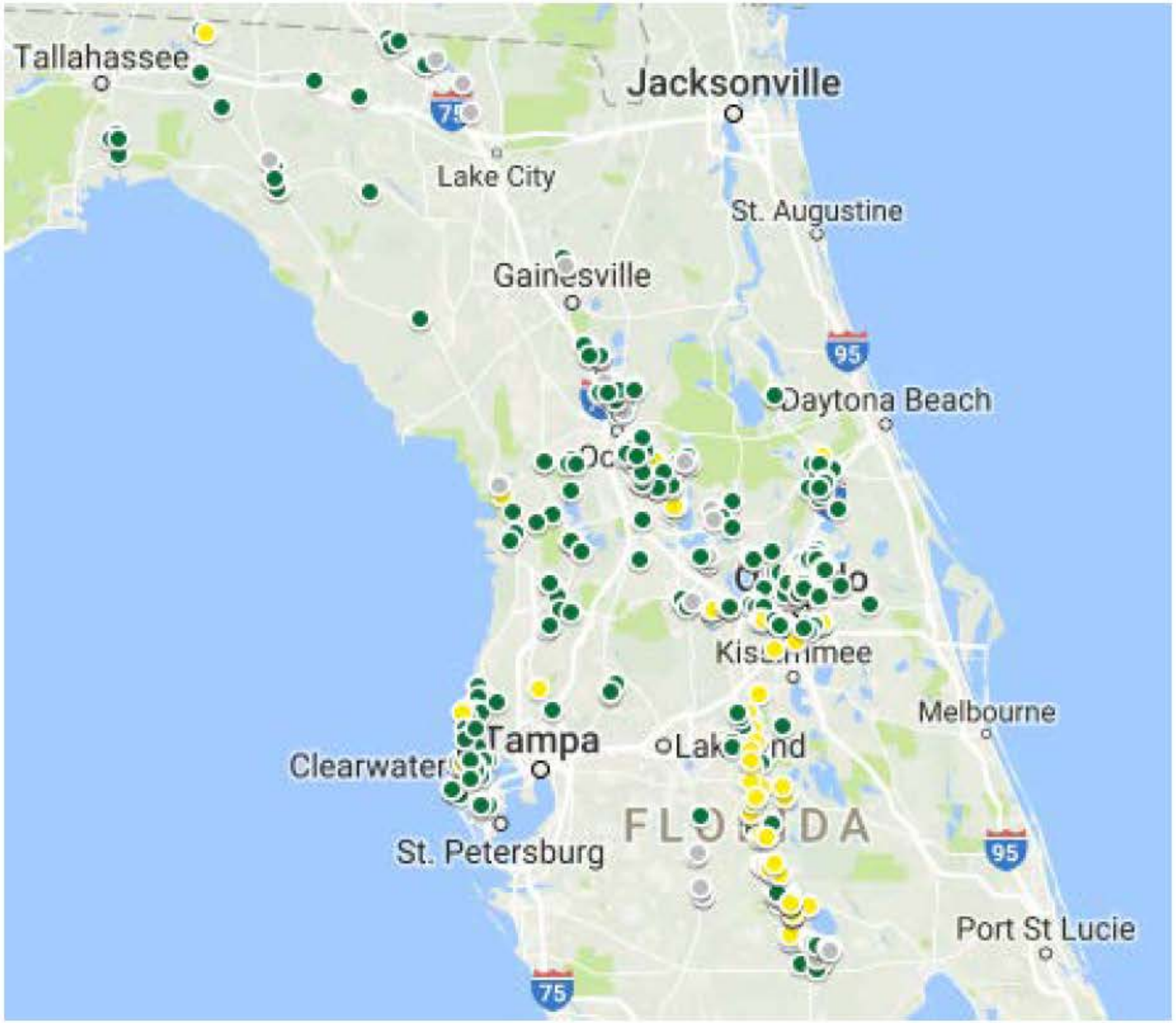
59% of broken poles had an attachment



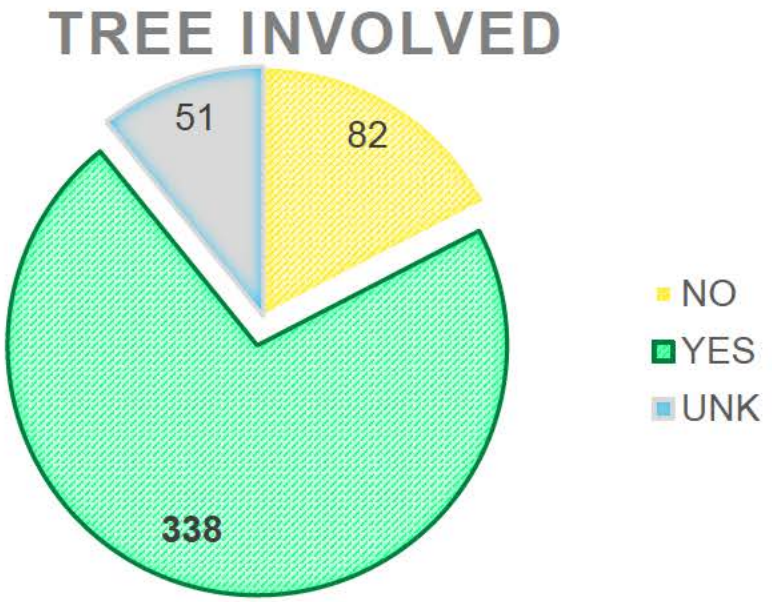


Total 471 Poles

BROKEN POLE VISUALIZATIONS



71.8% of broken poles had a tree involved

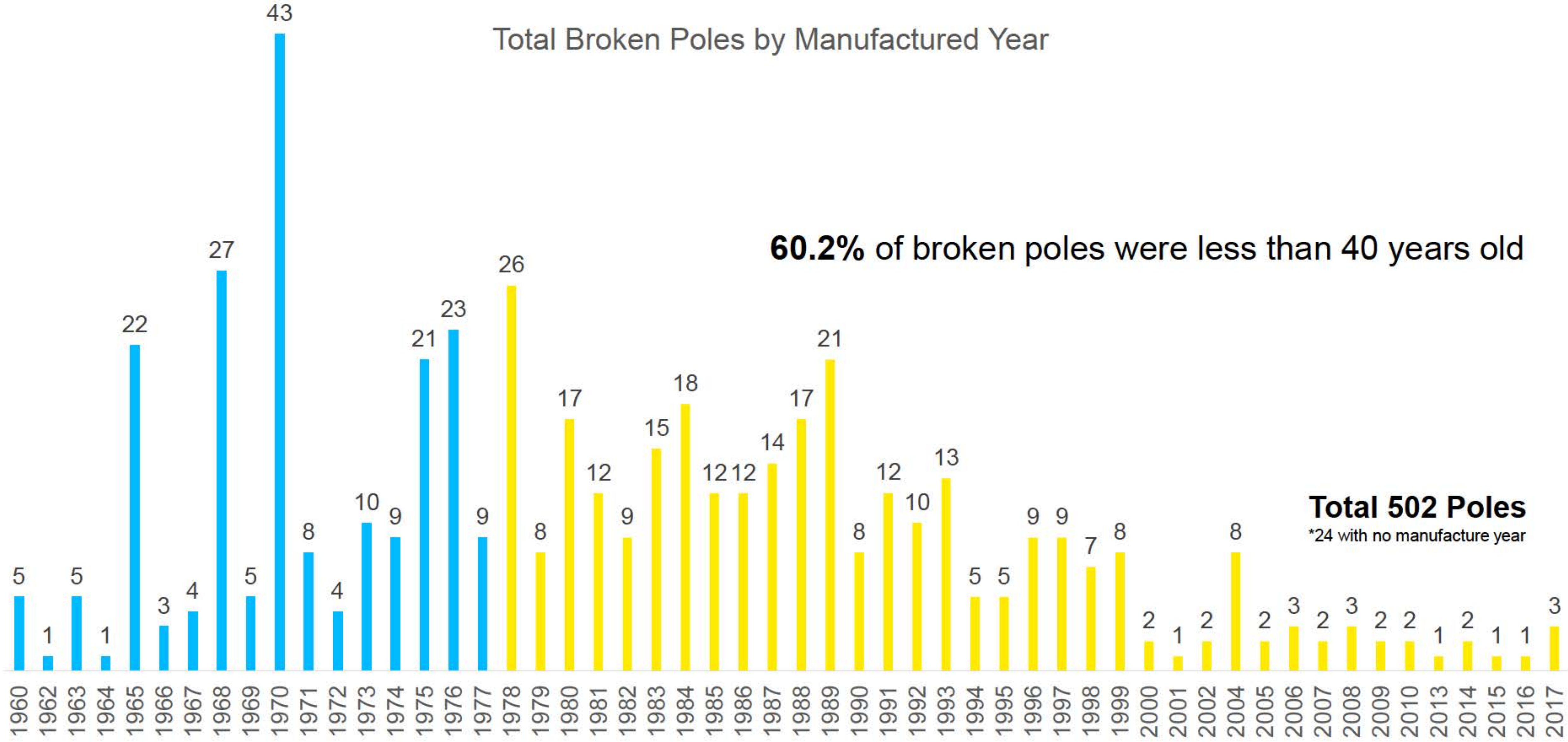


Total 471 Poles

BROKEN POLE VISUALIZATIONS

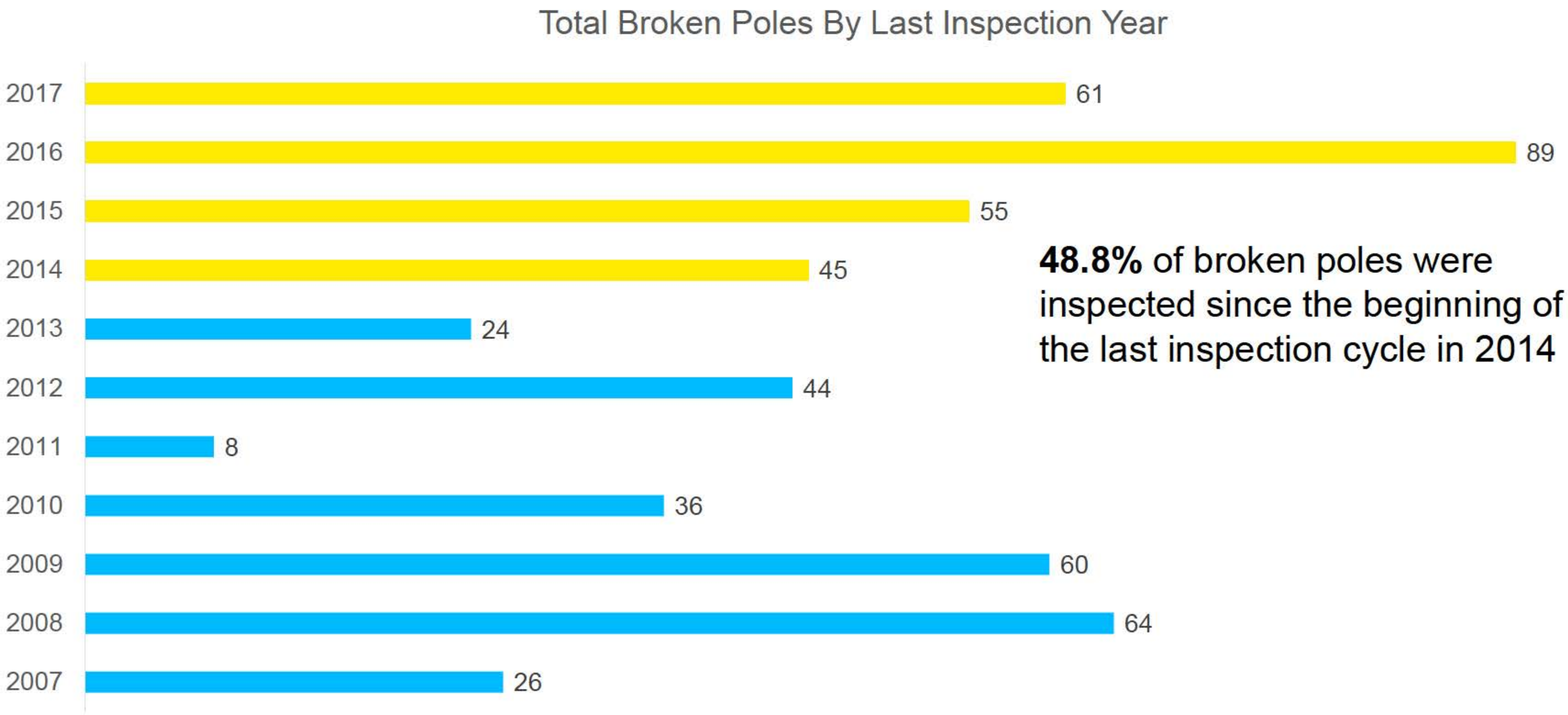
20170272-DEF-OPC-POD 2-14-000096

DUKE ENERGY. FLORIDA



BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA



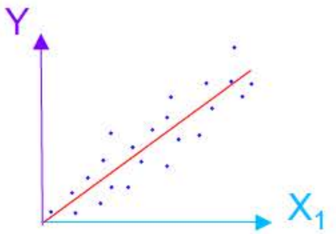
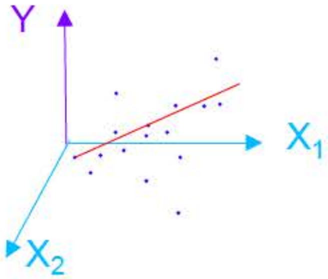
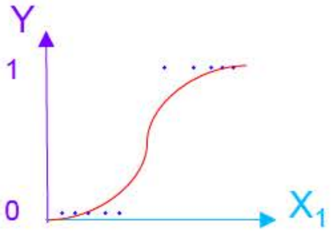
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression	Model Design	Why we use it
Simple Linear Regression 	Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression 	Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression 	$\text{Log}(\frac{Y}{1-Y})$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

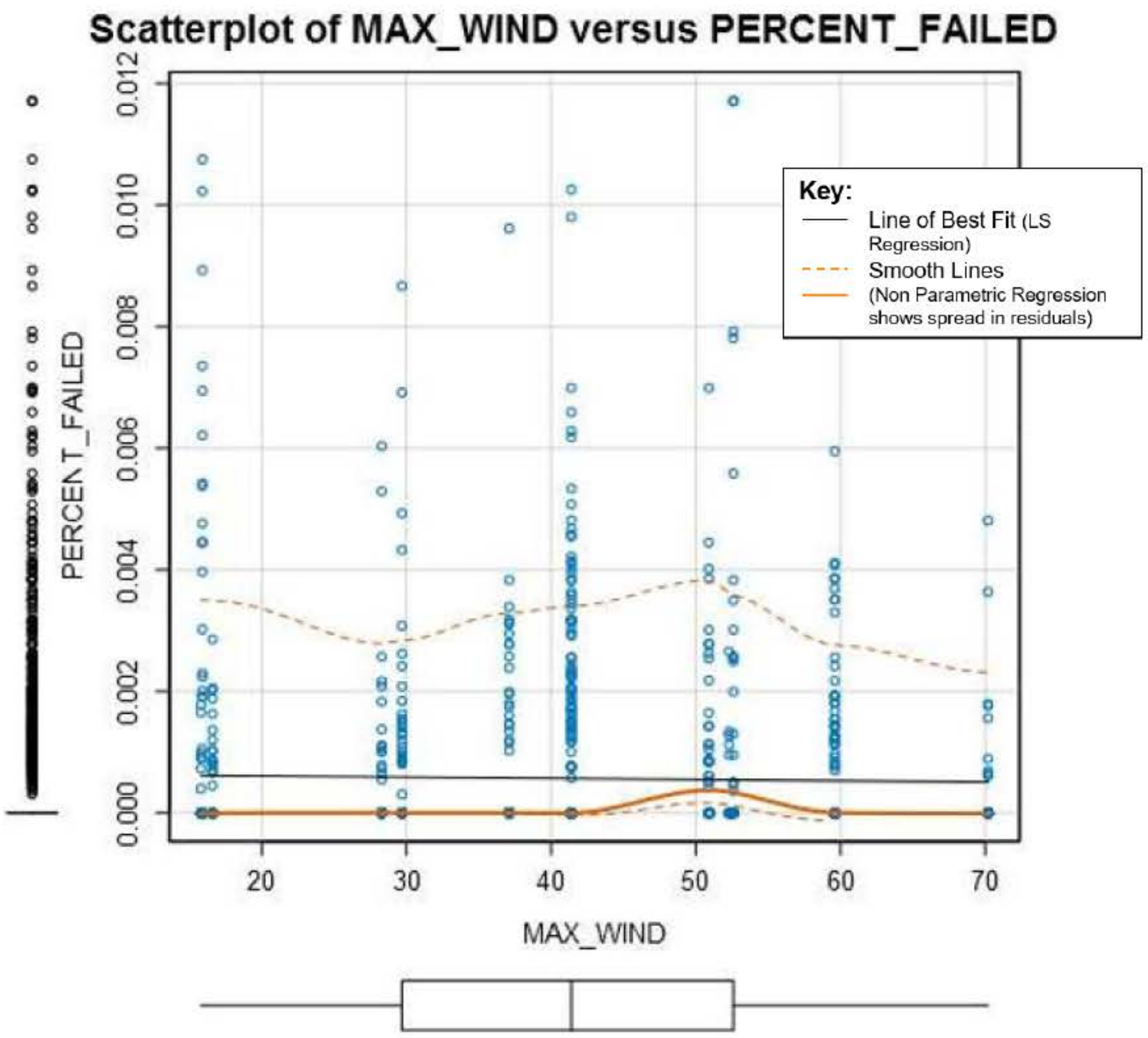
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: MAX GUST

Data Summary

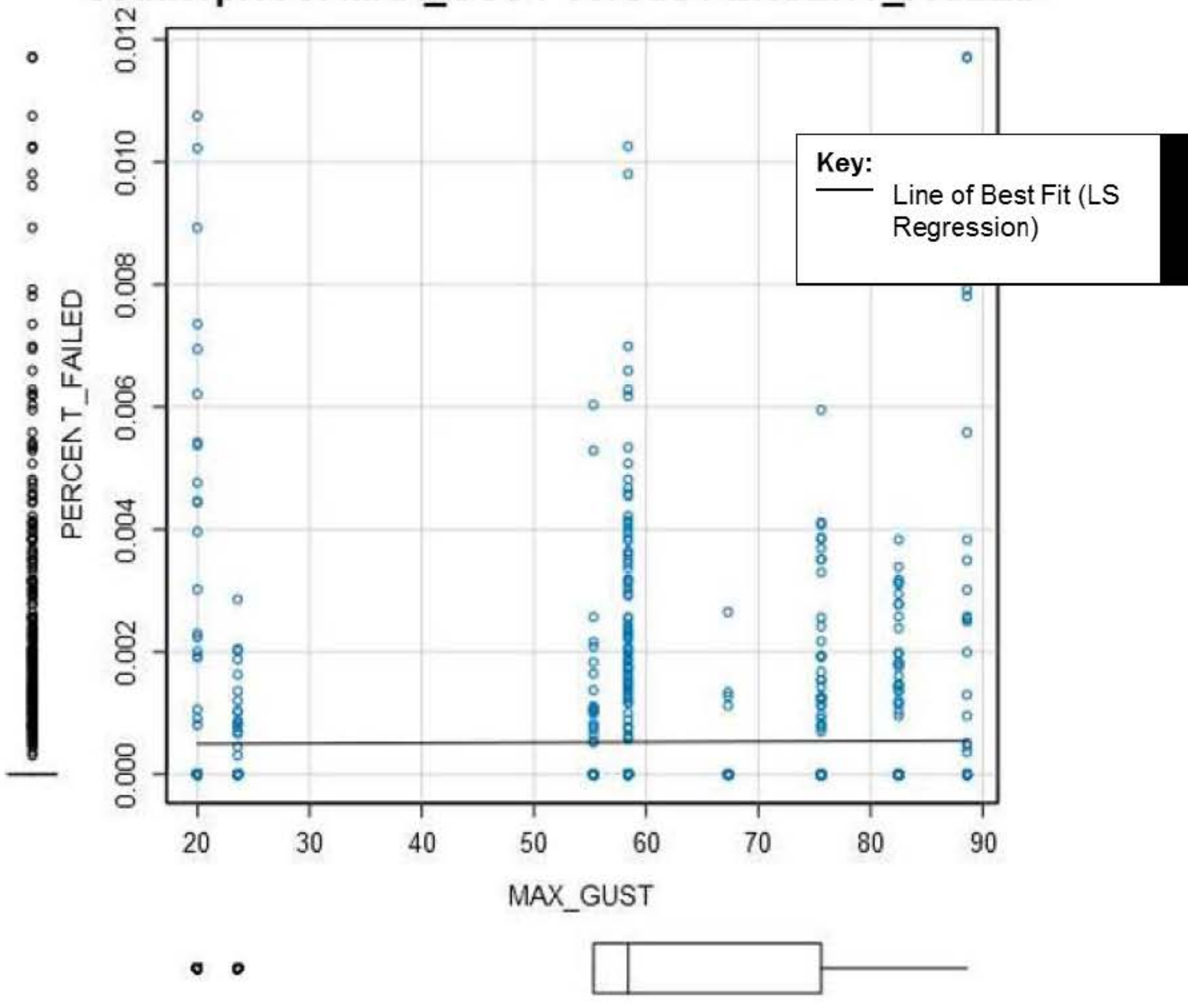
Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111

- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of MAX_GUST versus PERCENT_FAILED



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SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

Data Summary

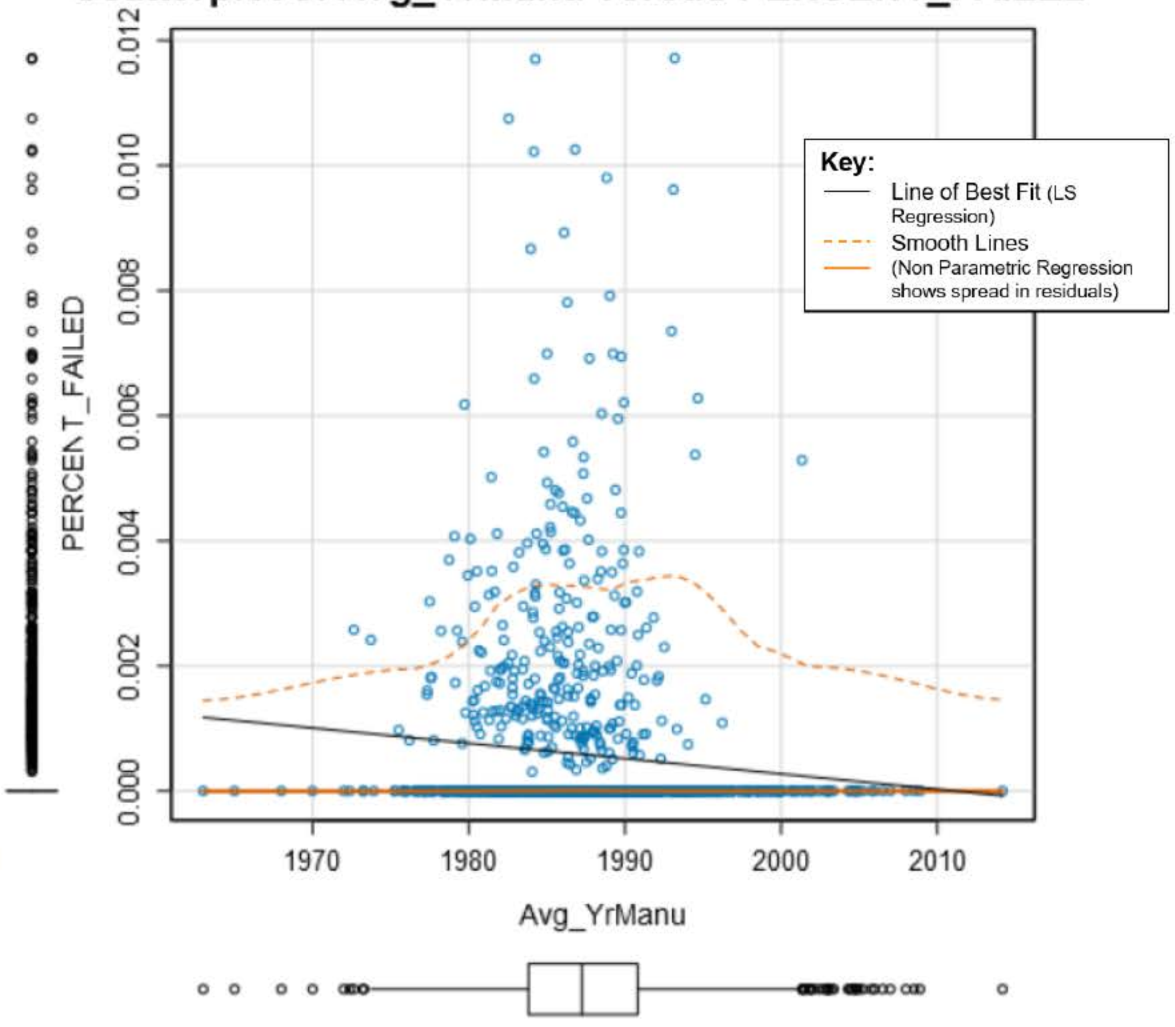
Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.

Scatterplot of Avg_YrManu versus PERCENT_FAILED



*Note: This analysis does not consider reinforcement of older poles.

SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

Data Summary

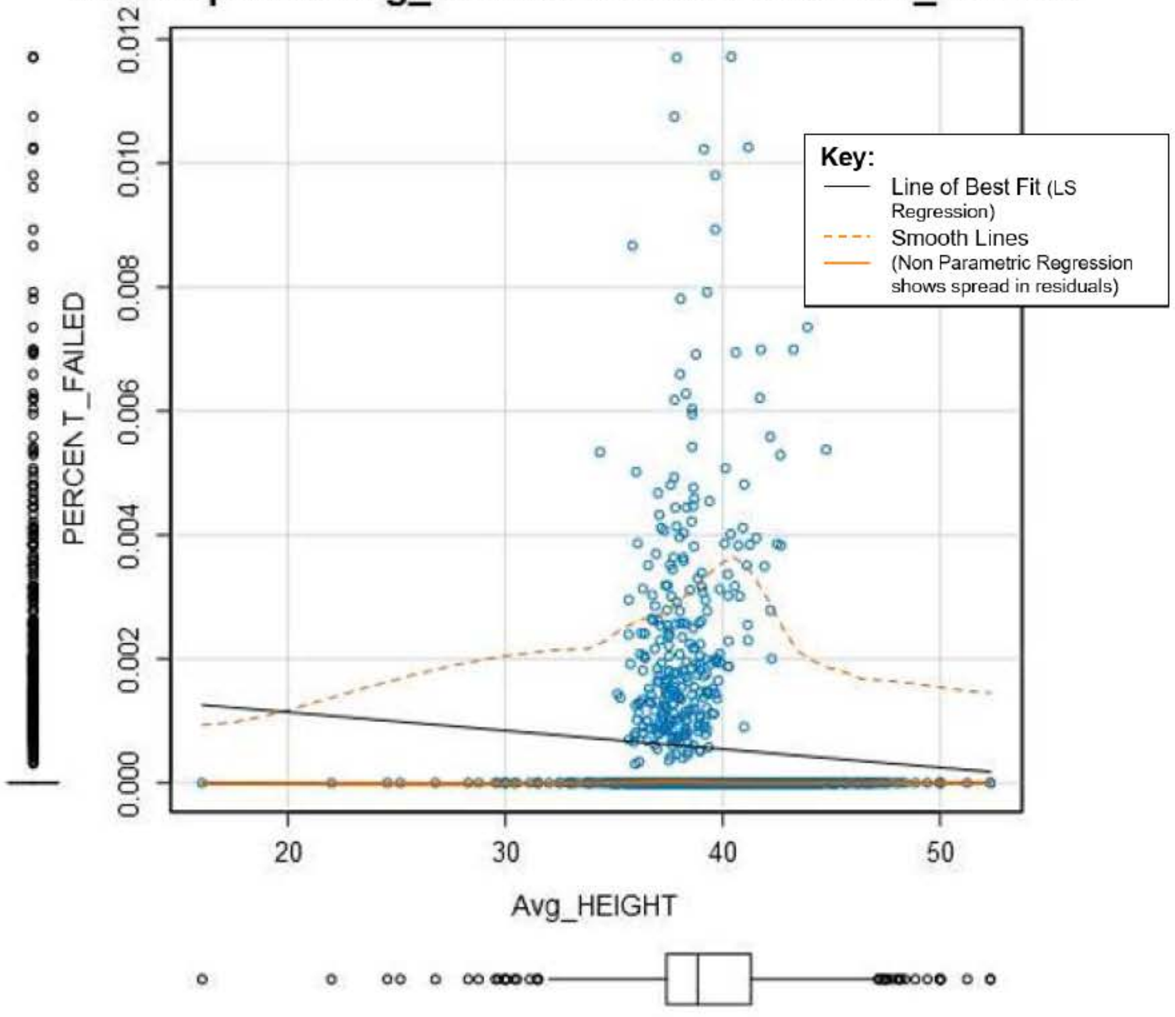
Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.

Scatterplot of Avg_HEIGHT versus PERCENT_FAILED



SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

Data Summary

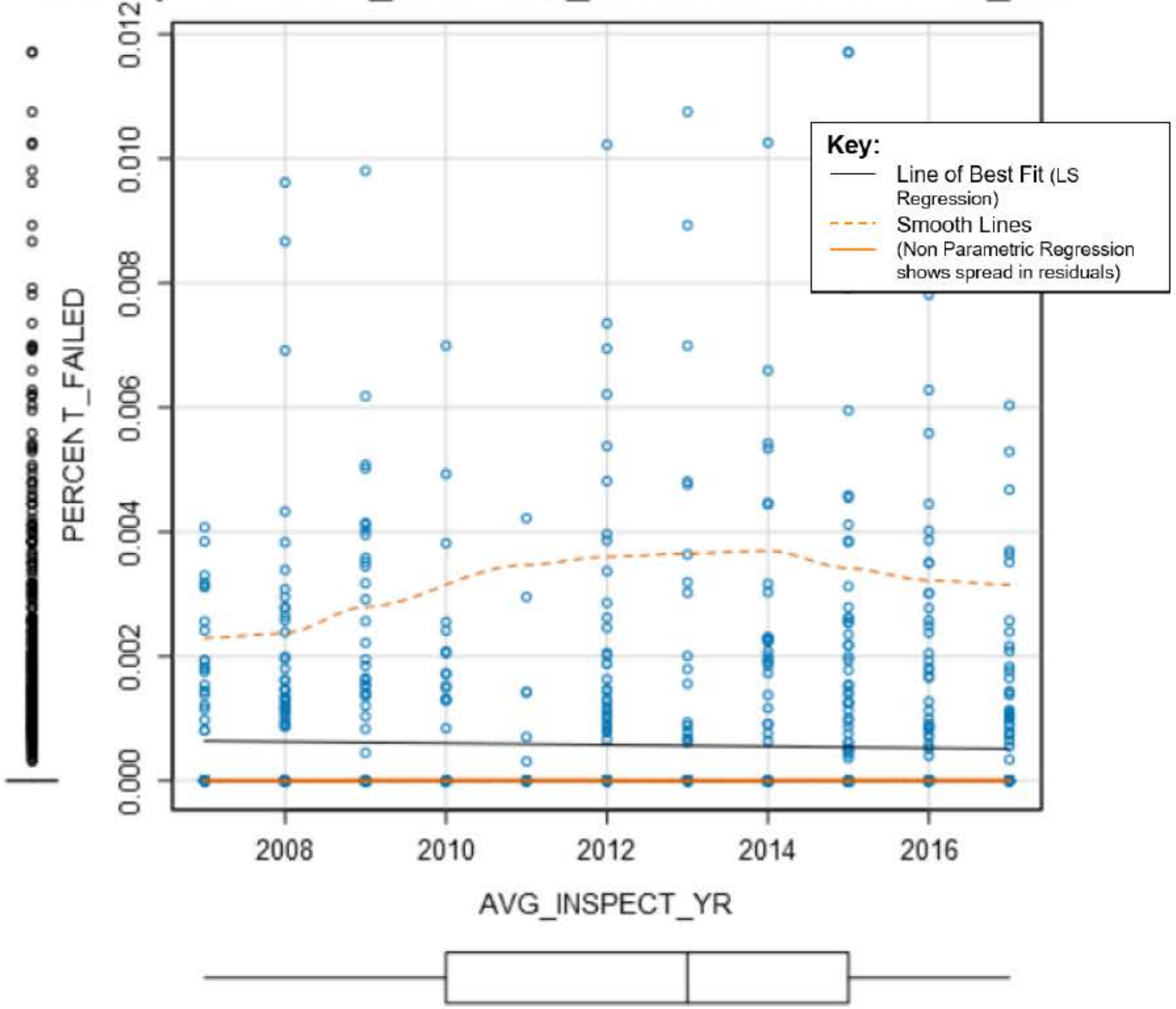
Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of AVG_INSPECT_YR versus PERCENT_FAIL



SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

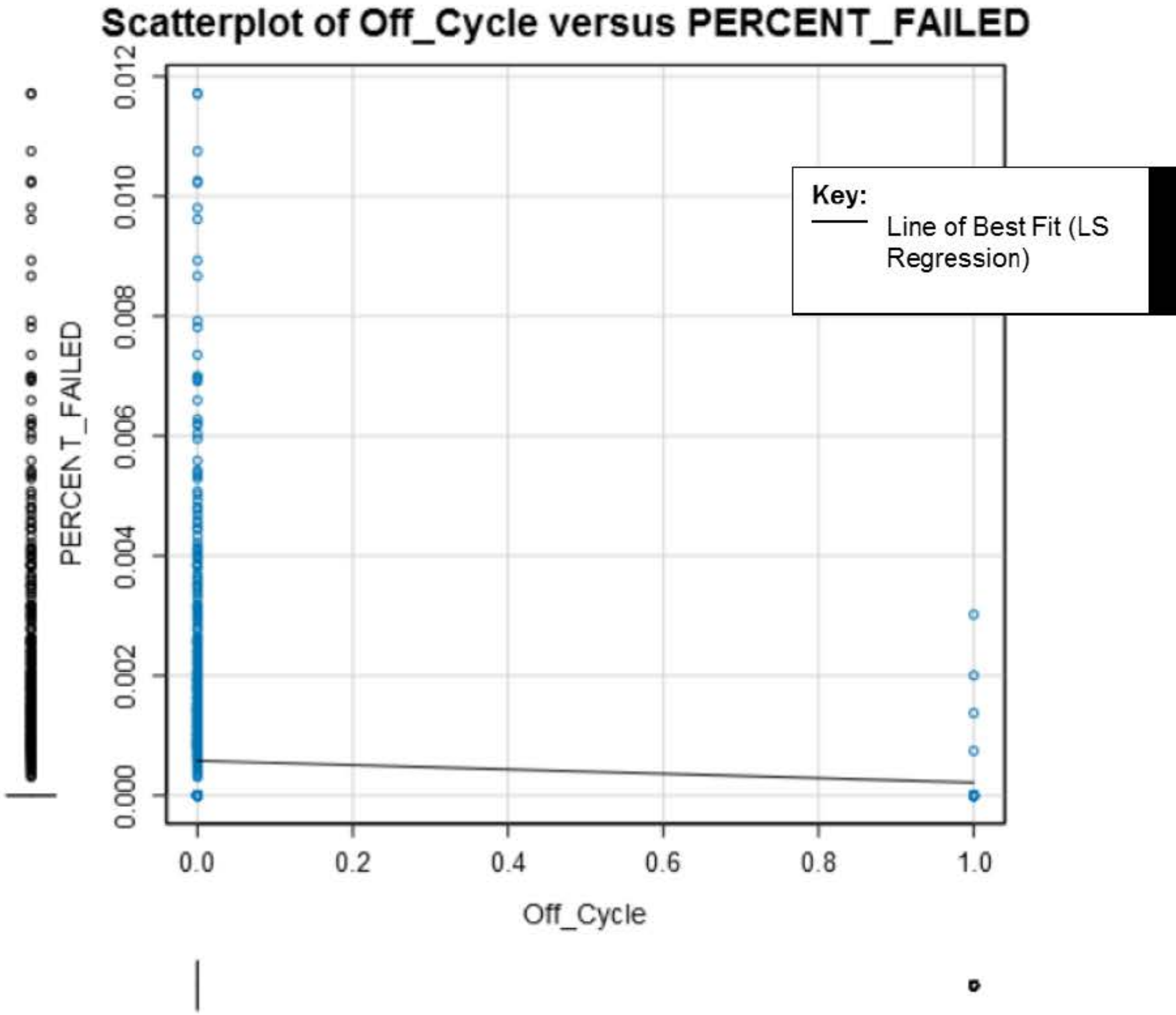
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates (P=0.0025<0.05). Circuits that have newer poles on average are also associated with a lower percent failure rates (P=0.00051<0.05).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates (P=0.003<0.05). Circuits that have newer poles on average are associated with a lower percent failure rates (P=0.00002<0.05).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

DUKE ENERGY. FLORIDA

MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384 poles	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.
- Circuits with a taller average pole height were more likely to have a lower pole failure rate.
- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.
- Circuits with older poles were associated with higher pole failure rates.
- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.
- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.
- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

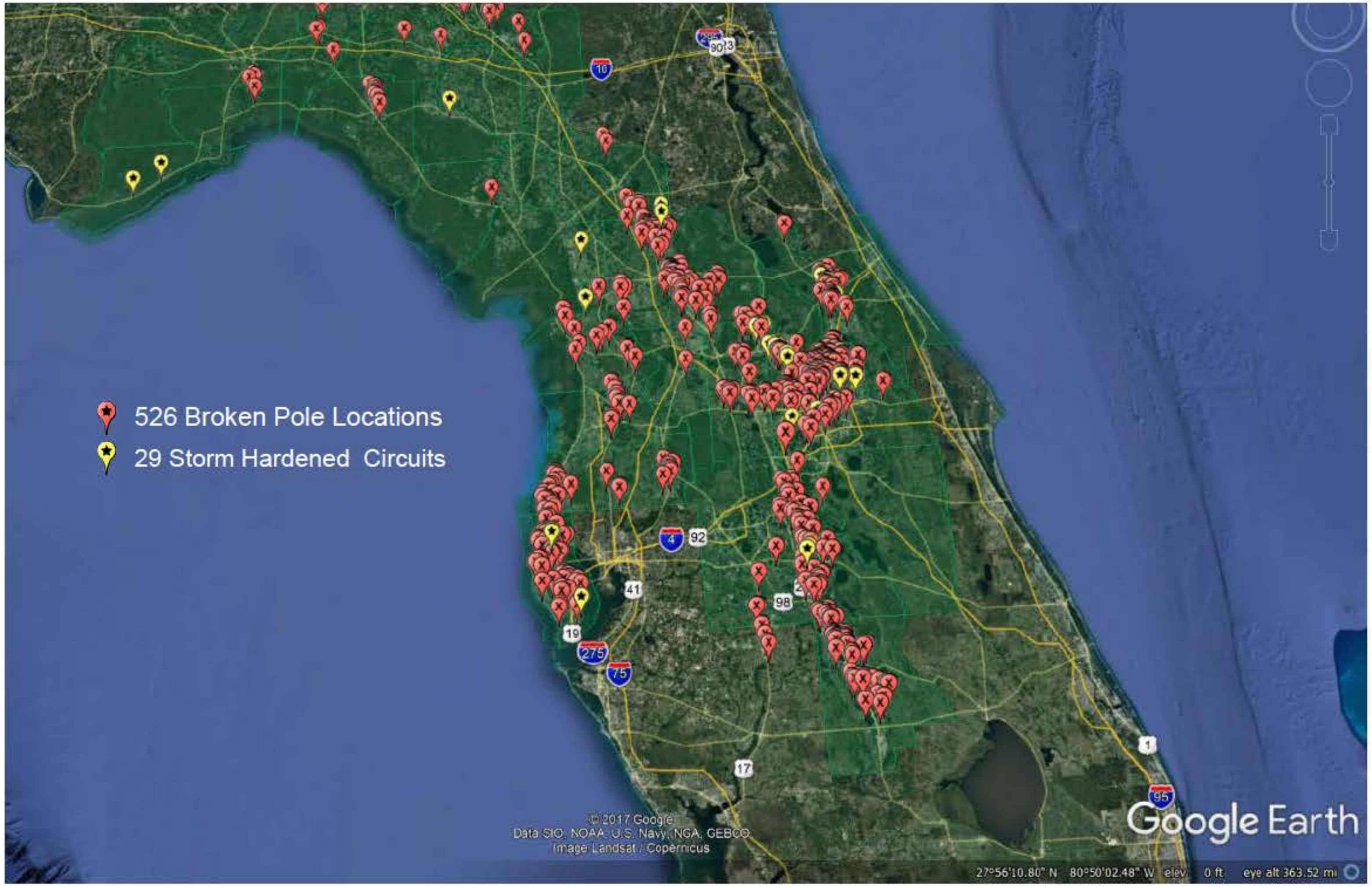
STORM HARDENING

METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

DUKE ENERGY

ACCENTURE

Exhibit 15

WORK STATEMENT NO.

Exhibit 15

WORK STATEMENT #_____

This Work Statement No._____ (the "**Work Statement**") is entered into by and between Duke Energy Business Services LLC, successor in interest to Duke Energy Shared Services, Inc. ("**Duke Energy**") and Accenture LLP ("**Supplier**"), pursuant to and subject to that certain Master Professional Services Agreement effective as of December 18, 2006 by and between Duke Energy and Supplier (the "**Agreement**"), the terms of which are incorporated herein by reference. Except as expressly set forth in this Work Statement, all applicable terms and conditions of the Agreement shall govern the obligations of Duke Energy and Supplier under this Work Statement.

This Work Statement describes the Services Supplier shall perform and deliver in accordance with this Work Statement and the Agreement.

IN WITNESS WHEREOF, Duke Energy and Supplier have each caused this Work Statement to be executed by its duly authorized representative, effective as of the Work Statement Effective Date set forth in **Section 1** below.

Accenture LLP

By: ______________________________

Print Name: ______________________________

Print Title: ______________________________

Date: ______________________________

Duke Energy Business Services, LLC

By: ______________________________

Print Name: ______________________________

Print Title: ______________________________

Date: ______________________________

1. **Introduction**.

Supplier has carefully reviewed Duke Energy's requirements and has performed the due diligence it deems reasonably necessary prior to execution of this Work Statement.

2. **Work Statement Term.**

The term of this Work Statement shall begin on November 10, 2017 ("**Work Statement Effective Date**") and continue until December 31, 2017, unless extended or terminated earlier in accordance the terms of the Agreement ("**Work Statement Term**"). For purposes of this Work Statement, the Work Statement Commencement Date shall be the date set forth in **Schedule E** (WS Transition Plan) to this Work Statement.

3. **Definitions.**

Any capitalized terms used in this Work Statement or its Schedules or Attachments but not defined herein or in **Schedule A** (WS Definitions) shall have the meaning ascribed to such terms in the Agreement or **Exhibit 1** (Profile Definitions).

4. **Services.**

Supplier shall provide the Services to Duke Energy and the Eligible Recipients in accordance with the Agreement (including Exhibits and Attachments thereto) as it may be modified and/or supplemented in this Work Statement (including the Schedules and Attachments hereto).

5. **Master Professional Services Agreement**

The Agreement contemplates that certain terms and conditions (i) will not apply to this Work Statement, or will be limited in their application to this Work Statement, unless the Parties affirmatively indicate herein that such terms and conditions shall apply or specify the extent to which they are applicable (each an "**Opt-In**" term or condition), or (ii) will apply to this Work Statement unless the Parties affirmatively indicate herein that such terms and conditions are modified in their application to this Work Statement (each an "**Opt-Out**" term or condition). **Annex 1** to this Work Statement contains certain Opt-In and Opt-Out terms and conditions. If an Opt-In provision is checked, the applicable terms and conditions specified in the indicated Section of the Agreement shall apply to this Work Statement as such terms and conditions may be modified herein. If an Opt-Out provision is checked in **Annex 1**, the applicable terms and conditions specified in the indicated Section of the Agreement shall be modified as specified in **Annex 1**.

In addition to the foregoing, the Agreement is modified as and to the extent provided below:

Modifications

N/A

Additions

N/A

6. **Schedules and Attachments.**

The following Schedules and Attachments that are indicated with a checkmark are appended to this Work Statement and are hereby incorporated by reference:

Included Attachments	Schedule or Attachment	Title of Schedule or Attachment
☐	Schedule A	WS Definitions
☒	Schedule B	WS Service Description
☐	Schedule C	WS Service Levels
☐	WS Attachment C.1	Service Levels Matrix
☐	WS Attachment C.2	Service Level Definitions
☐	WS Attachment C.3	Critical Deliverables
☒	Schedule D	WS Pricing
☒	WS Attachment D.1	Pricing Forms
☐	WS Attachment D.2	Financial Responsibility Matrix
☐	WS Attachment D.3	Duke Energy Base Case
☐	WS Attachment D.4	Resource Units/Resource Baselines
☐	WS Attachment D.5	Termination Charges
☐	Schedule E	WS Transition Plan
☐	Schedule F	WS Duke Energy Facilities
☐	Schedule G	WS Supplier Facilities
☐	Schedule H	WS Software
☐	Schedule I	WS Equipment
☐	WS Attachment I.1	Duke Energy Provided Equipment
☐	Schedule J	WS Third Party Contracts
☐	Schedule K	WS Key Supplier Personnel
☐	Schedule L	WS Subcontractors

☐	Schedule M	WS Managed Third Parties
☐	Schedule N	WS Termination/Expiration Rights
☐	Schedule O	WS Reports
☐	Schedule P	WS Satisfaction Survey
☐	Schedule Q	WS Termination Assistance Services

Work Statement No: __

Annex 1

1. **OPT-IN Provisions.**

a. ☐ **<u>Sections 4.1(a)(iii)</u>. Services to be Performed by Supplier**.

Indicate whether a Duke Energy Base Case is attached for the purpose of Section 4.1(a)(iii). N/A

b. ☐ **<u>Section 4.2(d)</u>: Transition Meeting; Reports.**

Indicate frequency of transition meetings; reports. Parties may choose to reference Schedule E if the relevant informaiton is contained therein. N/A

c. ☐ **<u>Section 4.3(b)(4)</u>: Right to Purchase Equipment.**

Indicate whether Duke Energy will have the right to purchase/assume lease for Equipment as provided in Section 4.3(b)(4). N/A

d. ☐ **<u>Section 9.4(d)</u>: Industry Standards.**

Indicate any industry standards for which Supplier must achieve and/or maintain certification or compliance (in addition to any such requirements expressly specified in the Agreement). N/A

e. ☐ **<u>Section 13.3(d)</u>: Personal Data/Business Associate Agreement.**

Indicate whether Supplier must execute a Business Associate Agreement due to having access to "protected health information" as specified in Section 13.3(d). N/A

2. **OPT-OUT Provisions**

a. **<u>Section 4.3(b)(2); Right to Hire Supplier Personnel</u>**

Indicate any Supplier employees that are not eligible for hiring by Duke Energy or the Eligible Recipients N/A

b. ☐ **<u>Sections 9.1(b) and 9.4(c)</u>: Policy and Procedures Manual.**

Indicate the extent to which the update to the umbrella Policy and Procedures Manaual will be limited with respect to this Work Statement; see Sections 9.1, 9.4(c) of the Agreement. N/A

c. ☐ **<u>Section 14.2(b)</u>: Ownership of Duke Energy–Specific Developed Materials**

Indicate any exceptions to the default ownership of Duke Energy-Specific Developed Materials; see Section 14.2(b). N/A

d. ☐ **<u>Section 15.7</u>: Compliance with Laws**

Note any exceptions to the Parties respective obligations with respect to compliance with Laws as specified in Section 15.7 of the Agreement. N/A

e. ☐ **<u>Section 20.2</u>: Termination for Convenience**

Note any change to the default notice period for termination for convenience. N/A

DUKE ENERGY

ACCENTURE

Schedule B

Work Statement No.

WS Service Description

Schedule B

WS Service Description

This is **Schedule B** to the Work Statement No. ____ ("**Work Statement**") under the Master Professional Services Agreement by and between Duke Energy and Supplier (the "**Agreement**"). All capitalized terms used but not defined in this Schedule shall have the meanings given them in the Agreement or the Work Statement.

The terms and conditions of Sections 1 and 2 of **Exhibit 2** and all Attachments and appendices to **Exhibit 2** are incorporated herein by reference. In addition, each Section of Exhibit 2 indicated below with a checkmark is also incorporated herein by reference, as the terms of such Sections may be modified as indicated below the applicable Section number.

Section 1. General

Section 2. Application Methodologies, Standards and Architecture

---

☐ **Section 3. Application Planning and Analysis Services**

N/A

☐ **Section 4. Application Development Services**

N/A

☐ **Section 5. Application Testing Services**

N/A

☐ **Section 6. Application Implementation Services**

N/A

☐ **Section 7. Application Maintenance and Support Services**

N/A

☐ **Section 8. ADM Management**

N/A

☒ Section 9. Staff Supplementation and Project Services

Project Overview

Duke Energy is looking to conduct a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma. The purpose of the study is to determine the correlations and major causes of failure in support of the report that Duke Energy is expected to submit to the Florida PSC in 2018. The specific analyses that Duke Energy wants to conduct are listed below:

Op Center comparisons

- Total vs Broken Pole Population
- Statistical Projection vs Actual Broken Poles
- Broken Poles by Vintage
- Broken Pole vs Projected Winds

System Comparisons

- Broken Poles vs. Inventory Used
- Broken Poles by Failure Mode
- Common Failure Modes
- Poles w/ attachments vs w/o attachments
- The impact of vegetation
- Historical comparisons 2004 vs 2017
- Impact to Storm Hardened circuits
- Performance of Storm Hardened Circuits
- Comparative Analytics of Storm Hardened feeders juxtaposed with the impact of both DE Standards and the ongoing pole replacement program.

Industry Benchmarking Comparisons

- Southeast Electric Exchange Companies
- Other EEI Companies
- Other US Electric Utilities
- Comparative trends and analytics from documented weather events.

Project Services

Supplier will perform the services described below and such tasks, responsibilities and obligations may be revised, supplemented or changed during the period of this WS pursuant to the Change Control Procedures described in the Agreement (collectively, the “Services”).

i. **Initiative mobilization**
   a. Confirm project deliverables and hypothesis with the Duke Energy FL team
   b. Understand the available forensic and weather data available

c. Organize the available data into a single electronic database (tables) to allow for analysis
d. Identify any gaps in the data and develop strategies to gather the missing information

ii. **Conduct data analysis**
a. Define the analytic process for each of the hypothesis
b. Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
c. Identify the key drivers or pole failures and determine the overall cause and effect
d. Develop conclusions based on the statistical analysis

iii. **Perform Benchmark Comparison (Supplier has a storm performance database that includes more than 100 utility responses to major weather events over the last 15 years)**
a. Gather key statistics from the Duke Energy FL response to Hurricane Irma using a pre-developed template
b. Identify the comparable events from the database to benchmark Duke Energy FL response against
c. Conduct benchmark comparison and identify key metrics
d. Develop conclusions based on the benchmark analysis

iv. **Synthesize and Summarize**
a. Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison.
b. Ensure that the summary is suitable for inclusion in the 2018 Duke Energy Report to FPSC and possible hearings regarding the Hurricane Irma restoration.

Project Deliverables

The Project team will work on the Deliverables described below during the term of this WS.

Ref.	Deliverables	Description	Duke Energy	Supplier
1.	Consolidate and Organize Forensic Data	• Gather the available information and organize it in the electronic format that can be easily analyzed (database of forensic data)	Assist	Primary
2.	Regression Analyses	• Confirm the specific hypotheses that Duke Energy wants the analysis to focus on (start with the list provided in the project description above) • Conduct regression and other statistical analysis to answer the hypotheses (assume up to 20 hypotheses)	Assist	Primary
3.	Conduct Benchmark Analysis	• Gather the key statistics related to the Duke Energy FL response to Hurricane Irma (using the template for the Supplier storm benchmark database) • Conduct the benchmark analysis of the Duke Energy FL performance against the comparable events in the database.	Assist	Primary

Ref.	Deliverables	Description	Duke Energy	Supplier
4.	Executive Summary Report	• Summarize the findings in a brief report format that is suitable for inclusion in the • The final deliverable should be in a format that is suitable for inclusion in the 2018 Duke Energy report to the Florida Public Service Commission (FPSC) and possible hearings regarding the 2017 storm season.	Assist	Primary

The Party with "Primary" responsibility shall have the obligation of completing the Deliverable and directing the "Assist" responsibility.

The Party with "Assist" responsibility shall assist the Party with "Primary" responsibility.

<u>Project Final Acceptance</u>

Supplier will provide a Project Final Acceptance form to Duke Energy for signature to acknowledge acceptance of the Project Services and Deliverables and completion of the Project.

Deliverable Acceptance

Supplier shall, upon completion of a Deliverable, notify Duke Energy that such Deliverable has been completed and is ready for review and sign off. Promptly after receipt of such notice, Duke Energy shall evaluate the Deliverable for acceptance to determine whether it substantially conforms to the description contained in the WS Deliverables table contained in the WS. The only basis for Acceptance of a Deliverable will be substantial conformance to such Deliverable description. The only basis for rejection of a Deliverable will be the failure of the Deliverable to substantially conform to such Deliverable description. A Deliverable shall be deemed Accepted if Duke Energy has not signed off on the Deliverable after five (5) business days or has not provided, in writing, a written basis for rejection of the Deliverable within five (5) business days from notification that a Deliverable is ready for sign off. This provision shall override the Deliverables Acceptance provision in the Agreement.

Deliverables Sign Off

The appropriate individuals required to sign off will be identified for each Deliverable by the Engagement Managers. The individuals signing off must include at a minimum one (1) Duke Energy team member and one (1) Supplier team member.

☐ **Section 10. Systems Integration Services**

N/A

☐ **Section 11. Problem Management and Help Desk Support**

N/A

☐ **Section 12. Application Quality Assurance**

N/A

☐ **Section 13. Application Metrics and Productivity**

N/A

☐ **Section 14. Third Party Relationships**

N/A

Additional Services –

None

DUKE ENERGY

ACCENTURE

Schedule D

Work Statement No. _____

WS Pricing

Schedule D

WS Pricing

This is **Schedule D** to the Work Statement No. _____ ("**Work Statement**") under the Master Professional Services Agreement by and between Duke Energy and Supplier (the "**Agreement**"). All capitalized terms used but not defined in this Schedule shall have the meanings given them in the Agreement or the Work Statement.

This **Schedule D** is subject to all of the conditions set forth in **Exhibit 4** of the Agreement, unless specifically modified herein or by one of the Attachments specified in Section 2.

1. **Modifications/Additions to Exhibit 4**:

- *None*
- **Limitations on Section 4.6 Rights (Right to In-source or Use of Third Parties).**
- *None.*

2. **Included Attachments**.

Attachment	Attachment Name	Attachment Status	Comment
WS Attachment D.1	**Pricing Forms**	**Attached**	
WS Attachment D.2	**Financial Responsibilities Matrix Exceptions**	**Deleted**	
WS Attachment D.3	**Duke Energy Base Case**	**Deleted**	
WS Attachment D.4	**Resource Units / Resource Baselines**	**Deleted**	
WS Attachment D.5	**Termination Charges**	**Deleted**	

DUKE ENERGY
MASTER PROFESSIONAL SERVICES AGREEMENT

WORK STATEMENT ATTACHMENT D.1

Attachment to Exhibit 15 (Form of Work Statement)
Attachment to Schedule D (Work Statement Pricing Forms)

Duke WCR__

2-Nov-17

This document contains confidential and proprietary information of Duke. It is furnished for evaluation purposes of, and preparation of a response to, this MPSA. Except with the express prior written permission of Duke, this document and the information c

DUKE ENERGY	2015	2016	2017	2018	TOTAL
Time and Materials Pricing					
T&M Detail Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]
Volume Discount	$ -	$ -	$ [redacted]	$ -	$ [redacted]
T&M Pass-through Expenses	$ -	$ -	$ [redacted]	$ -	$ [redacted]
					$ -
Sub-Total T&M Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]
					$ -
T&M estimated taxes					$ -
					$ -
Grand Total T&M Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]

REDACTED

Table 1:

Resource Summary						WS Annual Summary			
Name or Project Skill (if TBD)	**Skill Category (Rate Card)**	**Rate Type**	**Rate Type (Short)**	**Location**	**Role Duration**	**Work Statement**	**Discount %**	**WS Term Year**	**Bill Rates**
2017 - Consulting Discount 13.0%									
miki.deric		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
justin.b.wagaman		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
emma.tobey		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
TBD Analyst		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
							Total Hours	695.00	

Table 2:

Volume Discount Summary									
WS Term Year	**Annual Benefit**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	[redacted]	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
Total Discount Amount	[redacted]								

Table 3:

Total Fees by Month	Work Statement Term								
WS Term Year	**WS Annual Charge**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	$ [redacted]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table 4:

Total Expenses by Month	Work Statement Term								
WS Term Year	**WS Annual Charge**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	$ [redacted]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

REDACTED

Work Statement Term														
		Role Quantity (Supplier to input quantity of Skill Category Role)												
WS Annual Quantity	WS Annual Extended Charge	January	February	March	April	May	June	July	August	September	October	November	December	Total Hours
														-
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
-	$ -													-
-	$ -													-

September	October	November	December
-	-	-	-
-	-	-	-
-	-	[redacted]	[redacted]
-	-	-	-

September	October	November	December
$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -
$ -	$ -	$ [redacted]	$ [redacted]
$ -	$ -	$ -	$ -

September	October	November	December
$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -
$ -	$ -	$ [redacted]	$ [redacted]
$ -	$ -	$ -	$ -

RED ACTED

January	February	March	April	May	June	July	August	September	October	November	December	TOTAL	Volume Discount
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

REDACTED

DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

accentureconsulting

TABLE OF CONTENTS

EXECUTIVE SUMMARY

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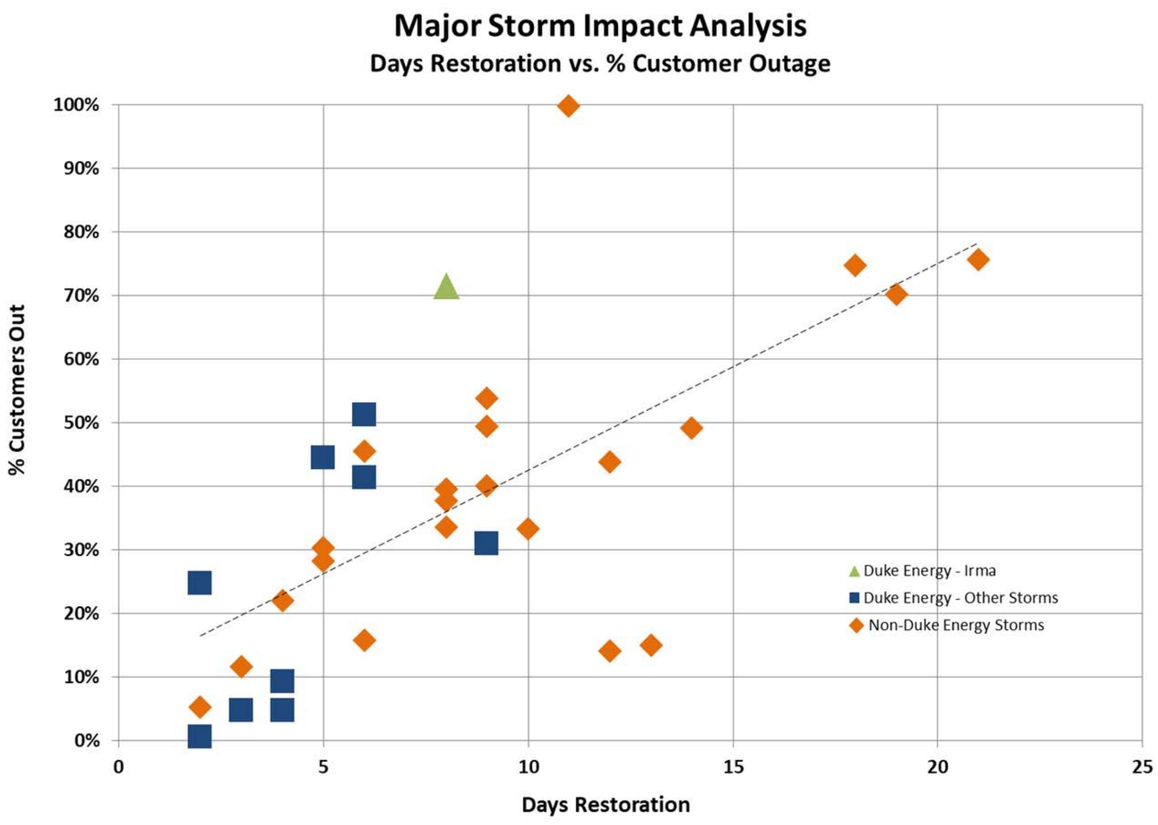
EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging “storm benchmark database” compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

EXECUTIVE SUMMARY – BENCHMARK

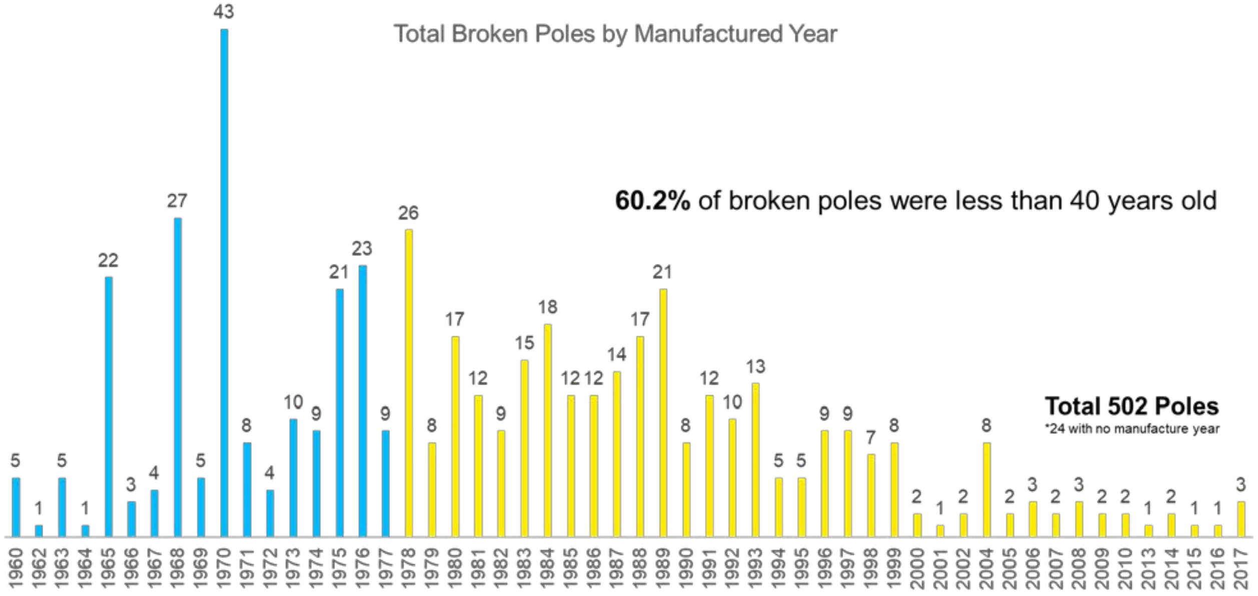
DUKE ENERGY. FLORIDA

- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



EXECUTIVE SUMMARY – FORENSIC

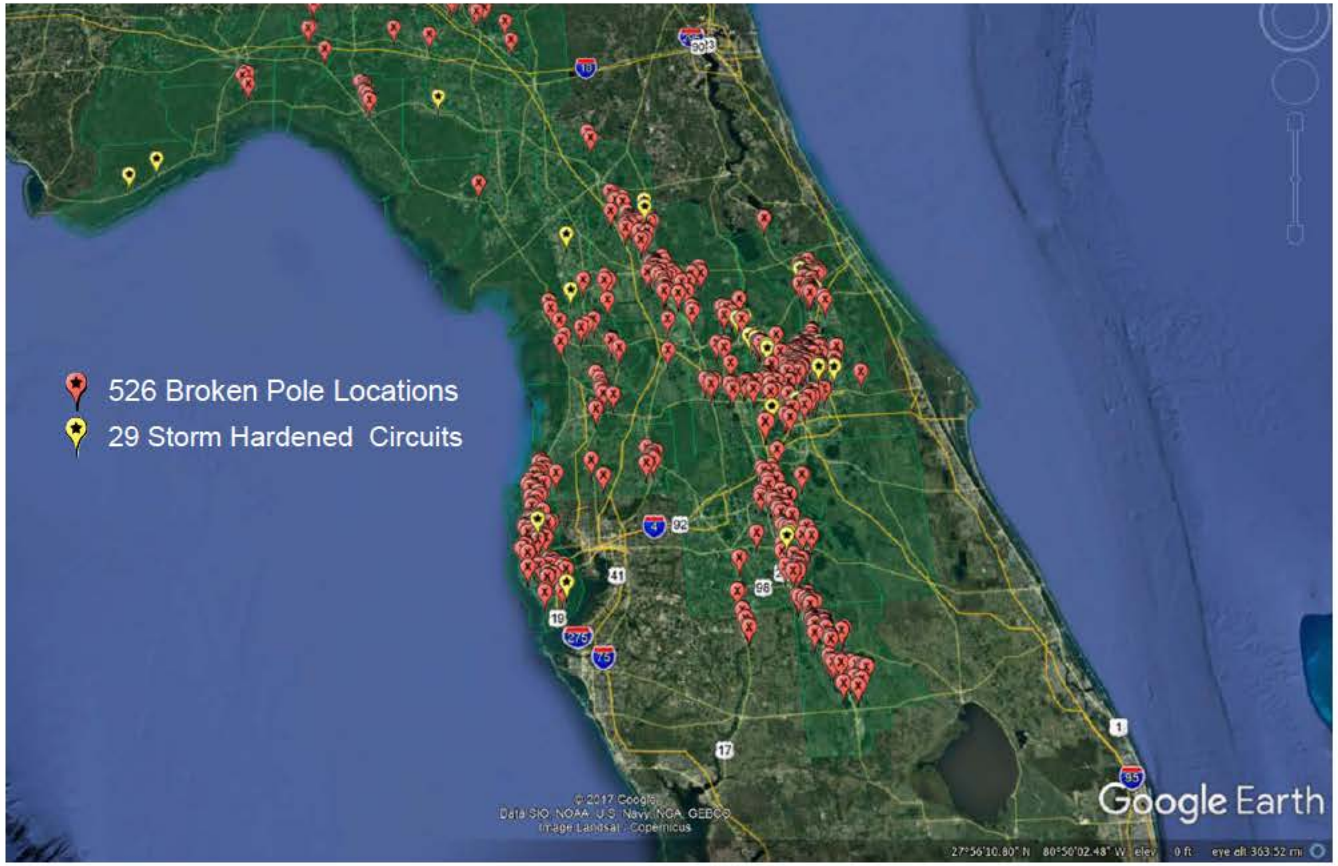
- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



DUKE ENERGY. FLORIDA

EXECUTIVE SUMMARY – SYSTEM HARDENING

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.



DUKE ENERGY FLORIDA

OVERVIEW/ PURPOSE

accentureconsulting

OVERVIEW/PURPOSE

- Duke Energy Florida ("Duke FL") conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture's storm benchmarking database to compare against Duke FL's response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL's hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance

- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL’s restoration efforts versus other utility companies captured in Accenture’s storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	1982
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

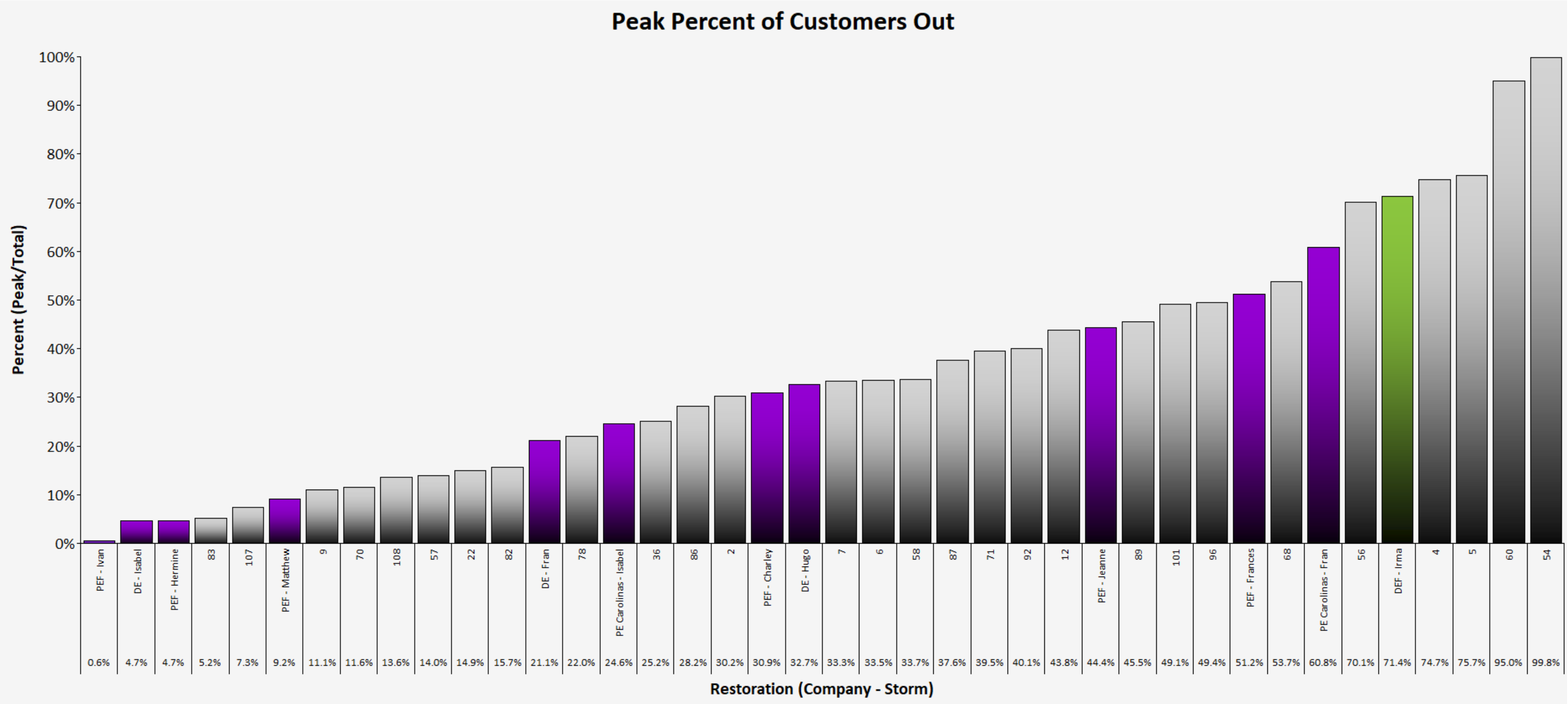
Restoration Duration	
Restoration Duration (# Days)	8 days

Restoration Costs	
Total Restoration Cost	$500M - $550M

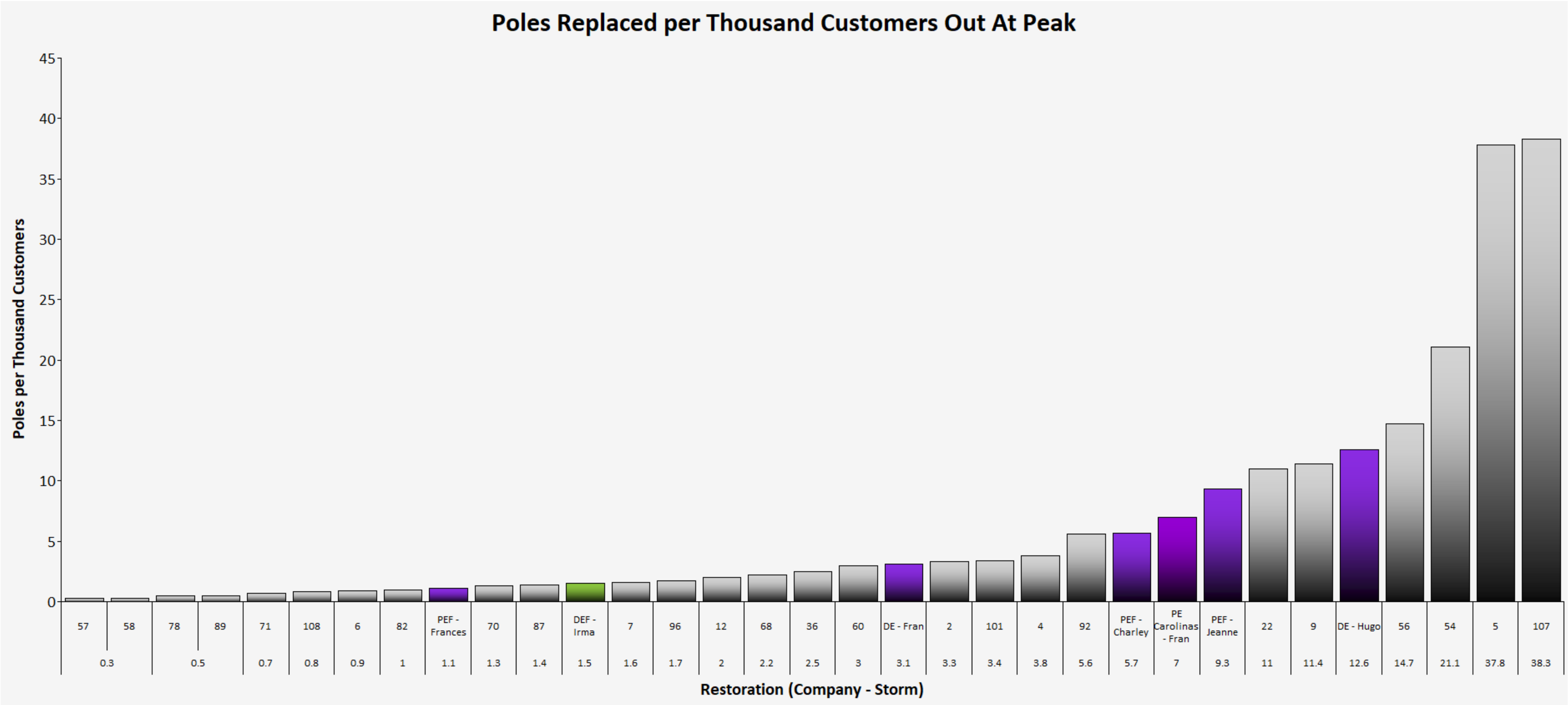
Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

BENCHMARK RESULTS



BENCHMARK RESULTS



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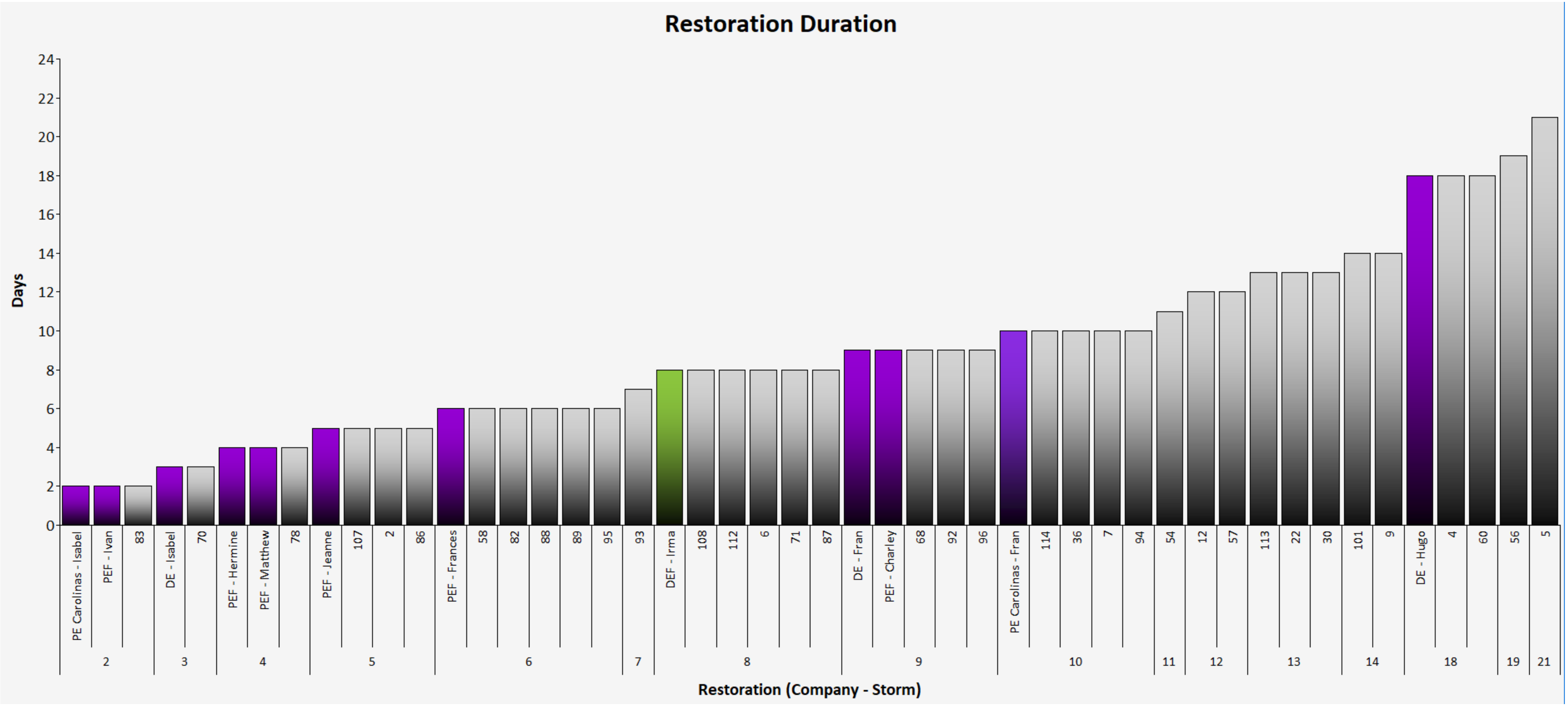
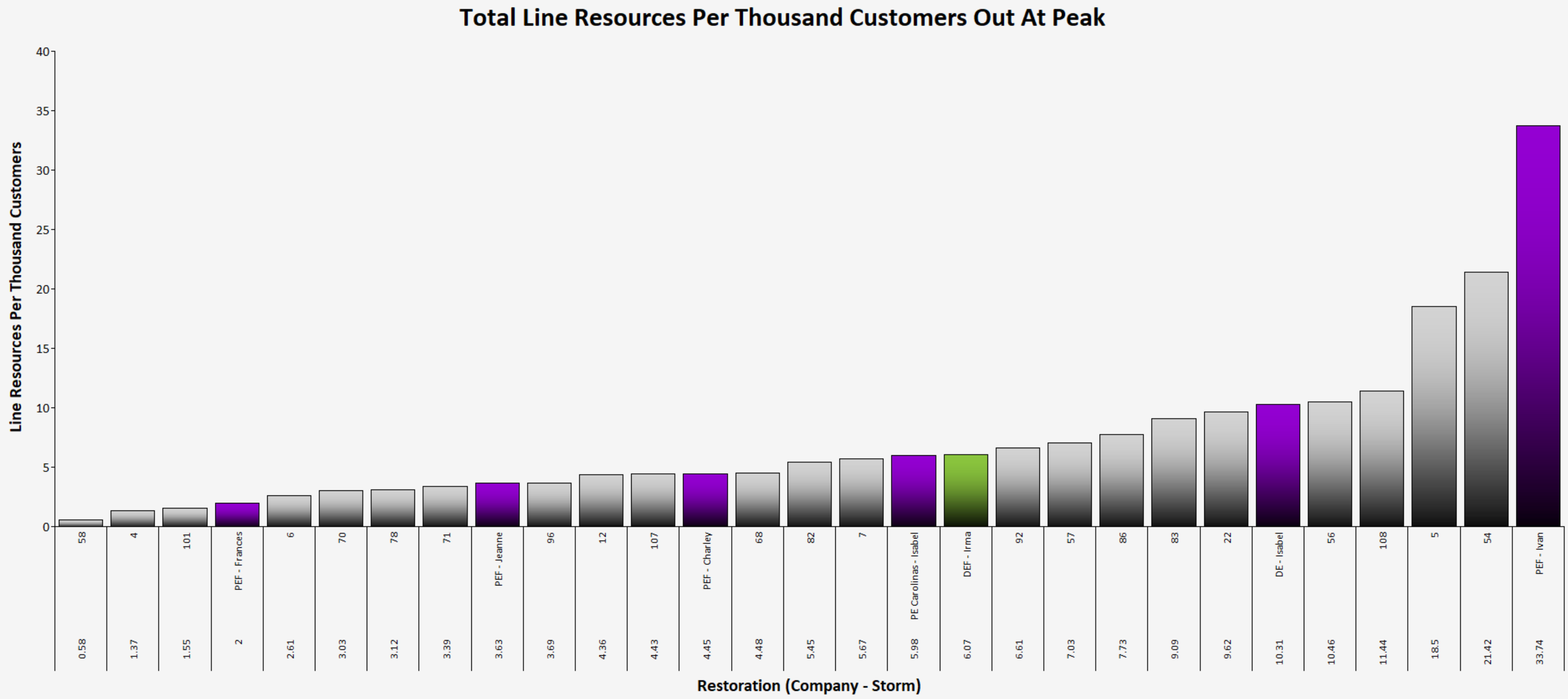
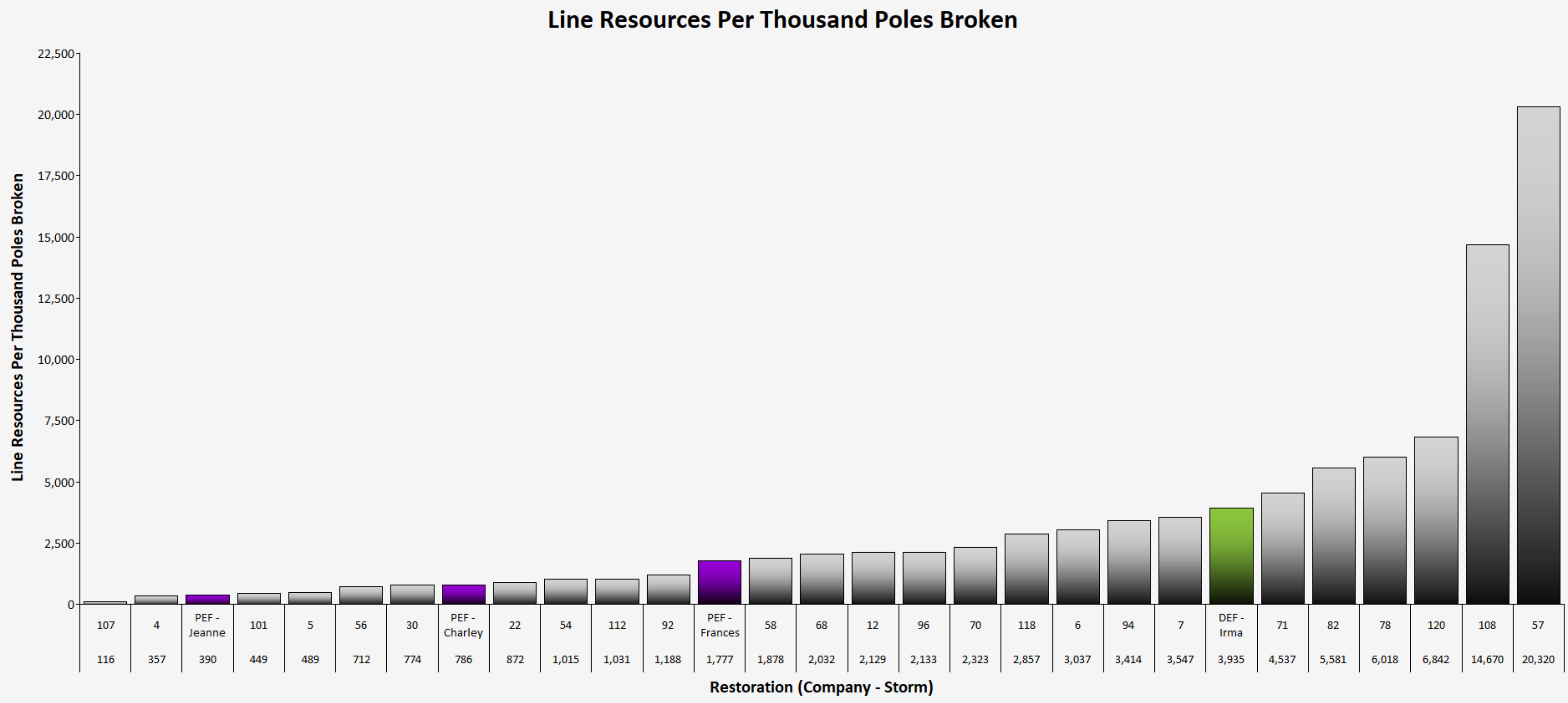
BENCHMARK RESULTS



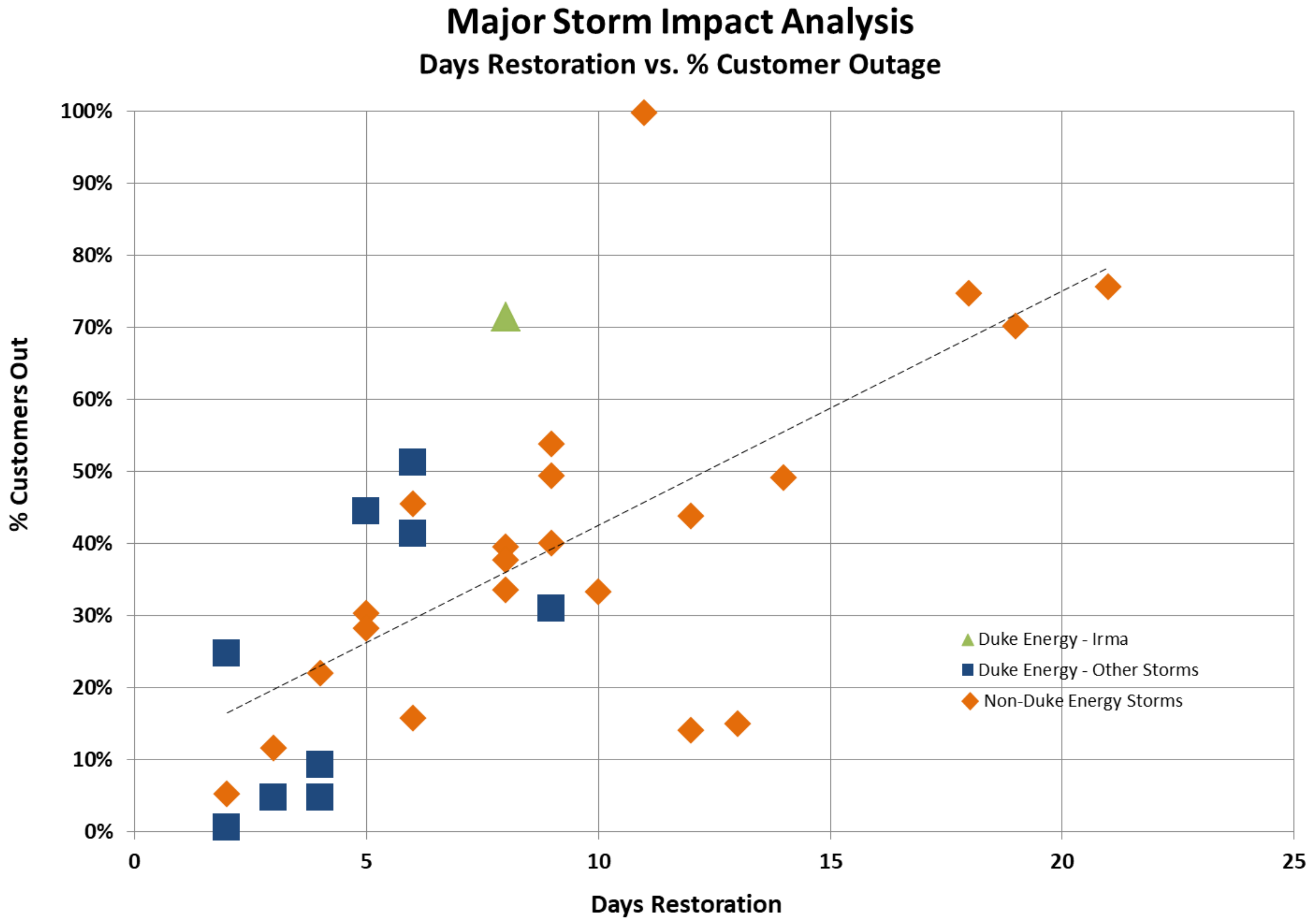
BENCHMARK RESULTS



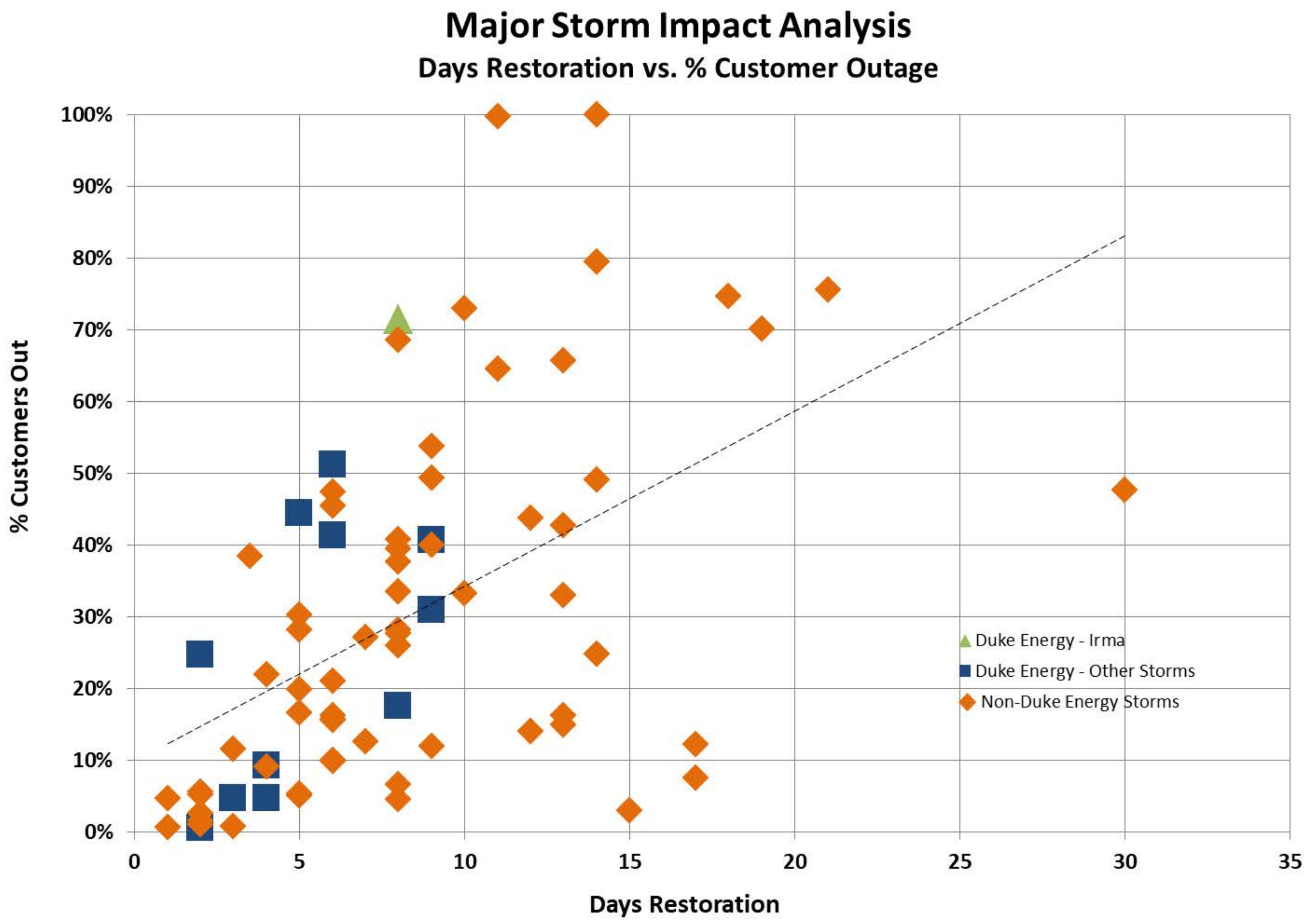
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

FORENSICS ANALYSIS

accentureconsulting

METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 1,841 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

Broken Poles Included in Forensic Analysis

1,841 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

Pole Inventory – Duke Florida

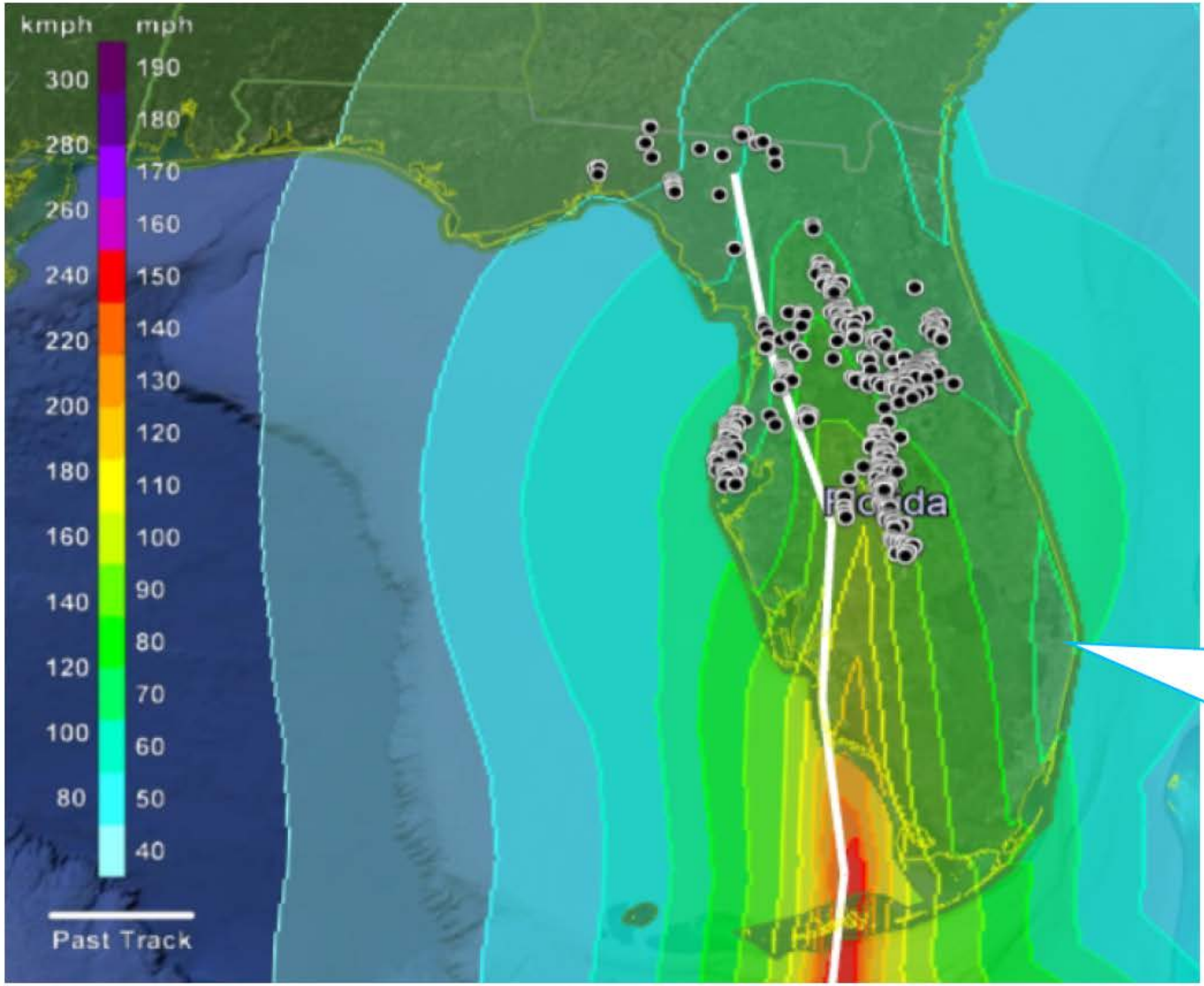
1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA



https://data.humdata.org/dataset/hurricane-irma-windspeed

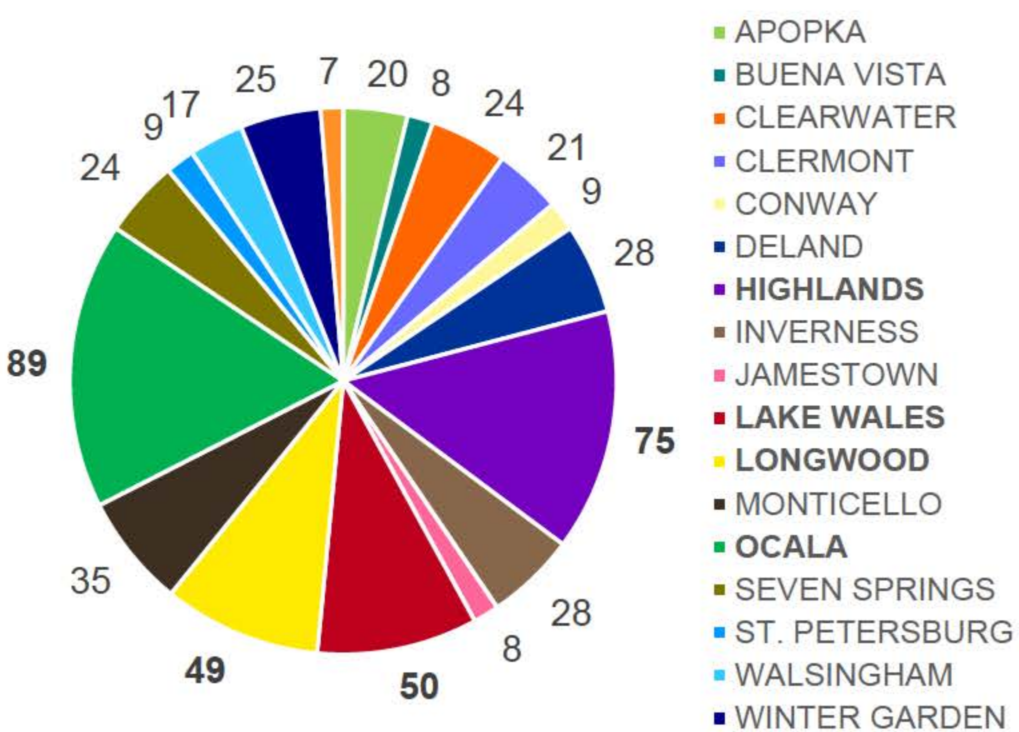
526 Broken Poles

Irma Path
9/11 12am – 12pm

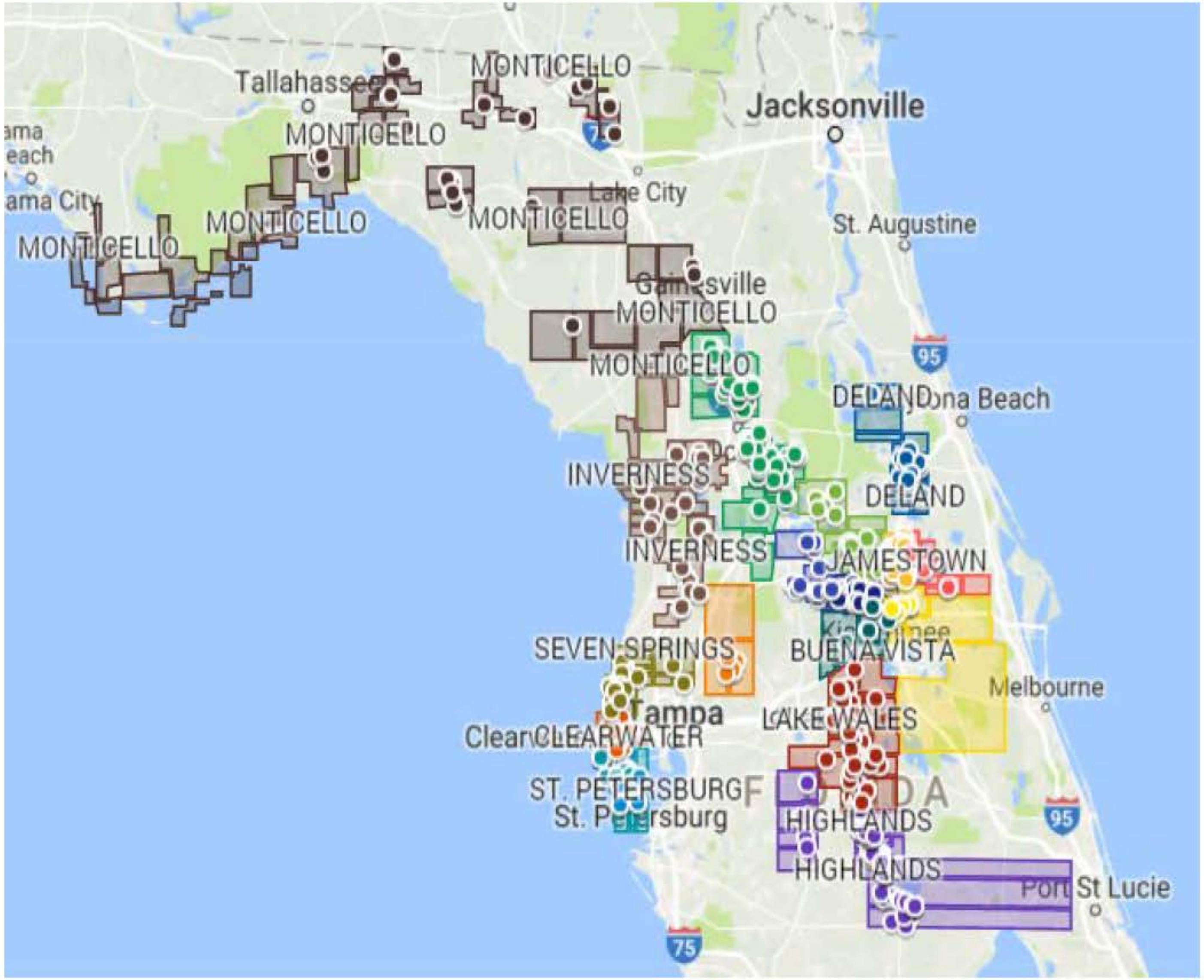
DUKE ENERGY FLORIDA

BROKEN POLE VISUALIZATIONS

Broken Poles By OP Center

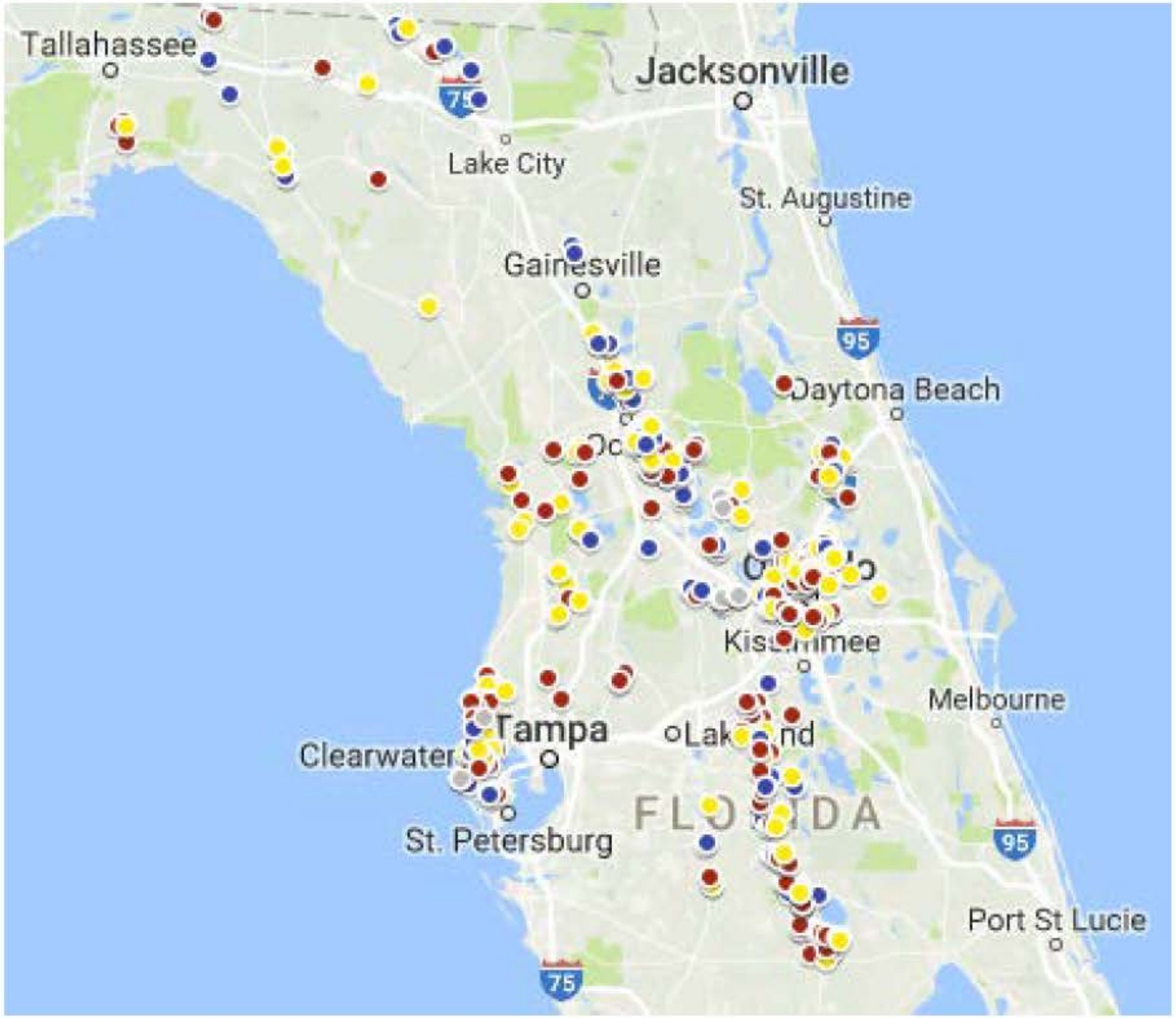


Total 526 Poles

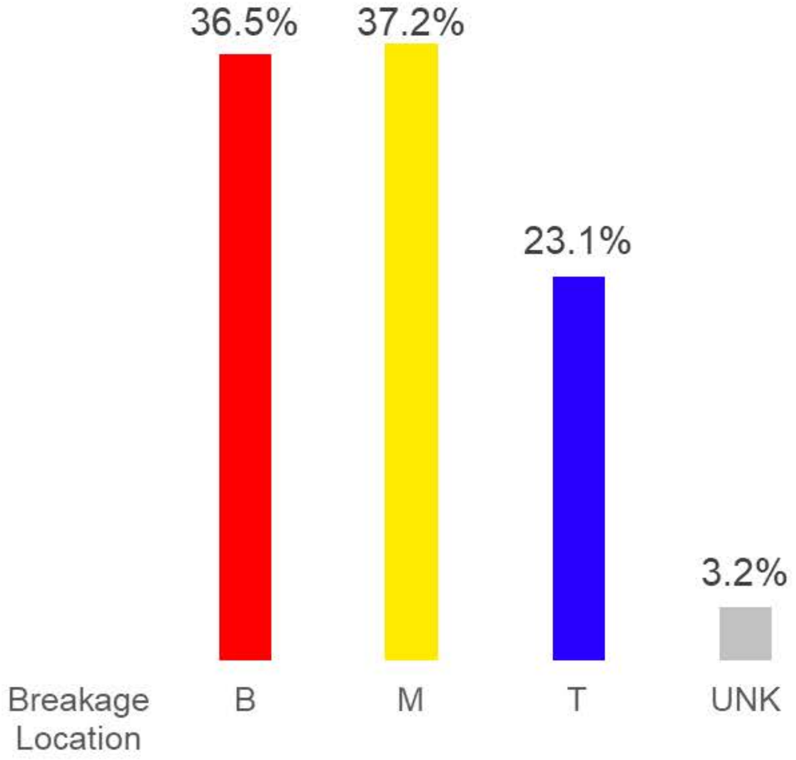


50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS



- **37.2%** of poles broke in the middle



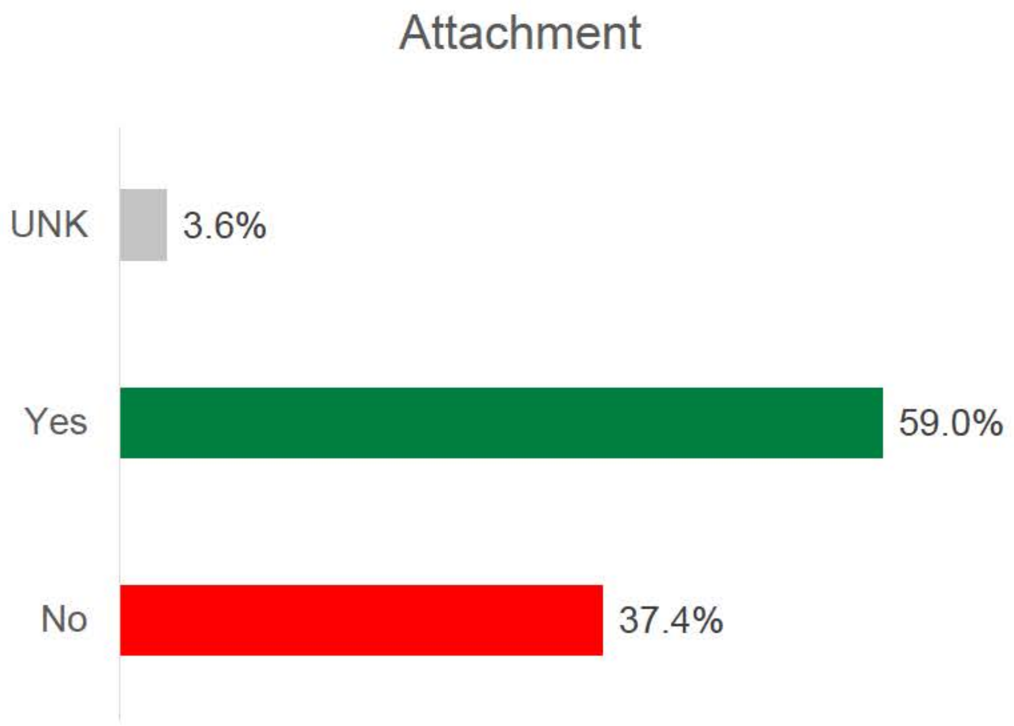
Total 471 Poles

***66 poles that broke at the bottom did not have reject status information**

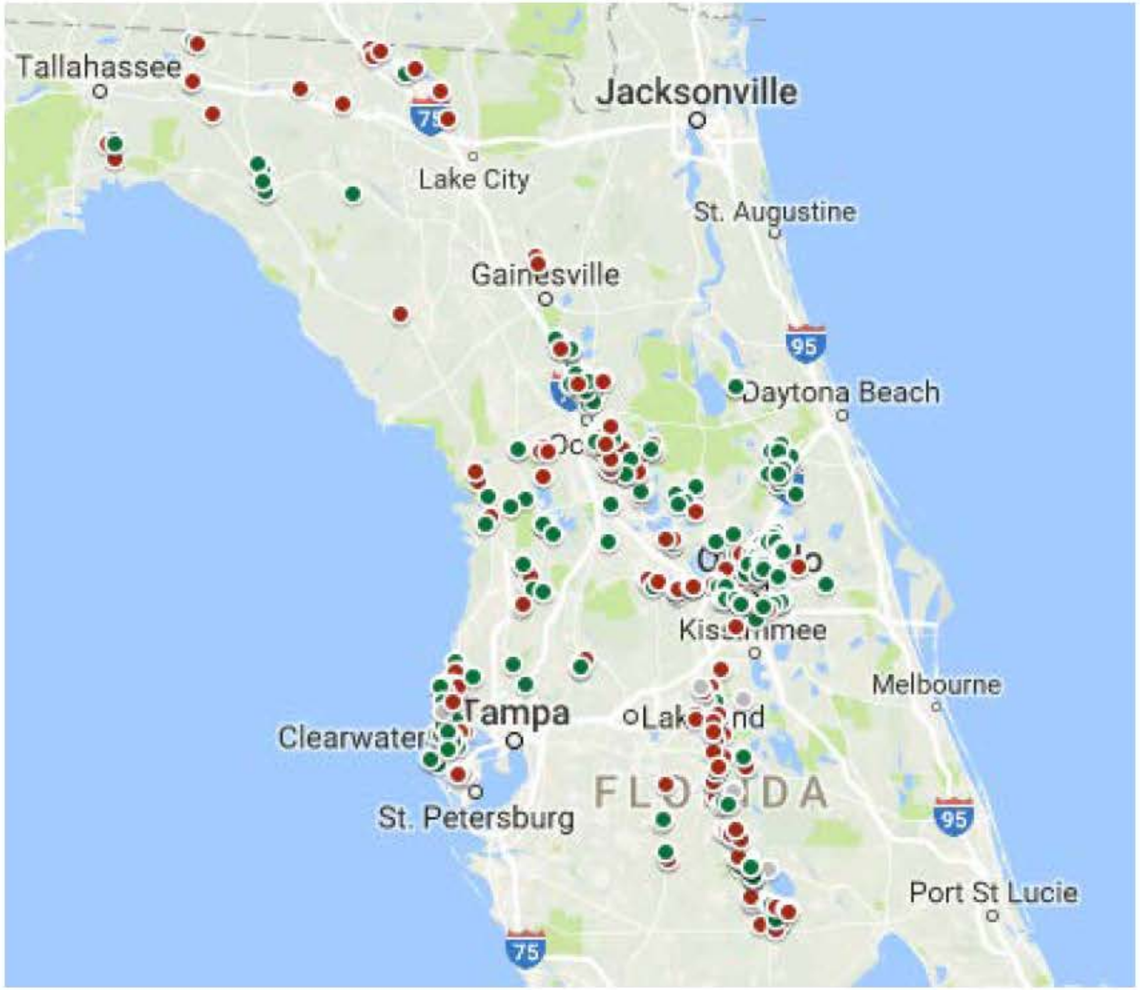
BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA

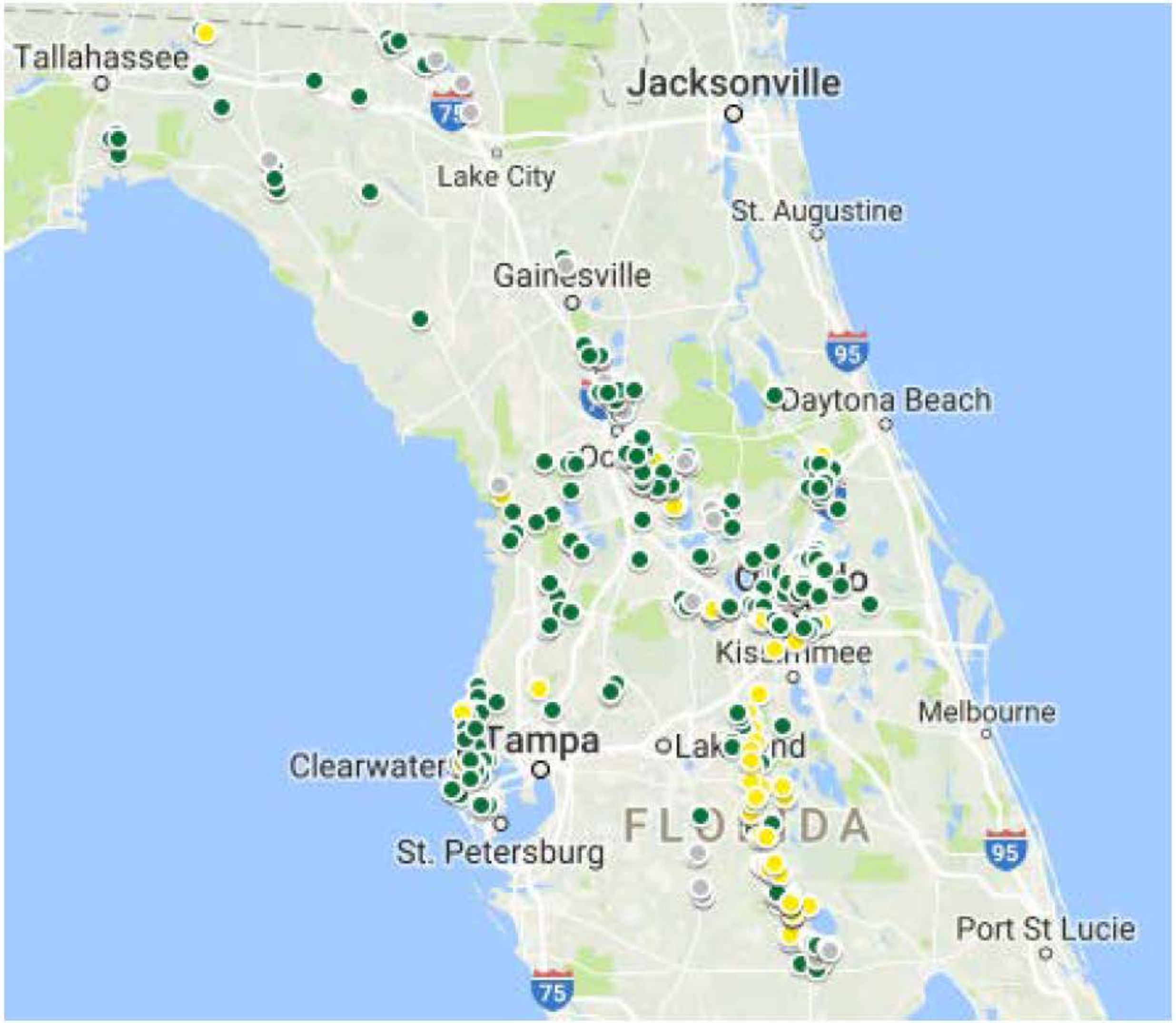
59% of broken poles had an attachment



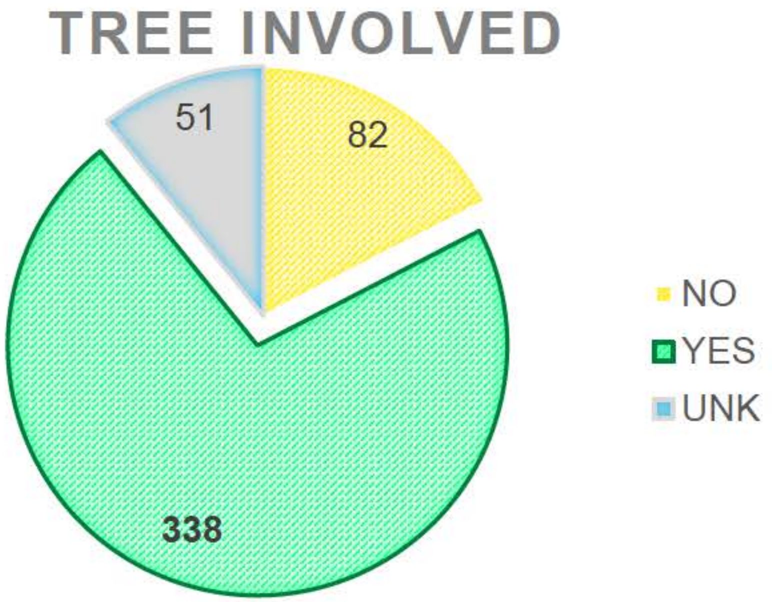
Total 471 Poles



BROKEN POLE VISUALIZATIONS



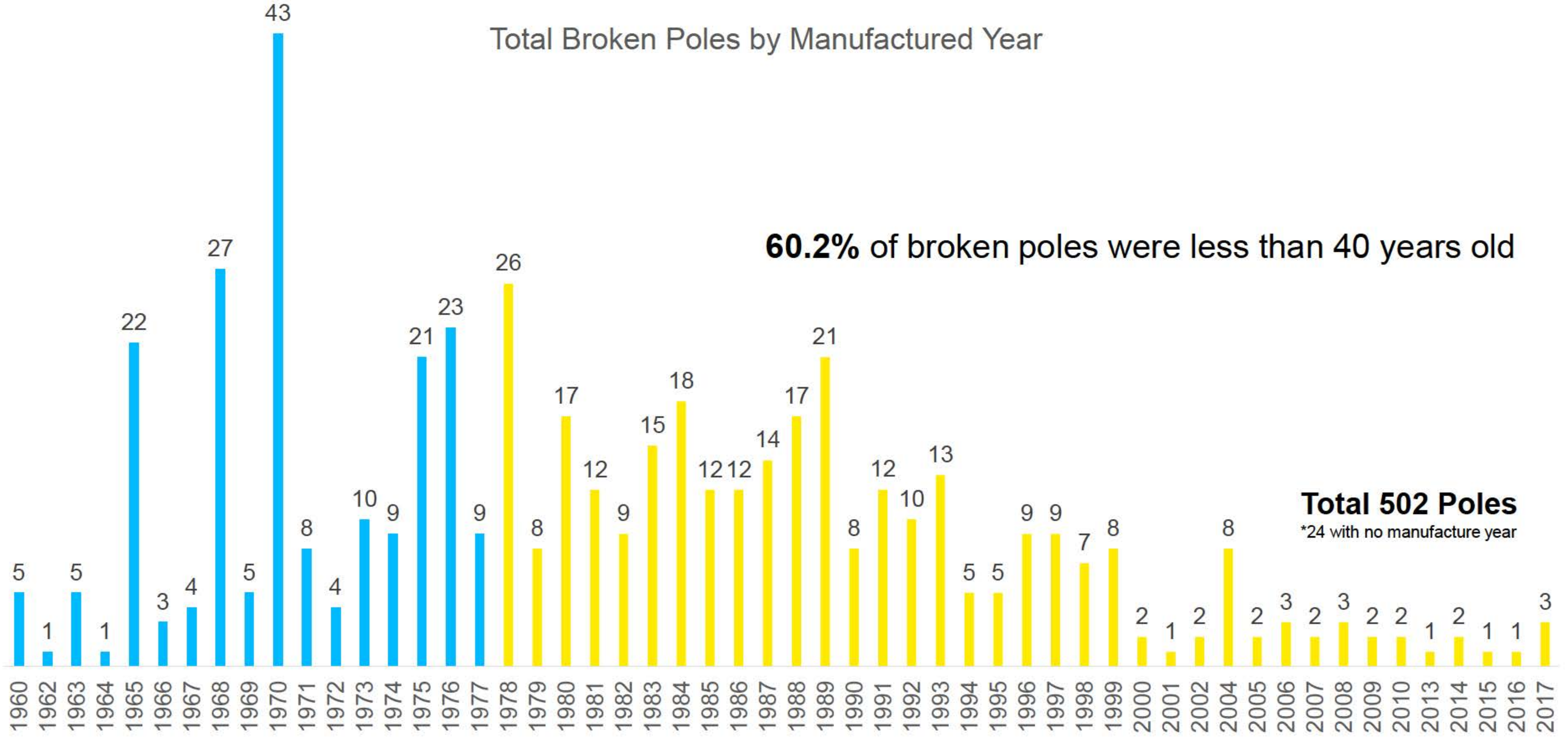
71.8% of broken poles had a tree involved



Total 471 Poles

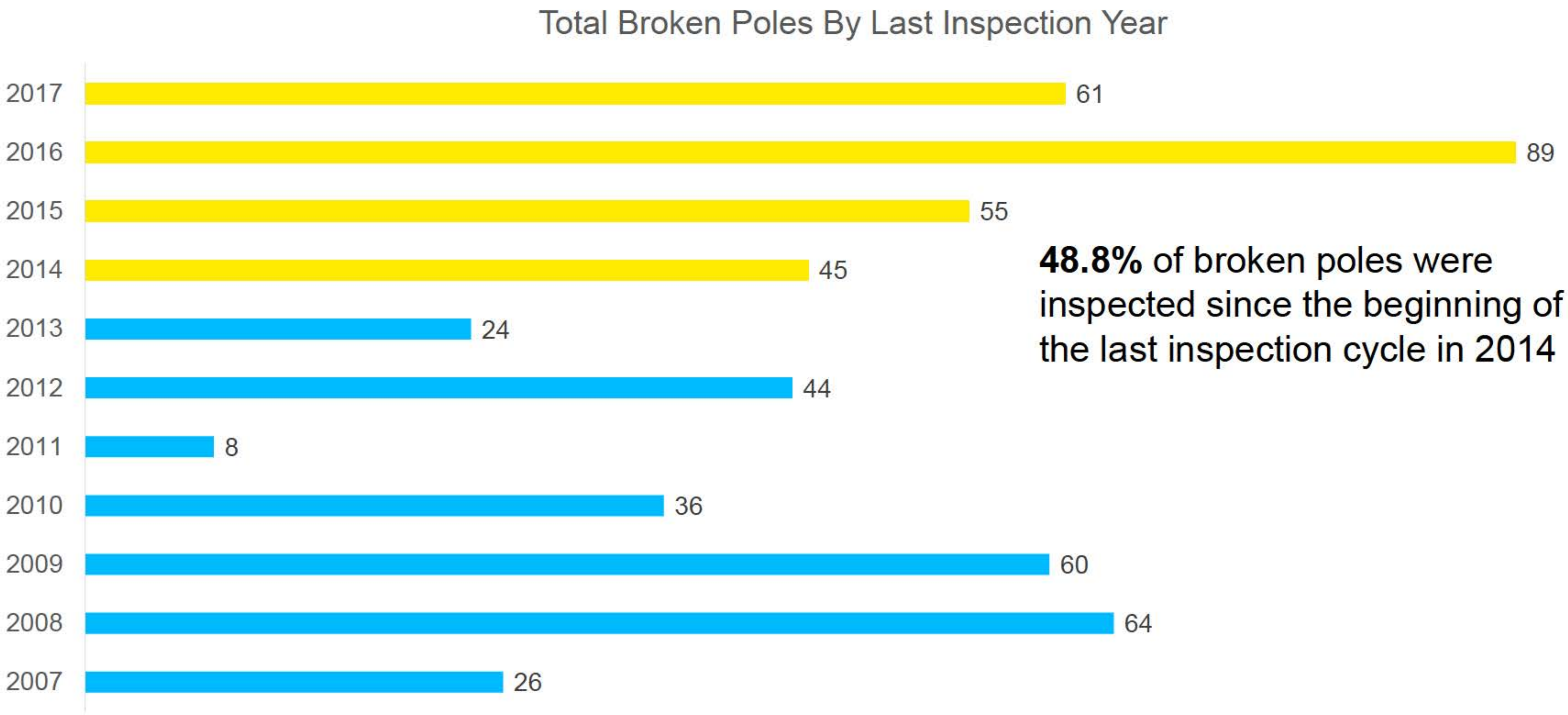
DUKE ENERGY. FLORIDA

BROKEN POLE VISUALIZATIONS



BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA



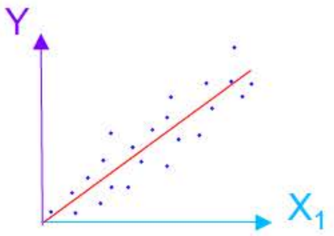
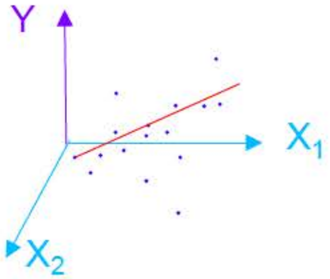
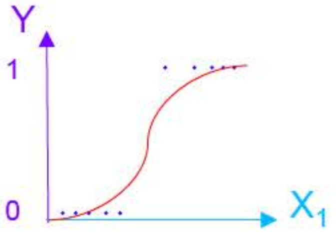
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression		Model Design	Why we use it
Simple Linear Regression		Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression		Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression		$\text{Log}(\frac{Y}{1-Y})$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

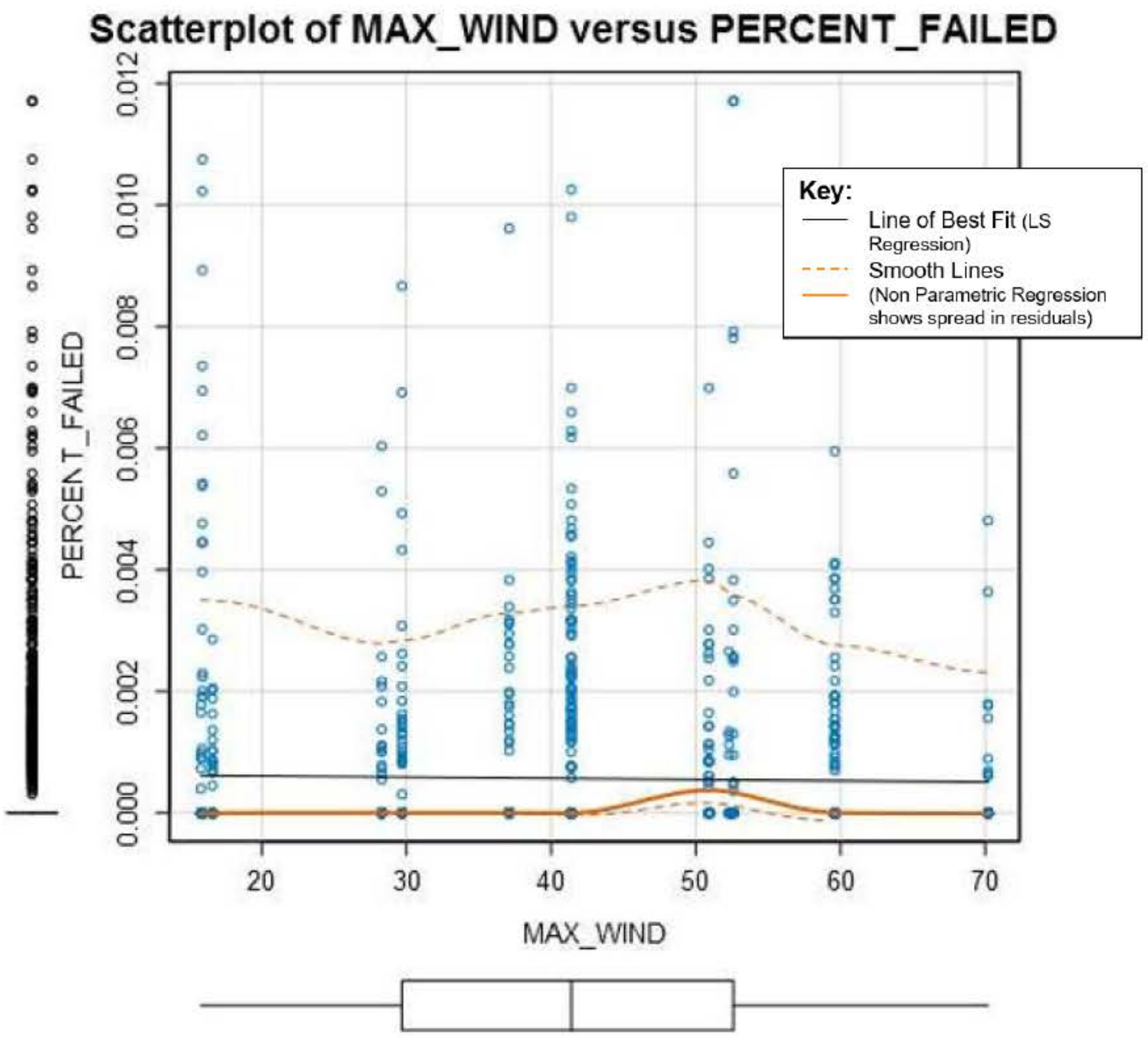
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: MAX GUST

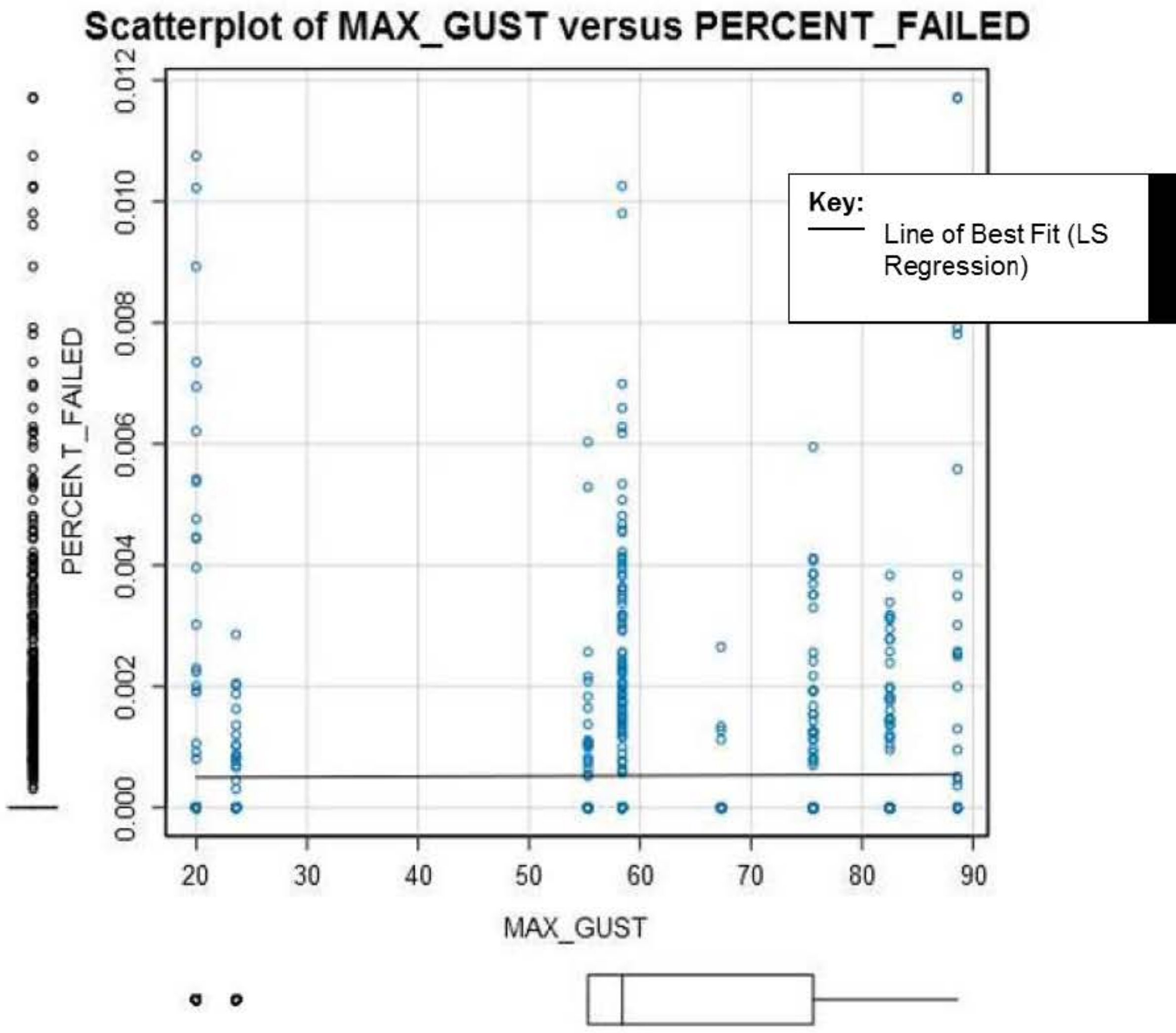
Data Summary

Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111

- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

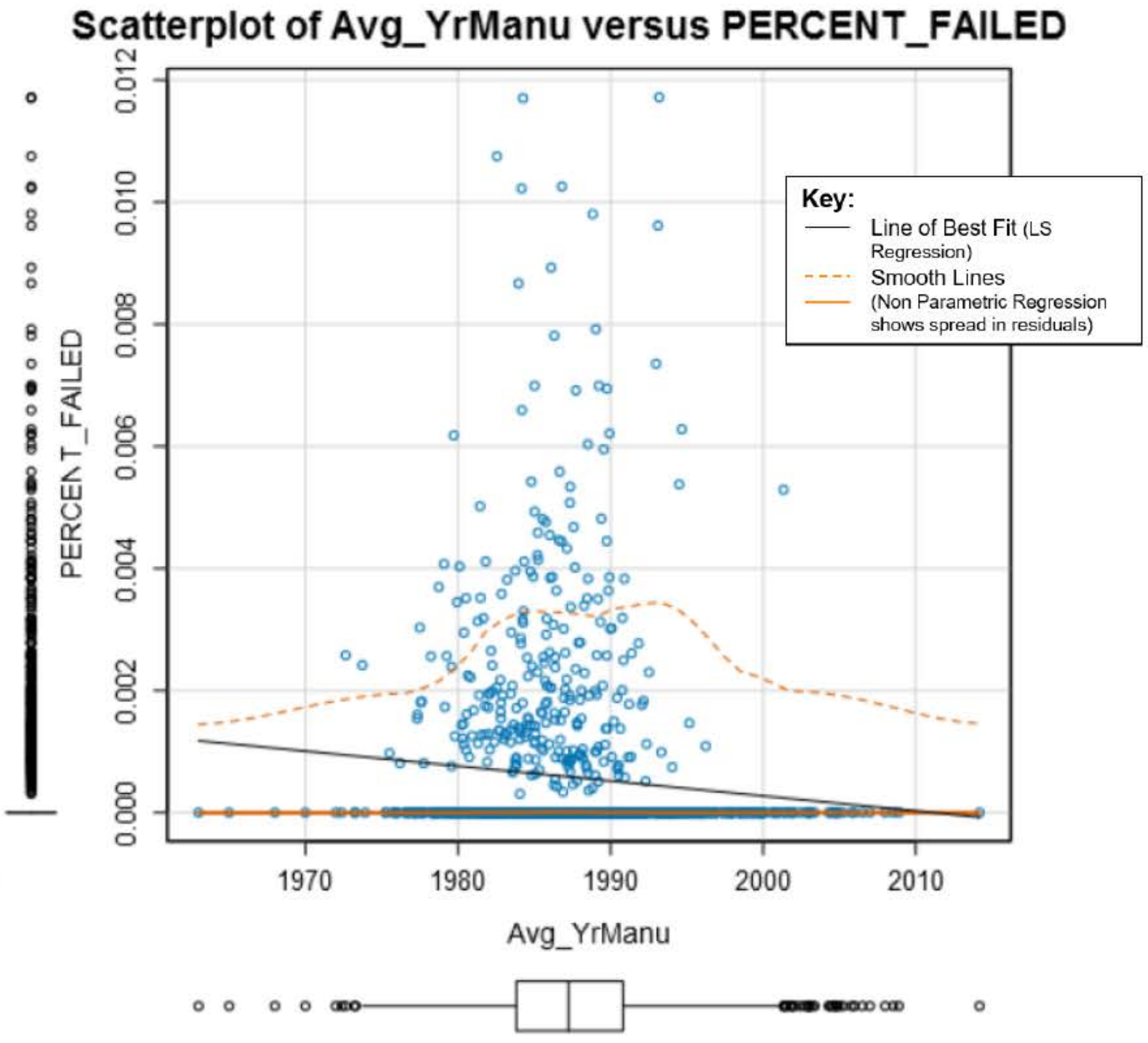
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.



*Note: This analysis does not consider reinforcement of older poles.

DUKE ENERGY. FLORIDA

SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

Data Summary

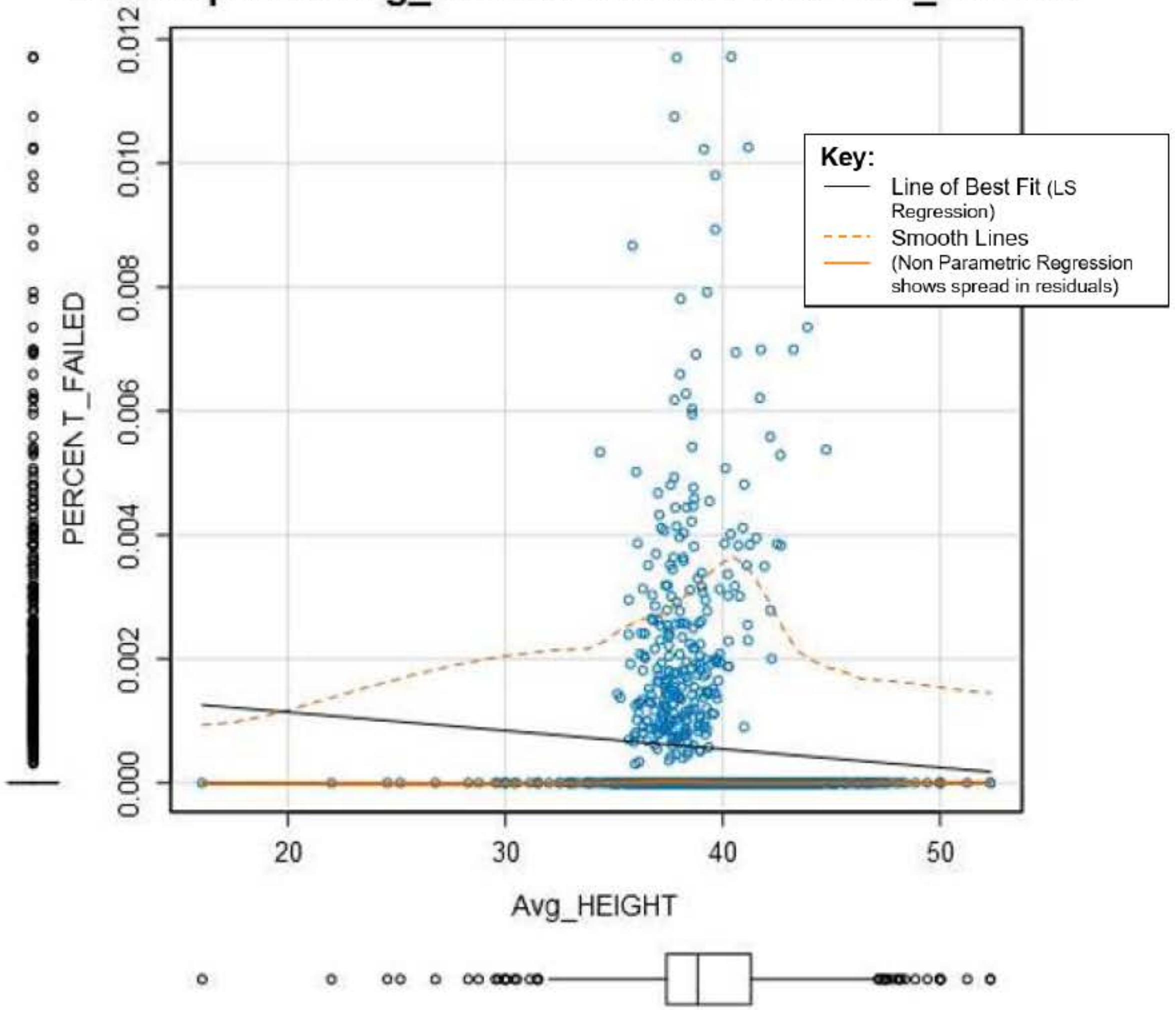
Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.

Scatterplot of Avg_HEIGHT versus PERCENT_FAILED



SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

Data Summary

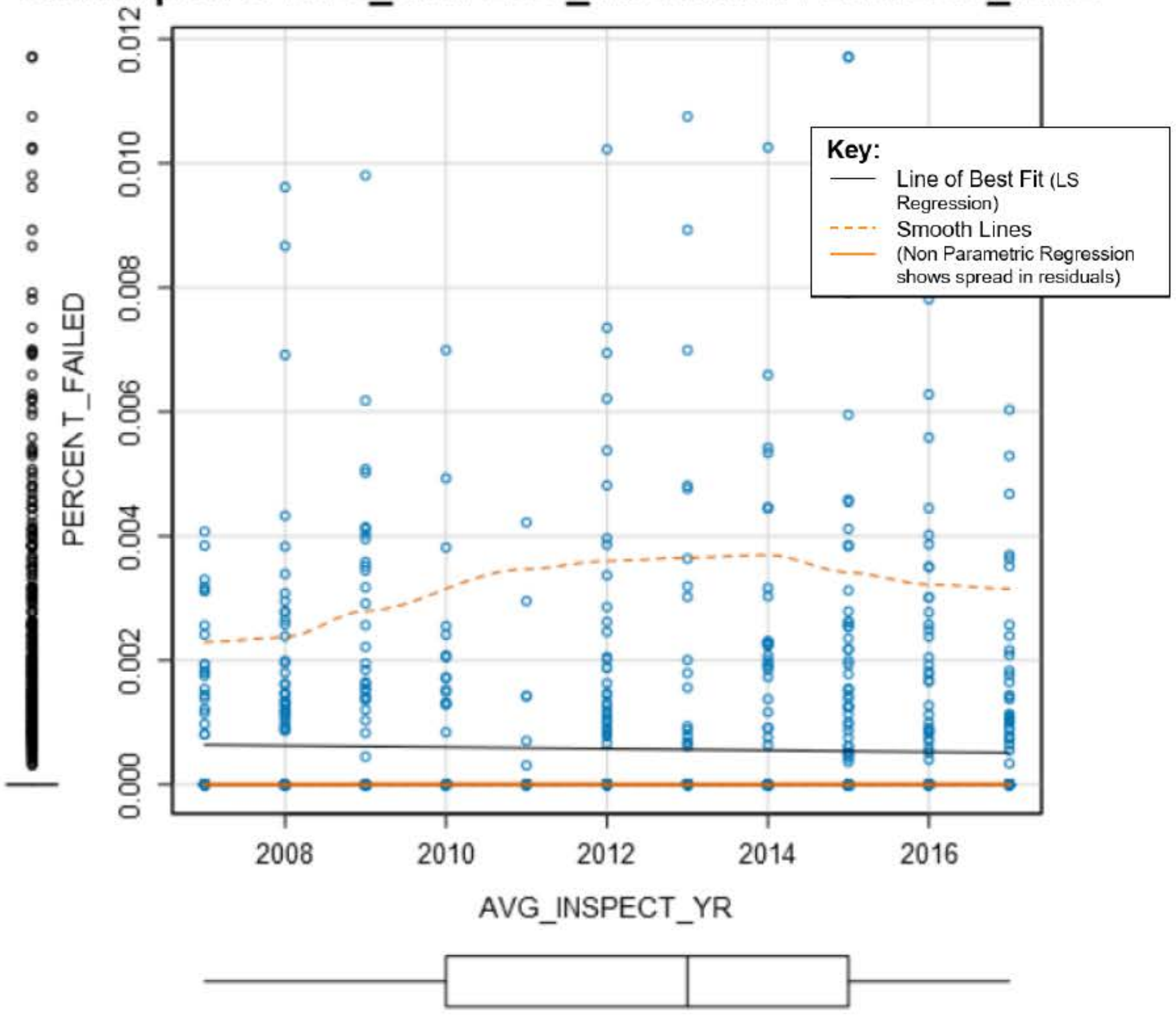
Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of AVG_INSPECT_YR versus PERCENT_FAIL



SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

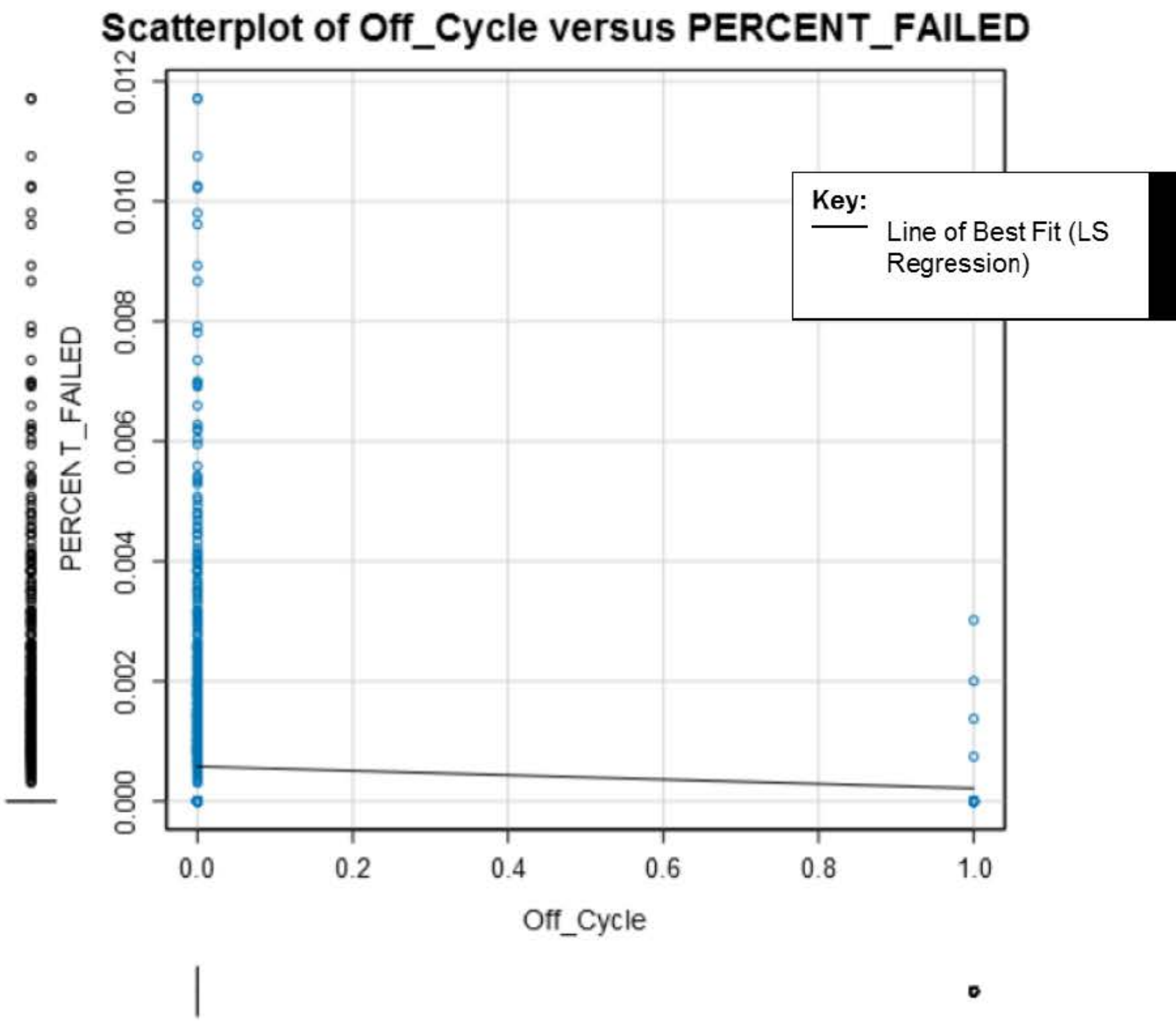
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates (P=0.0025<0.05). Circuits that have newer poles on average are also associated with a lower percent failure rates (P=0.00051<0.05).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates (P=0.003<0.05). Circuits that have newer poles on average are associated with a lower percent failure rates (P=0.00002<0.05).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.
- Circuits with a taller average pole height were more likely to have a lower pole failure rate.
- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.
- Circuits with older poles were associated with higher pole failure rates.
- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.
- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.
- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

DUKE ENERGY FLORIDA

STORM HARDENING

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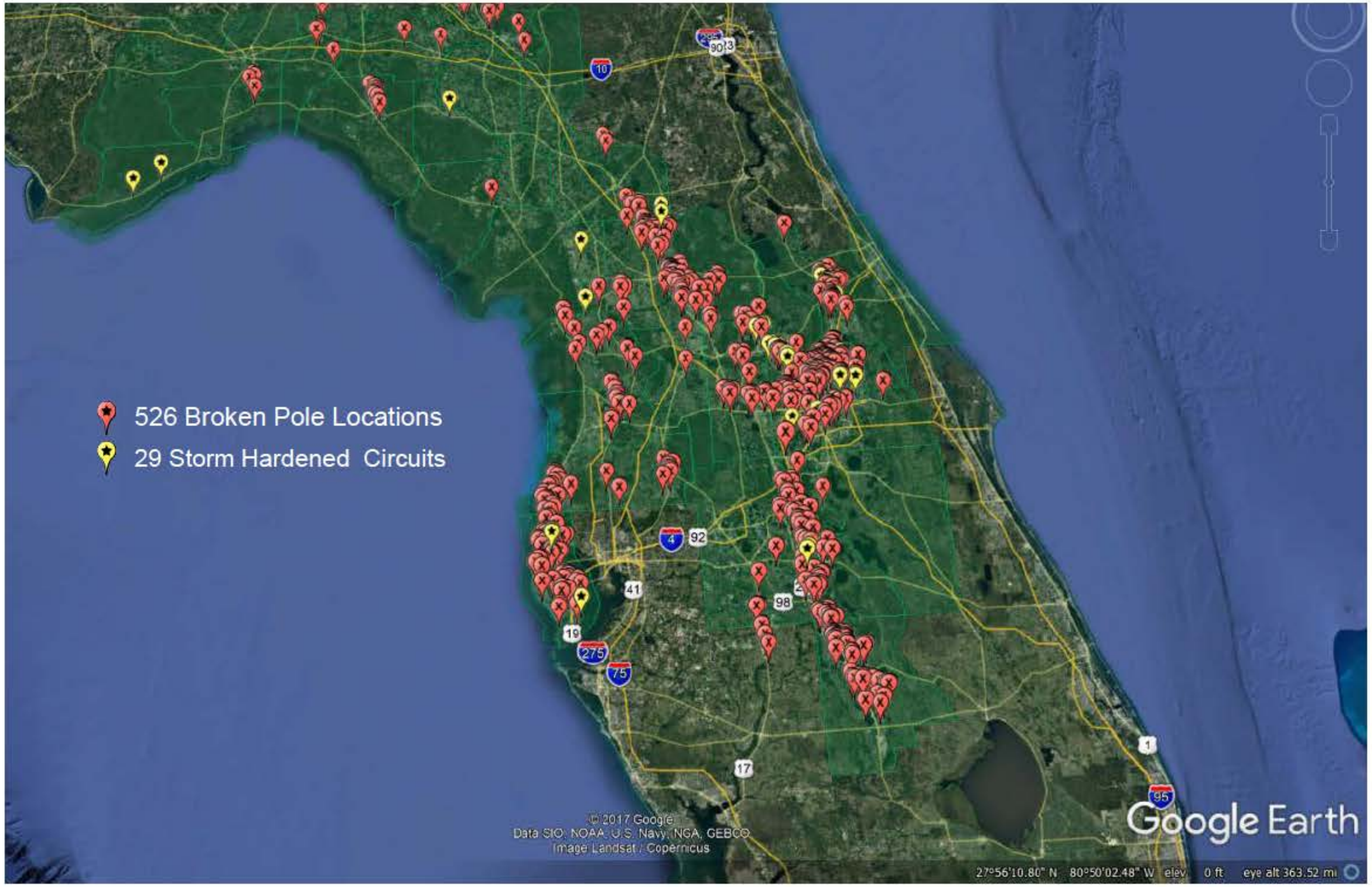
METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

Exhibit B

(2nd copy)

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Thursday, April 12, 2018 5:15 PM
To: Bonner, Larry G
Subject: Accepted: [External] Pole Forensics Report

Categories: Save File, PQR&I

*** Exercise caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. ***

REDACTED

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Tuesday, April 17, 2018 12:15 PM
To: Bonner, Larry G; Supplier Services@duke-energy.com
Cc: Deric, Miki; Bermejo, Lucas E.
Subject: RE: Accenture: Pole Forensics January 2018 Invoice

Categories: Save File, PQR&I

Thanks Larry!

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]]
Sent: Tuesday, April 17, 2018 12:14 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>; Supplier Services@duke-energy.com <SupplierServices@duke-energy.com>
Cc: Deric, Miki <miki.deric@accenture.com>; Bermejo, Lucas E. <lucas.e.bermejo@accenture.com>
Subject: [External] RE: Accenture: Pole Forensics January 2018 Invoice

I will inquire today and get back with you.

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Monday, April 16, 2018 3:30 PM
To: Supplier Services@duke-energy.com
Cc: Bonner, Larry G; Deric, Miki; Bermejo, Lucas E.
Subject: RE: Accenture: Pole Forensics January 2018 Invoice

Good afternoon,

Our records show that the following invoice (#1100372943) is overdue. Could you provide an update on when this invoice will be processed? Also there is another invoice (#1100383869) that is due next week. Could you look into this one as well?

If you have any questions, please feel free to reach out to me.

Open Receivables

Contract	Invoice #	WMU	Invoiced	Due	Due Date	Days Overdue
Pole Forensics	1100372943	Pole Forensics	[redacted]	[redacted]	3/31/2018	16
Pole Forensics	1100383869	Pole Forensics	[redacted]	[redacted]	4/26/2018	(10)

◄ 1 of 1 Go ►

Thanks for your help,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

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From: Bermejo, Lucas E.
Sent: Wednesday, February 14, 2018 12:50 PM
To: Supplierservices (Supplierservices@duke-energy.com) <Supplierservices@duke-energy.com>
Cc: [redacted]; Wagaman, Justin B. <justin.b.wagaman@accenture.com>; Deric, Miki <miki.deric@accenture.com>
Subject: Accenture: Pole Forensics January 2018 Invoice

*****Highly Confidential - To be Used by Authorized Personnel Only*****

Hello,

Attached please find January 2018 invoice for Accenture's Pole Forensics project and its PDF.

Please let us know if you have any questions/concerns.

Regards,

Lucas Bermejo
Accenture Business Services Buenos Aires
Client Financial Management *Analyst*

Defensa 390, C1065AAF
Buenos Aires
Telephone: *(54-11) 4516-5810*

Bangalore • Buenos Aires • Chennai• Chicago • Dalian • Dublin • Manila • Mumbai • Prague • Pune

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Wednesday, May 23, 2018 7:10 PM
To: Bonner, Larry G
Subject: RE: Invoices

Categories: PQR&I, Save File

This EXTERNAL email is originating from a third-party provider that conducts business on behalf of Duke Energy. Please continue to be vigilant when handling email.

Larry,

I took a look in our system and there are no open invoices so I believe they have cleared on our end. All work has been invoiced so I think we are good to go.

Thanks for your help getting those outstanding invoices paid!

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

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From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, May 23, 2018 12:54 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Invoices

Hi Justin,

I processed all of the invoices that were submitted. Can you verify that you have submitted invoices for all of the work, and that you guys have been paid?

Thanks,

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Thursday, May 24, 2018 9:47 AM
To: Bonner, Larry G
Subject: RE: Invoices

Categories: PQR&I, Save File

This EXTERNAL email is originating from a third-party provider that conducts business on behalf of Duke Energy. Please continue to be vigilant when handling email.

That's excellent news! Definitely let us know if the opportunity arises.

I hope you enjoy your Memorial Day weekend,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Thursday, May 24, 2018 9:41 AM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] RE: Invoices

You are welcome. BTW, it seems that there was considerable interest in the report that we did. It is my understanding that there is interest in us continuing this type of report out.

I'll keep you guys informed.

Have a good day

Larry

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Wednesday, May 23, 2018 7:10 PM
To: Bonner, Larry G
Subject: RE: Invoices

REDACTED

Larry,

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Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, May 23, 2018 12:54 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Invoices

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Thanks,

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Wednesday, March 28, 2018 10:15 AM
To: Bonner, Larry G; Deric, Miki
Subject: RE: Status of Final Report

Categories: Save File, PQR&I

*** Exercise caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. ***

Larry,

I must have misunderstood. The last email you sent on the 14th had, what we thought was, the final report. I didn't see any comments or redlines so I thought you were sharing the final report with us based on the edits you and I made over the phone. Was there something you were looking for from us?

Sorry for the confusion,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, March 28, 2018 9:45 AM
To: Deric, Miki <miki.deric@accenture.com>; Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Status of Final Report

Good Morning,

Can you advise me on the status of the final report?

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Sent: Friday, April 06, 2018 11:04 AM
To: Bonner, Larry G
Subject: RE: Status of Final Report
Attachments: Duke FL Pole Forensics Support Report FINAL v06-00 2018-04-06.pptx

Categories: Save File, PQR&I

Larry,

Per your request, here is the final report for the pole forensics support. We reviewed the notes and determined that it was good information that didn't need to be separated from the slide deck like you and I originally discussed yesterday. We also removed any mention of draft and the client attorney privilege statements on each slide.

If you have any further requests, please let me know.

It was a pleasure working with you on this effort and I hope to work with you again soon.

We appreciate the time and dedication you and your team put in to supporting this effort.

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

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From: Bonner, Larry G [mailto [redacted]
Sent: Thursday, April 5, 2018 3:04 PM
To: Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] RE: Status of Final Report

Sorry for the confusion. Yes. I just wanted you to look it over and remove the "Draft Analysis" and any other preliminary markings.

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

From: Wagaman, Justin B. [mailto:justin.b.wagaman@accenture.com]
Sent: Wednesday, March 28, 2018 10:15 AM
To: Bonner, Larry G; Deric, Miki
Subject: RE: Status of Final Report

*** Exercise caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. ***

Larry,

I must have misunderstood. The last email you sent on the 14th had, what we thought was, the final report. I didn't see any comments or redlines so I thought you were sharing the final report with us based on the edits you and I made over the phone. Was there something you were looking for from us?

Sorry for the confusion,

Justin Wagaman | Accenture
Industry Solutions & Services Manager | Utilities, Transmission & Distribution (T&D) | North America
Email: Justin.B.Wagaman@accenture.com | Cell: [redacted] | Skype: [redacted]

accentureconsulting

From: Bonner, Larry G [mailto [redacted]
Sent: Wednesday, March 28, 2018 9:45 AM
To: Deric, Miki <miki.deric@accenture.com>; Wagaman, Justin B. <justin.b.wagaman@accenture.com>
Subject: [External] Status of Final Report

Good Morning,

Can you advise me on the status of the final report?

Larry G. Bonner, P.E.

Power Quality & Reliability
Duke Energy - Florida
(407) [redacted]
#PurposeDriven

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DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

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TABLE OF CONTENTS

DUKE ENERGY FLORIDA

EXECUTIVE SUMMARY

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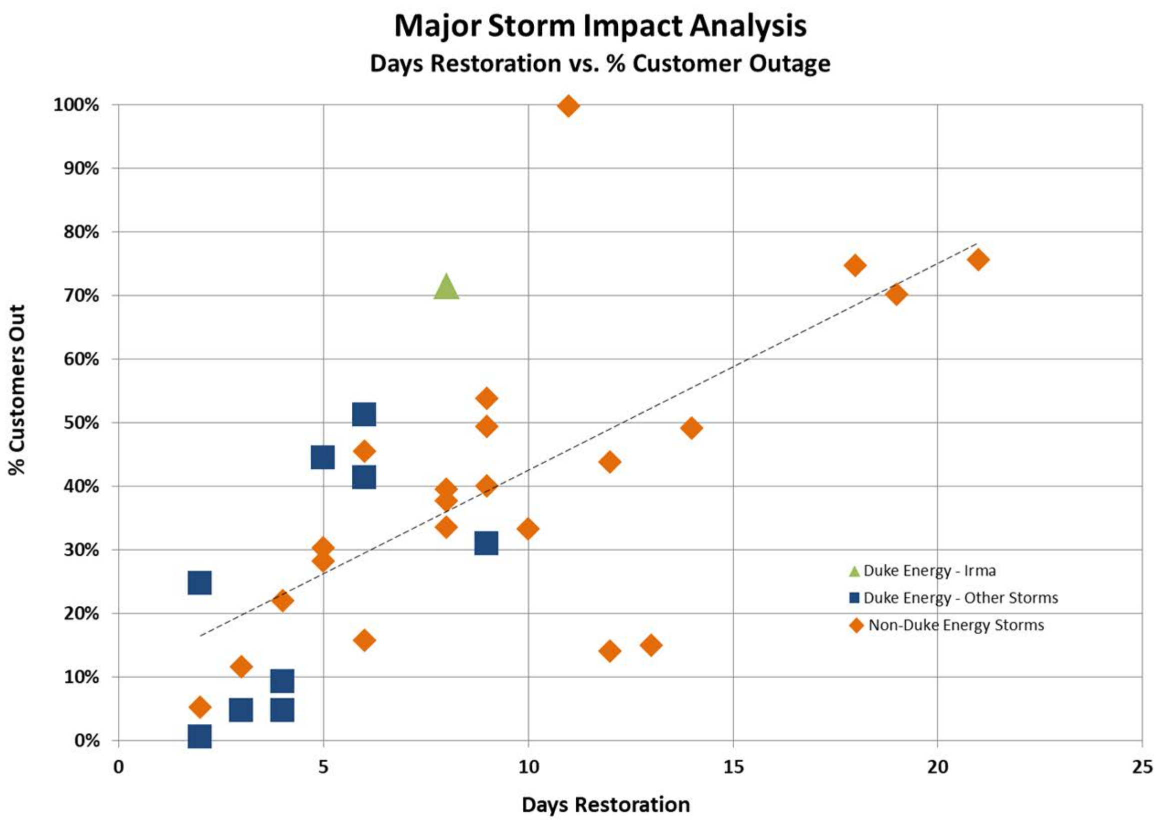
EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging “storm benchmark database” compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

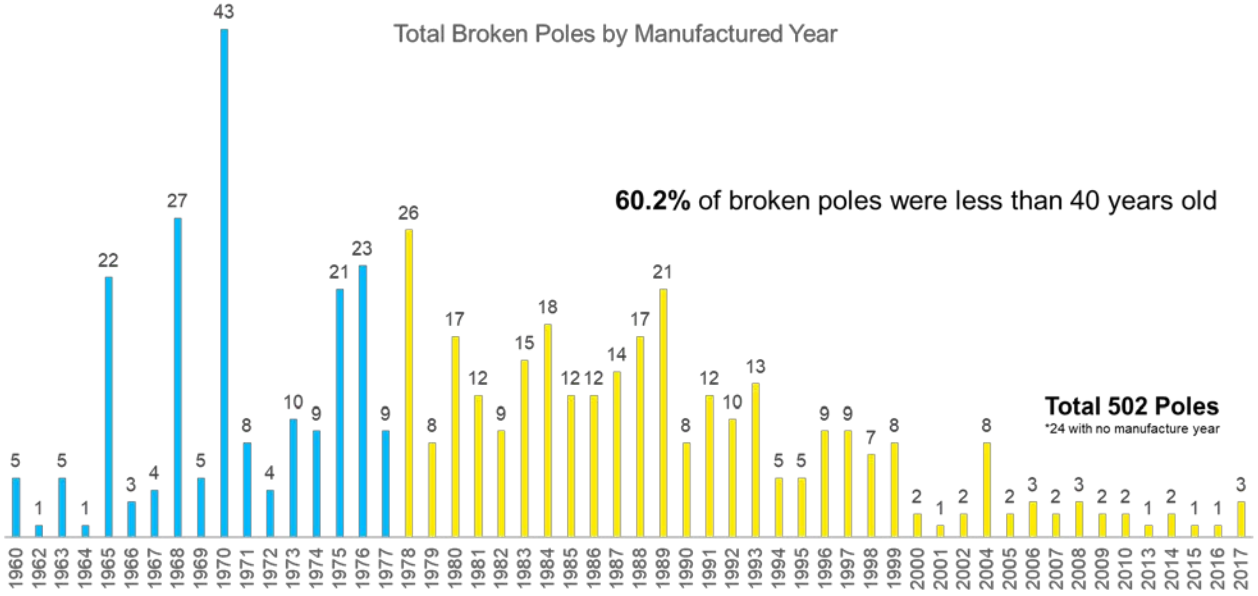
EXECUTIVE SUMMARY – BENCHMARK

- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



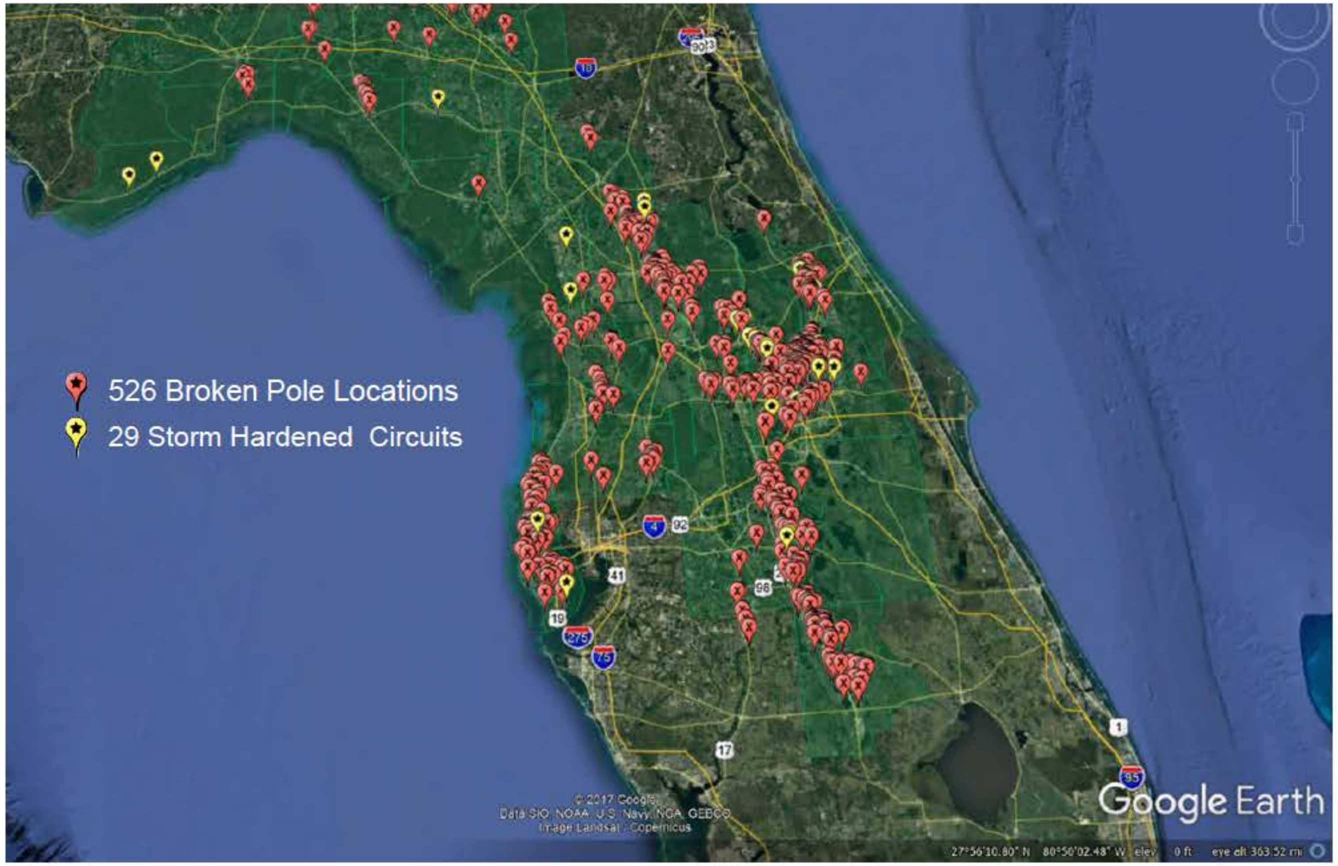
EXECUTIVE SUMMARY – FORENSIC

- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



EXECUTIVE SUMMARY – SYSTEM HARDENING

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.



OVERVIEW/ PURPOSE

OVERVIEW/PURPOSE

- Duke Energy Florida ("Duke FL") conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture's storm benchmarking database to compare against Duke FL's response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL's hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance

- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL's restoration efforts versus other utility companies captured in Accenture's storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	1982
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

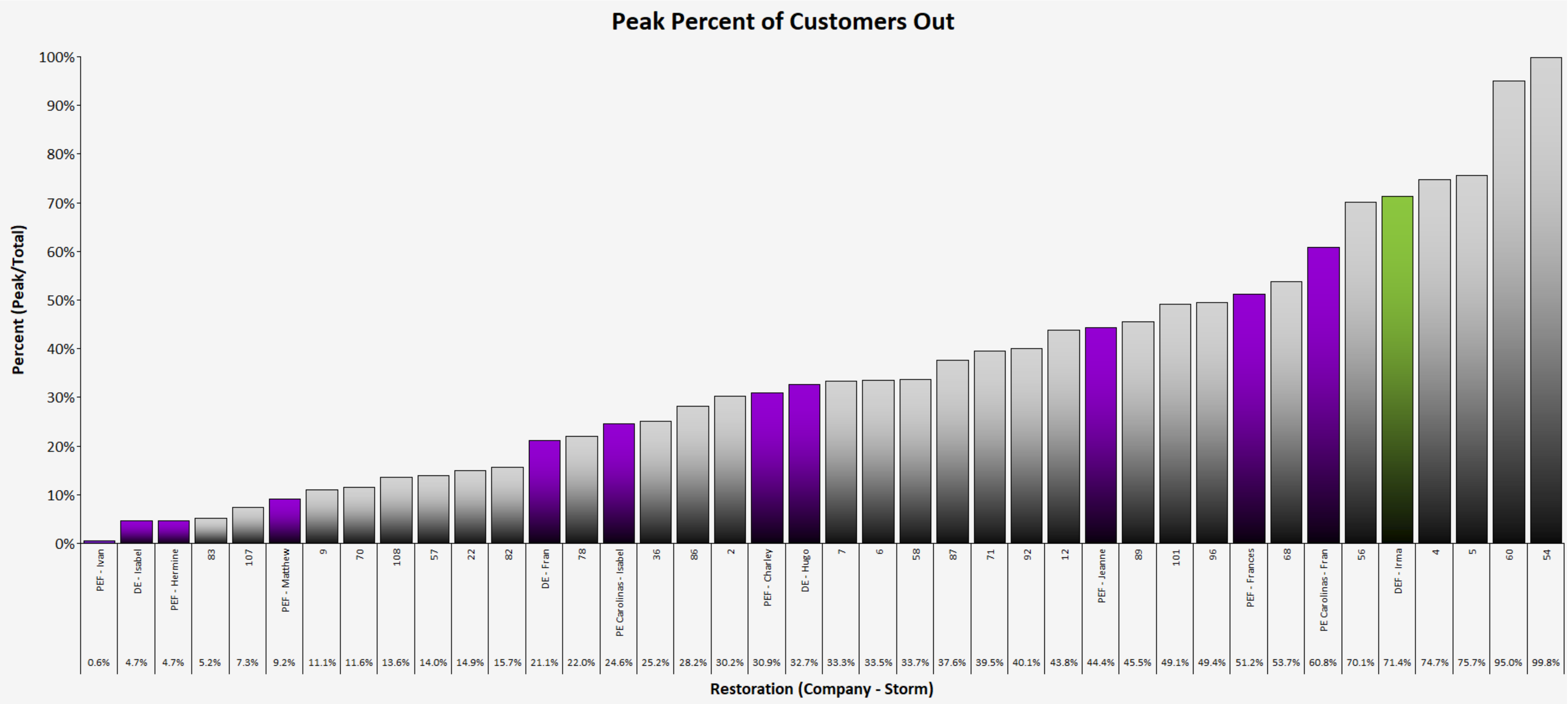
Restoration Duration	
Restoration Duration (# Days)	8 days

Restoration Costs	
Total Restoration Cost	$500M - $550M

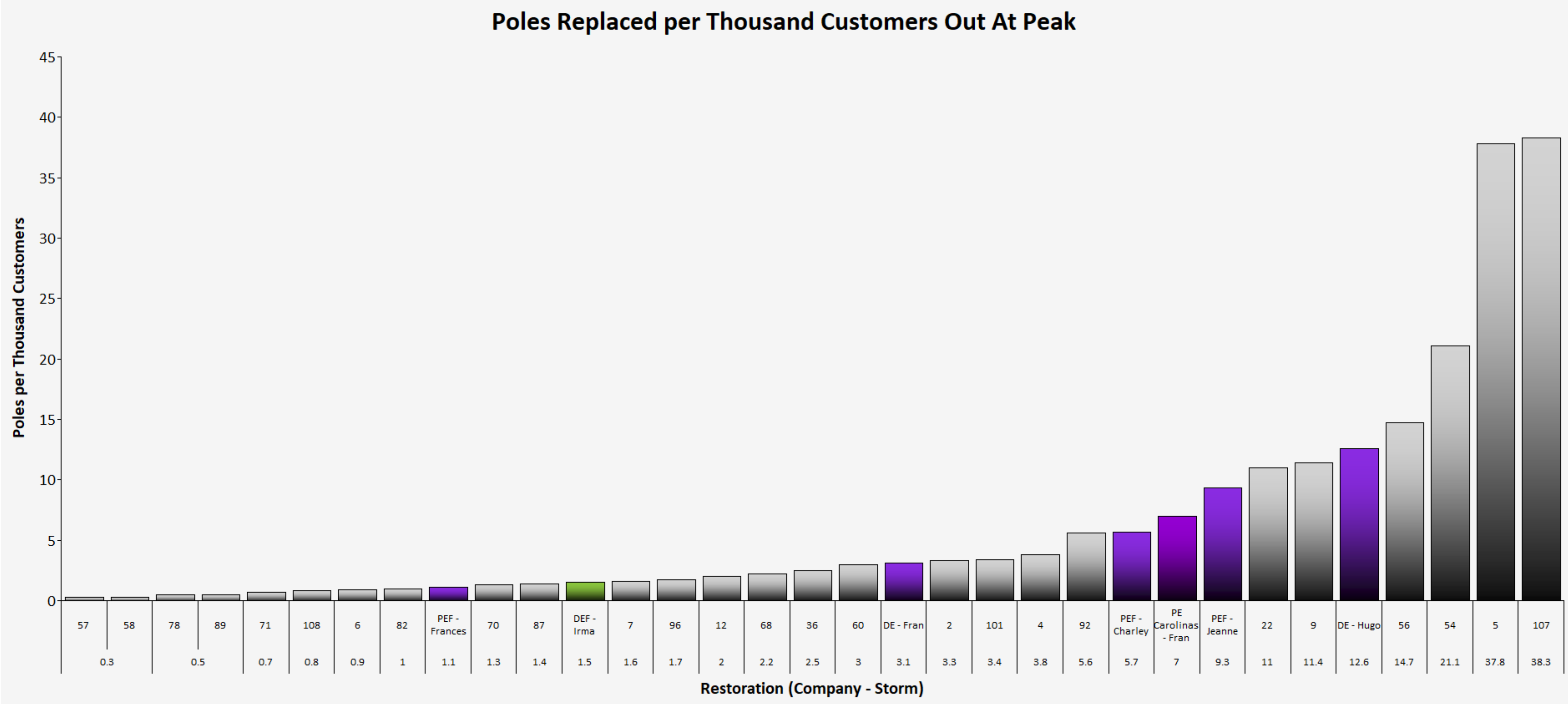
Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

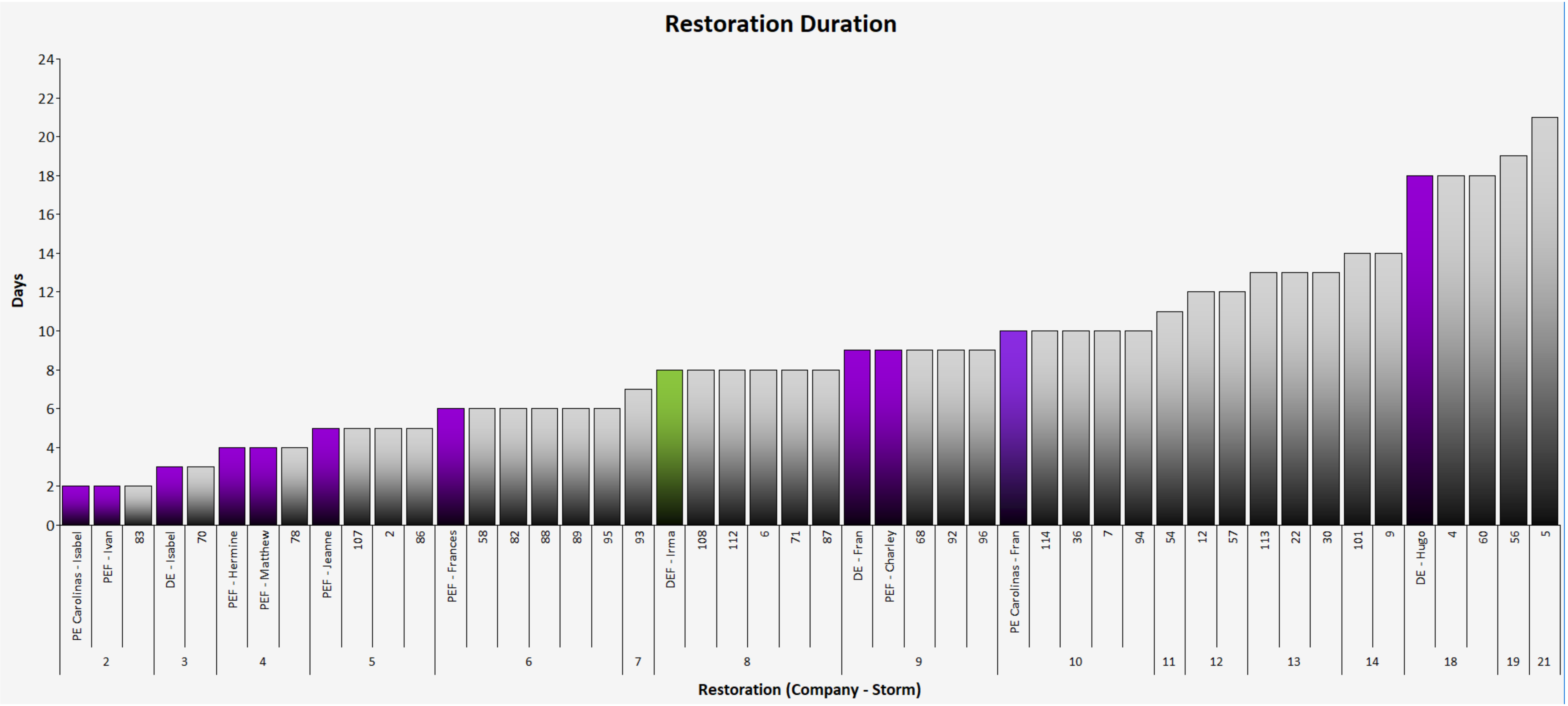
BENCHMARK RESULTS



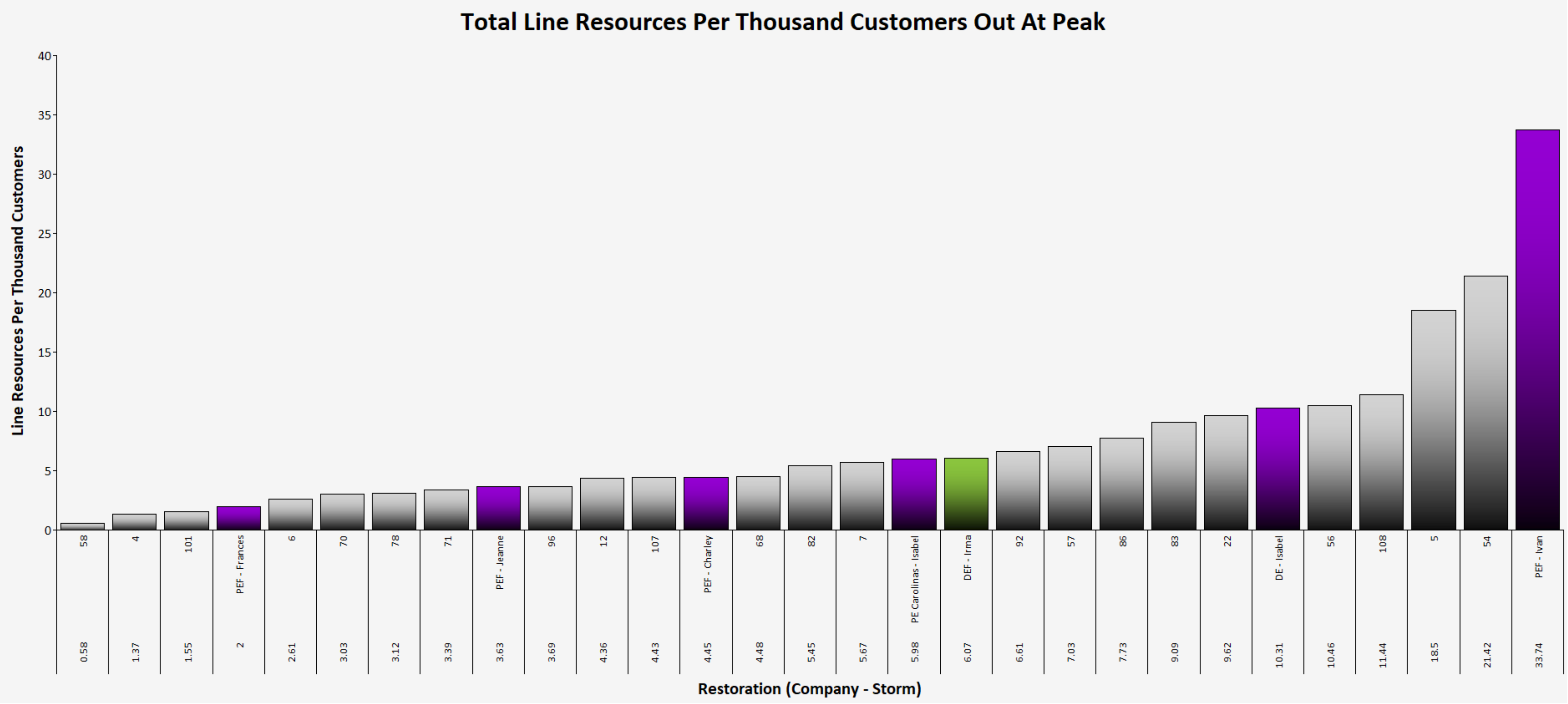
BENCHMARK RESULTS



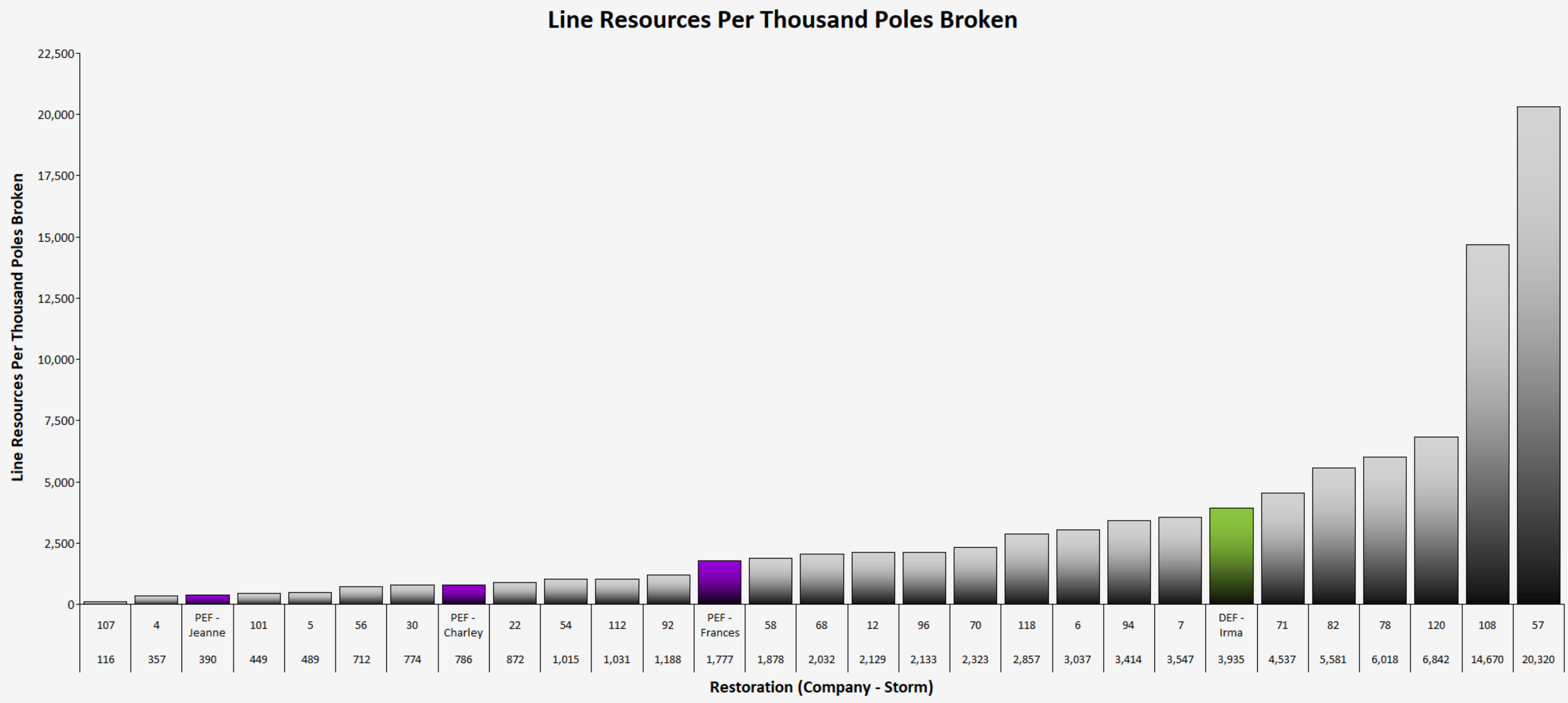
BENCHMARK RESULTS



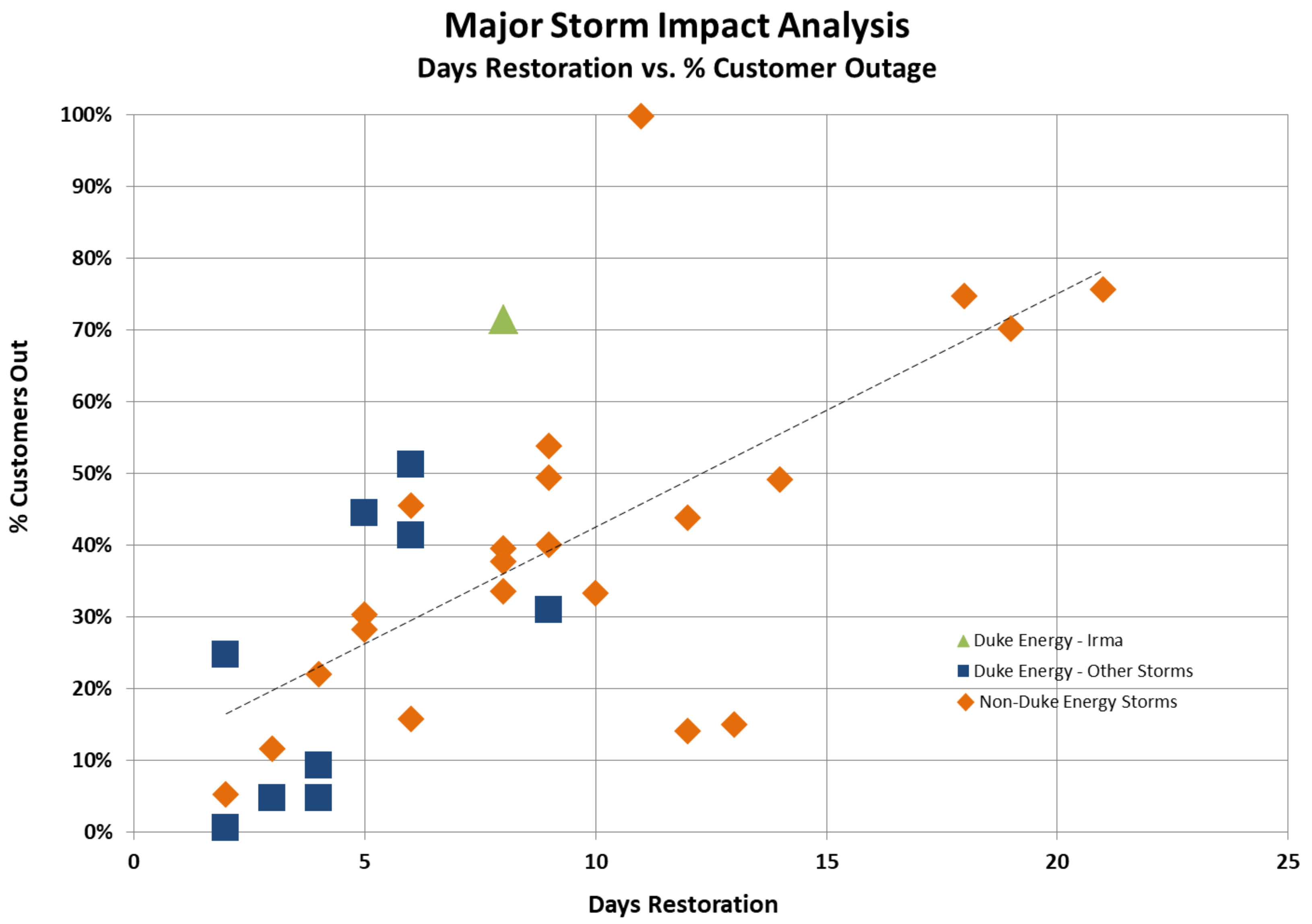
BENCHMARK RESULTS



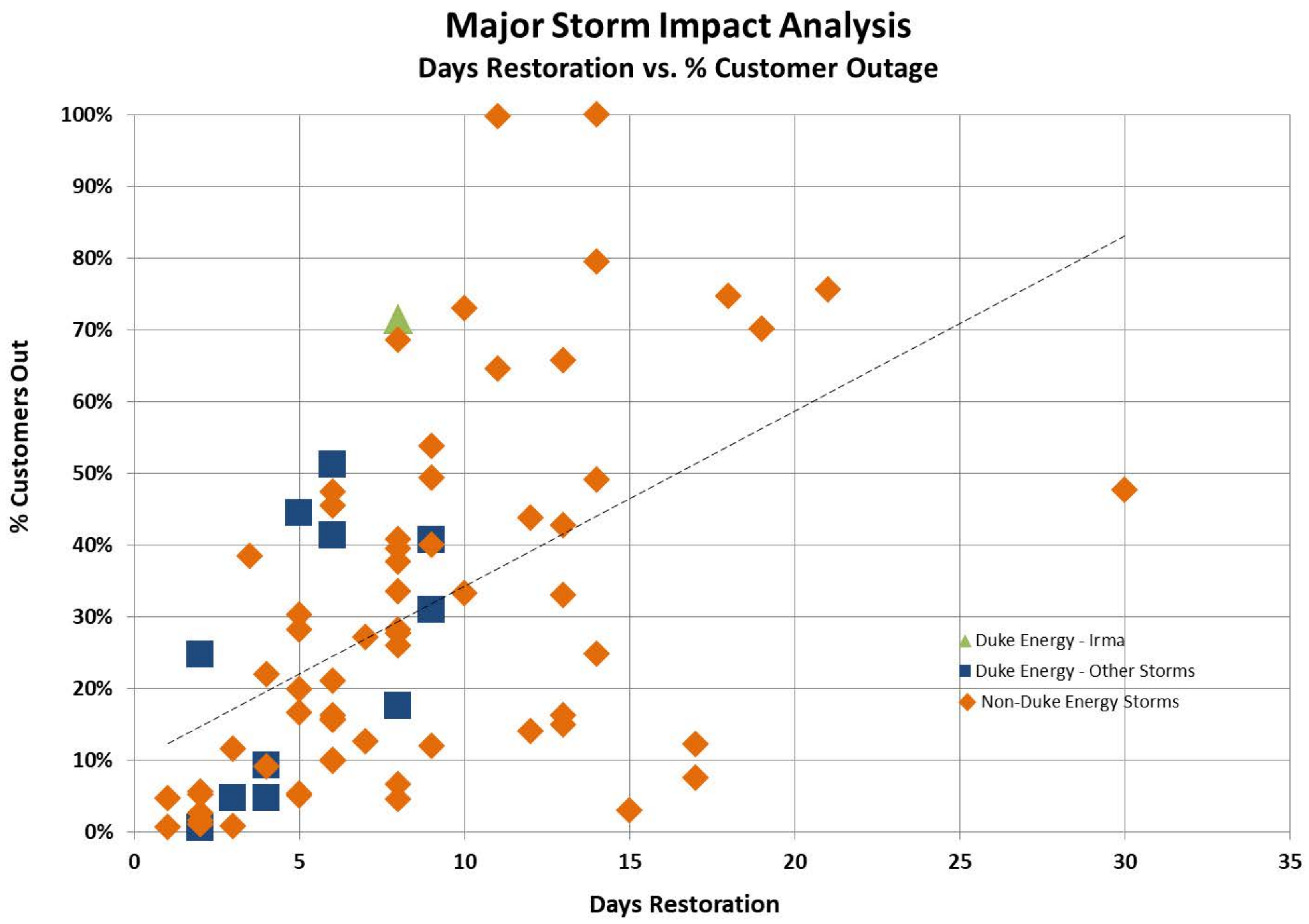
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

DUKE ENERGY.
FLORIDA

FORENSICS ANALYSIS

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METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 1,841 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

Broken Poles Included in Forensic Analysis

1,841 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

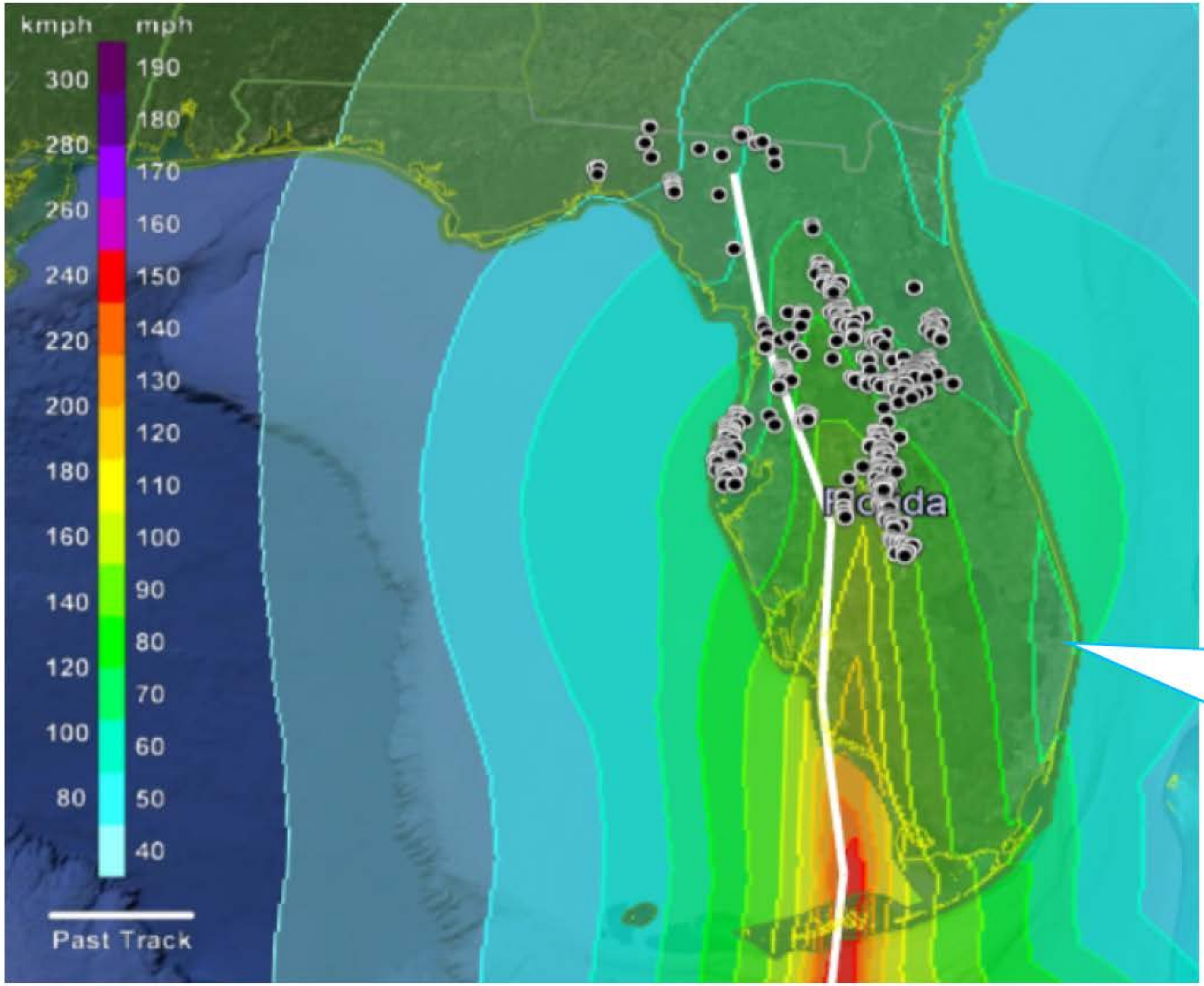
Pole Inventory – Duke Florida

1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS



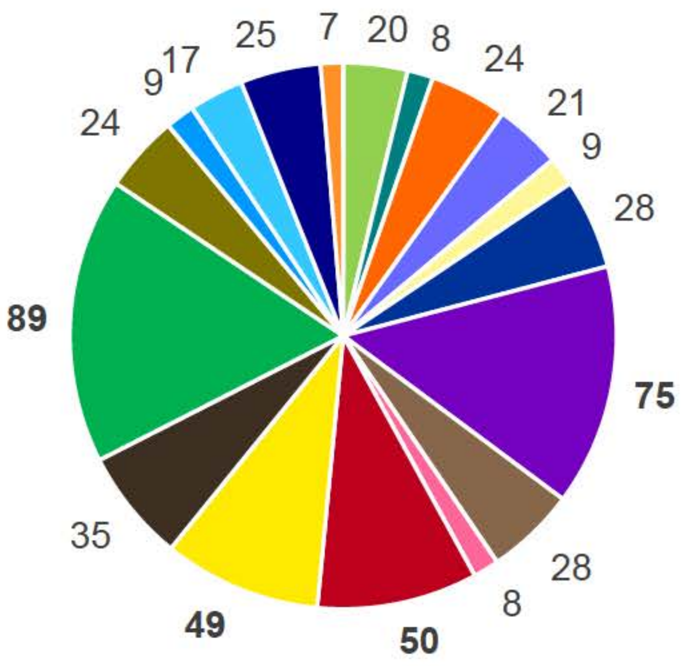
https://data.humdata.org/dataset/hurricane-irma-windspeed

526 Broken Poles

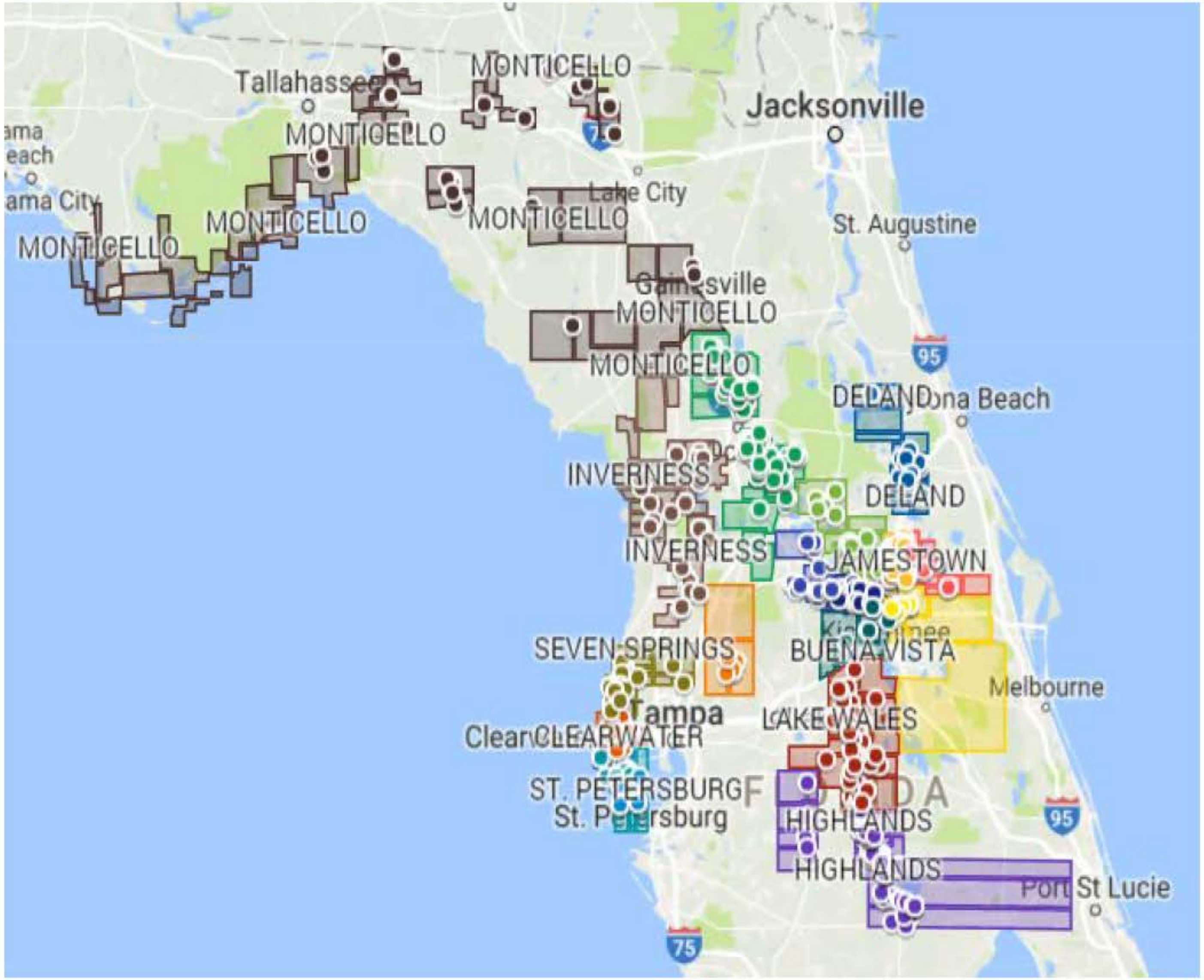
Irma Path
9/11 12am – 12pm

BROKEN POLE VISUALIZATIONS

Broken Poles By OP Center

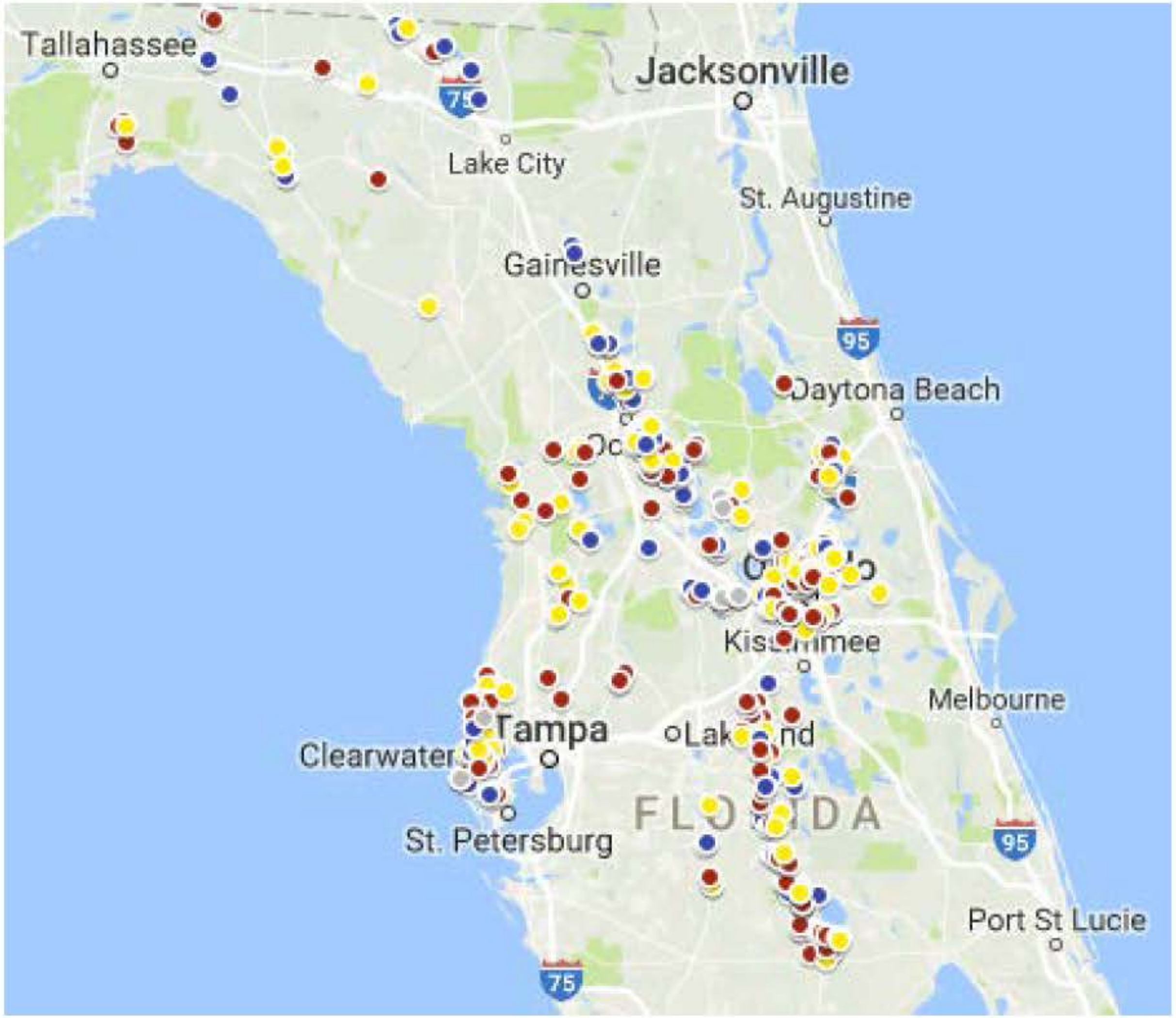


Total 526 Poles

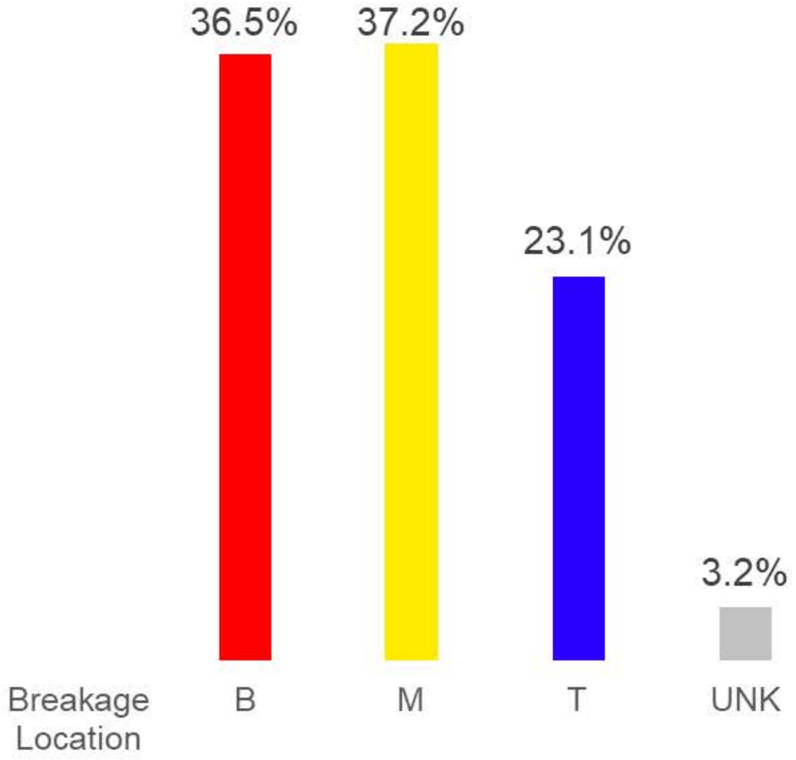


50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS



- **37.2%** of poles broke in the middle



Total 471 Poles

***66 poles that broke at the bottom did not have reject status information**

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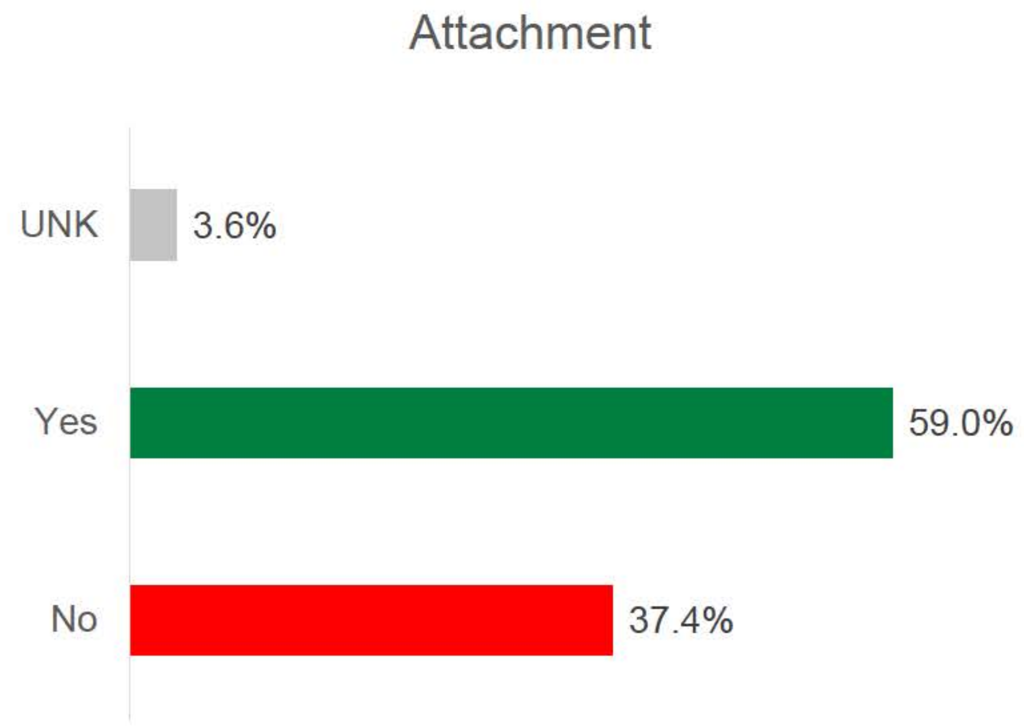
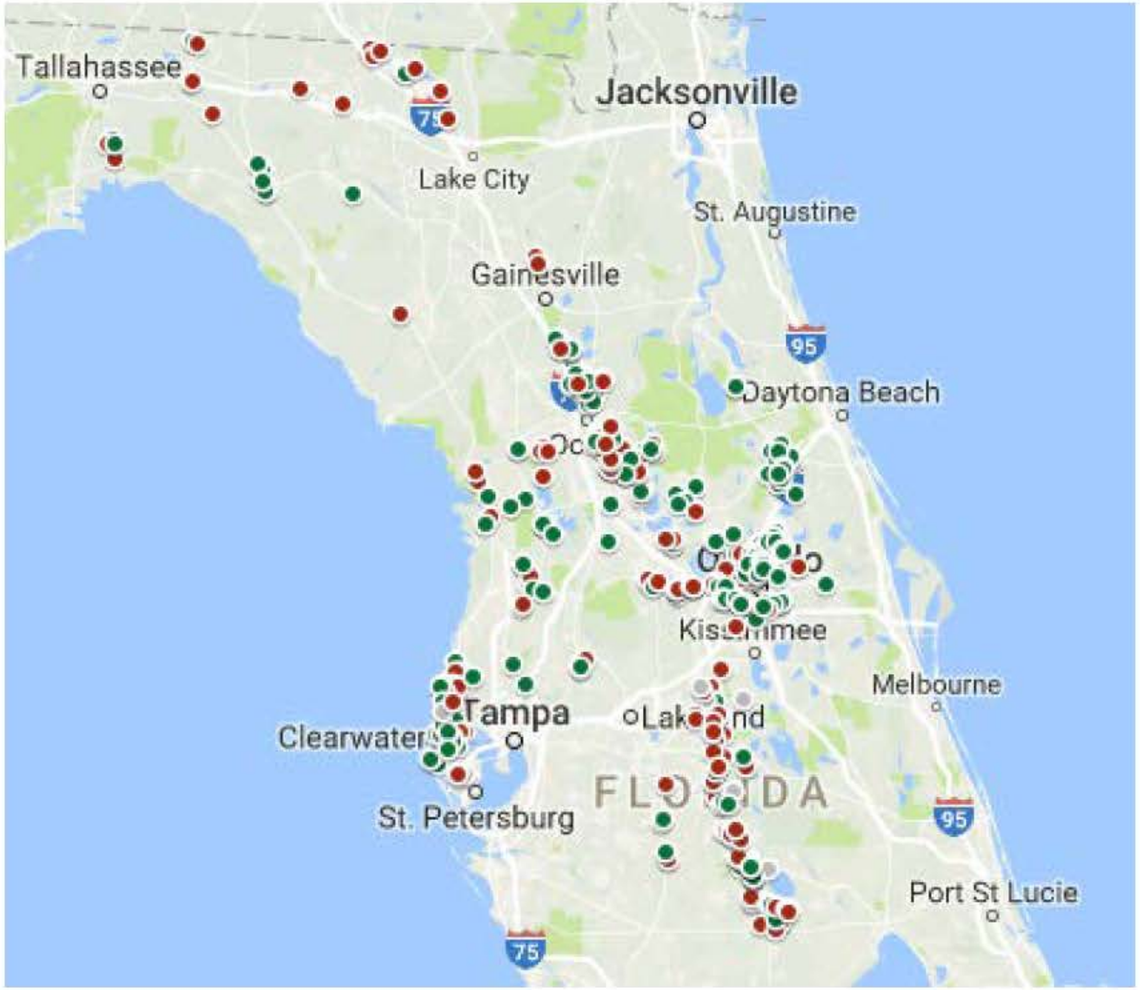
BROKEN POLE VISUALIZATIONS

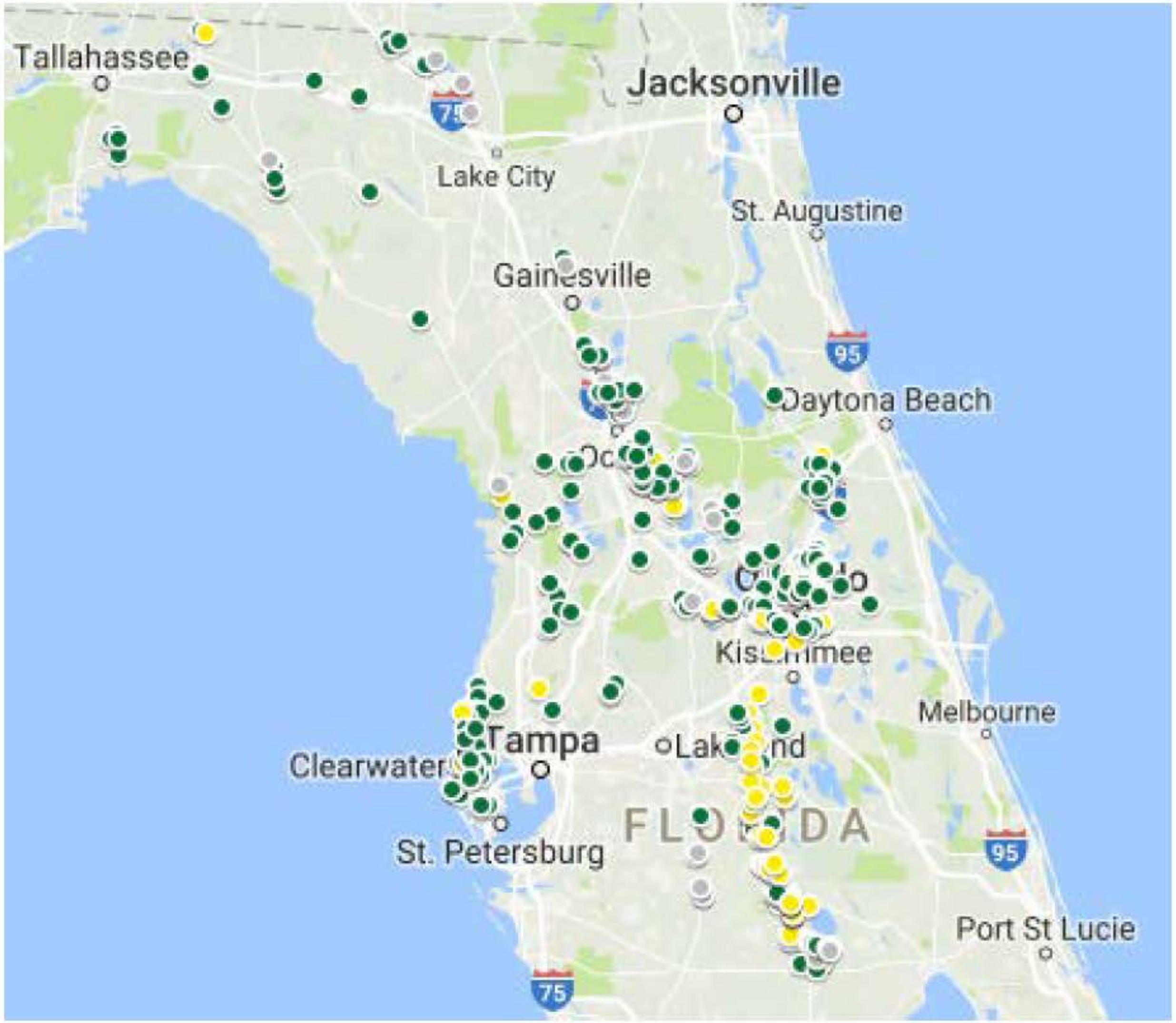
59% of broken poles had an attachment



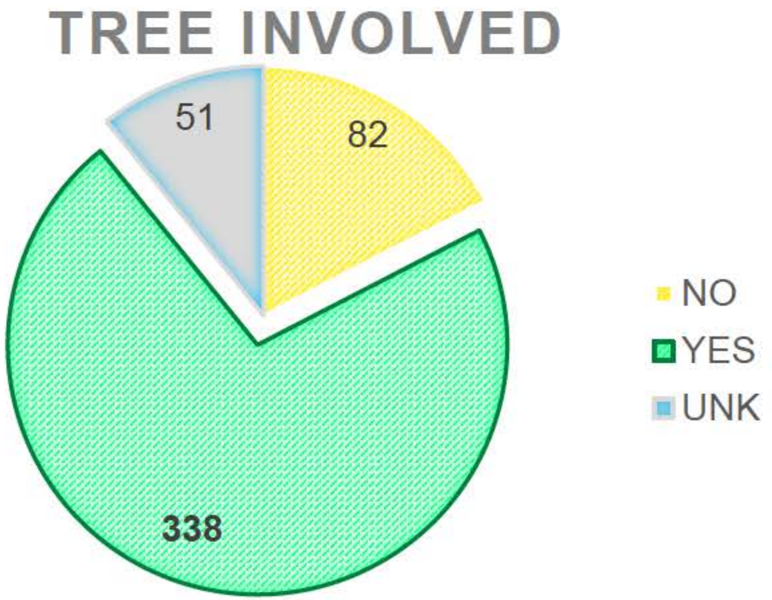


Total 471 Poles

BROKEN POLE VISUALIZATIONS

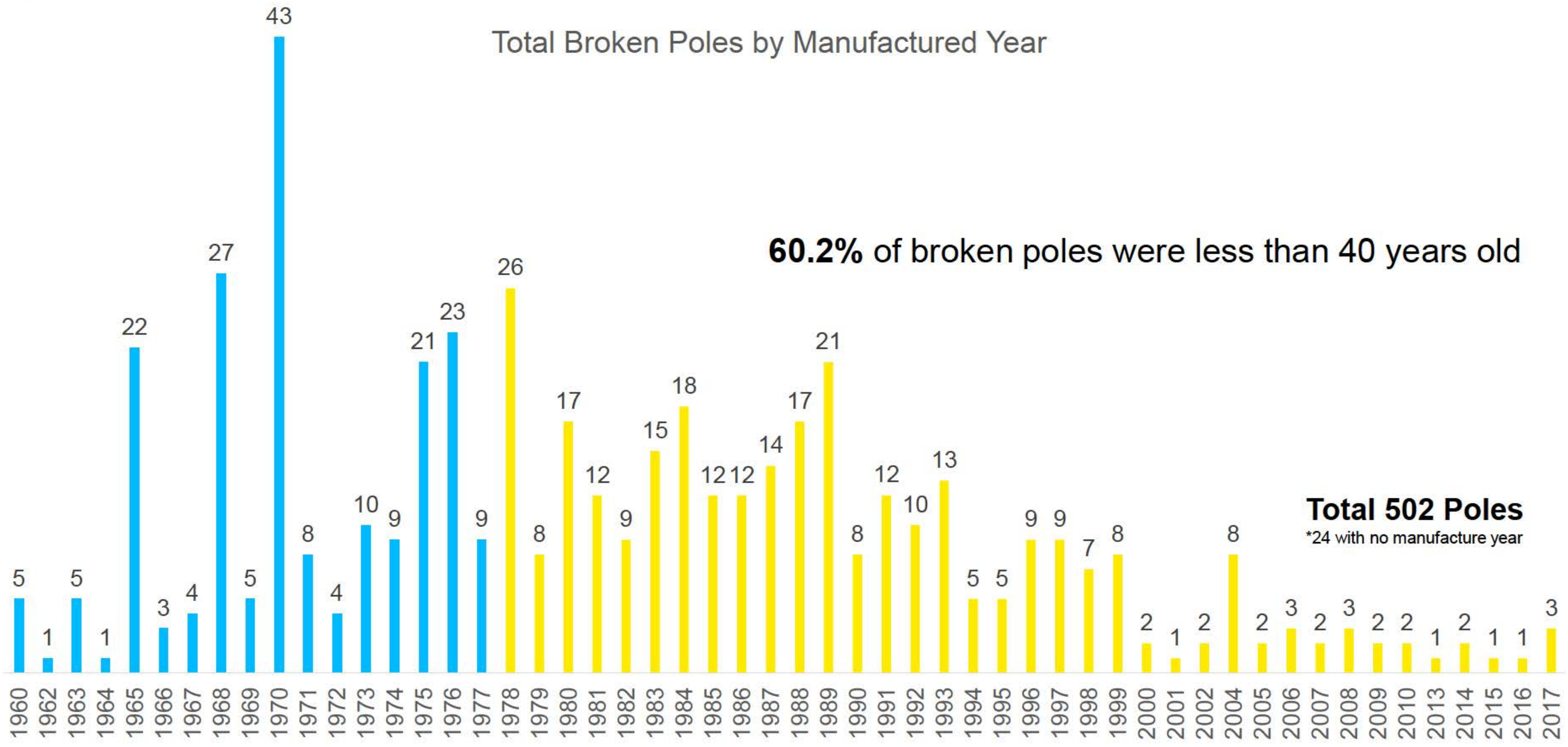


71.8% of broken poles had a tree involved

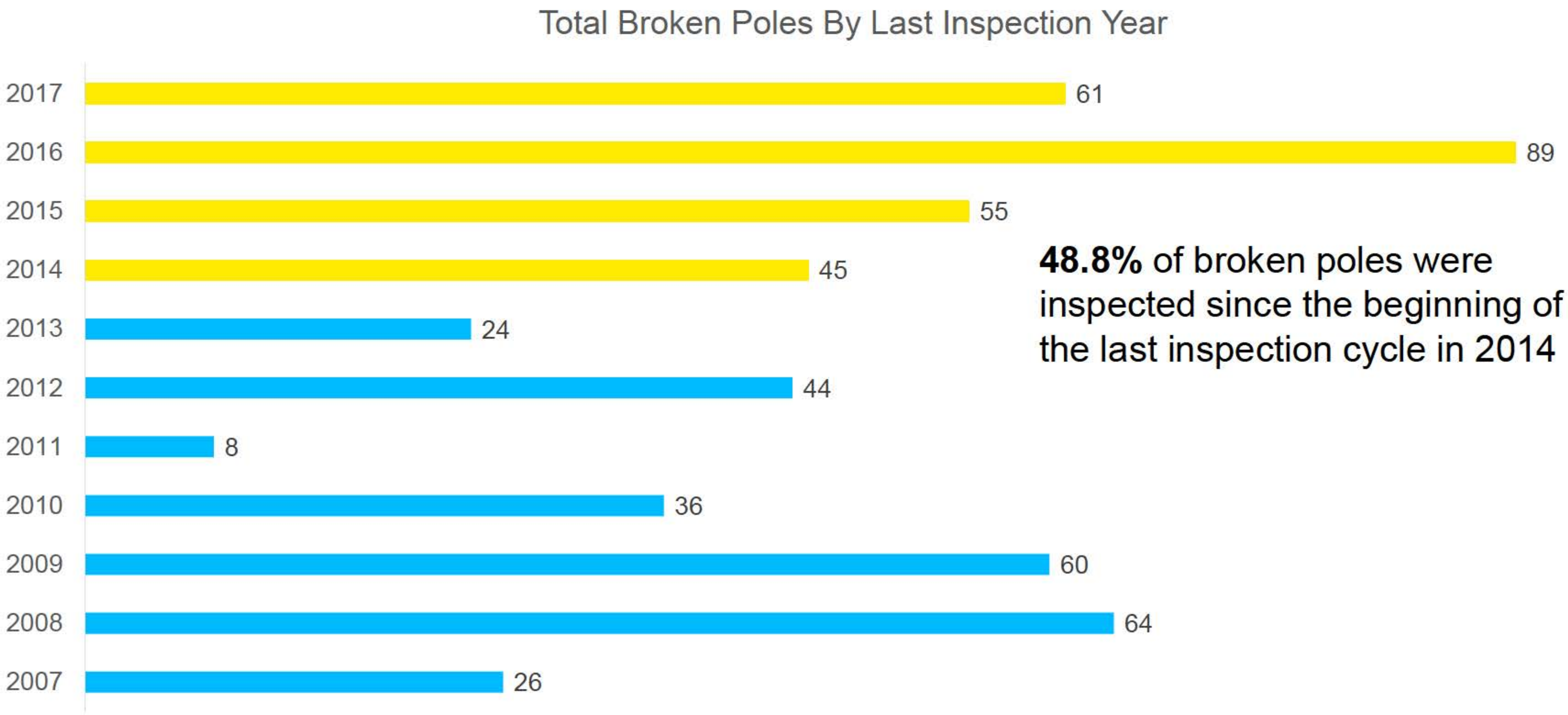


Total 471 Poles

BROKEN POLE VISUALIZATIONS



BROKEN POLE VISUALIZATIONS



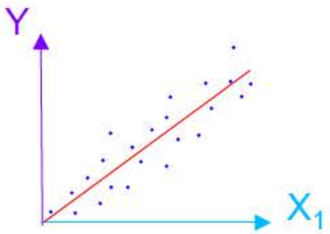
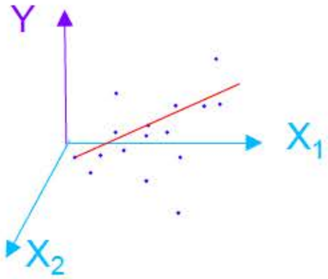
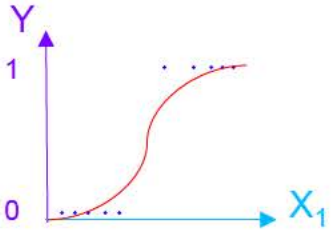
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression	Model Design	Why we use it
Simple Linear Regression 	Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression 	Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression 	$\text{Log}\left(\frac{Y}{1-Y}\right)$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

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POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

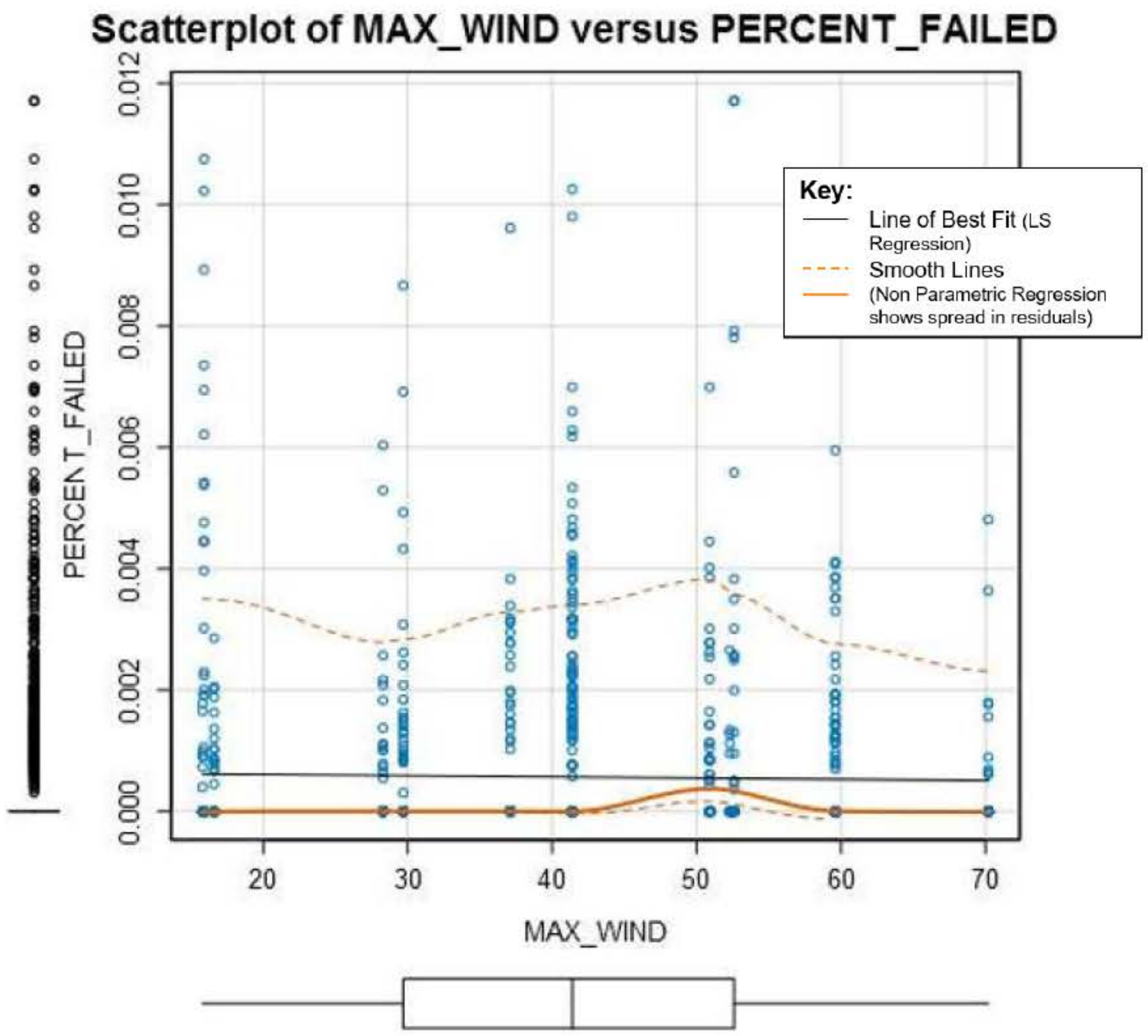
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



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SIMPLE LINEAR REGRESSION: MAX GUST

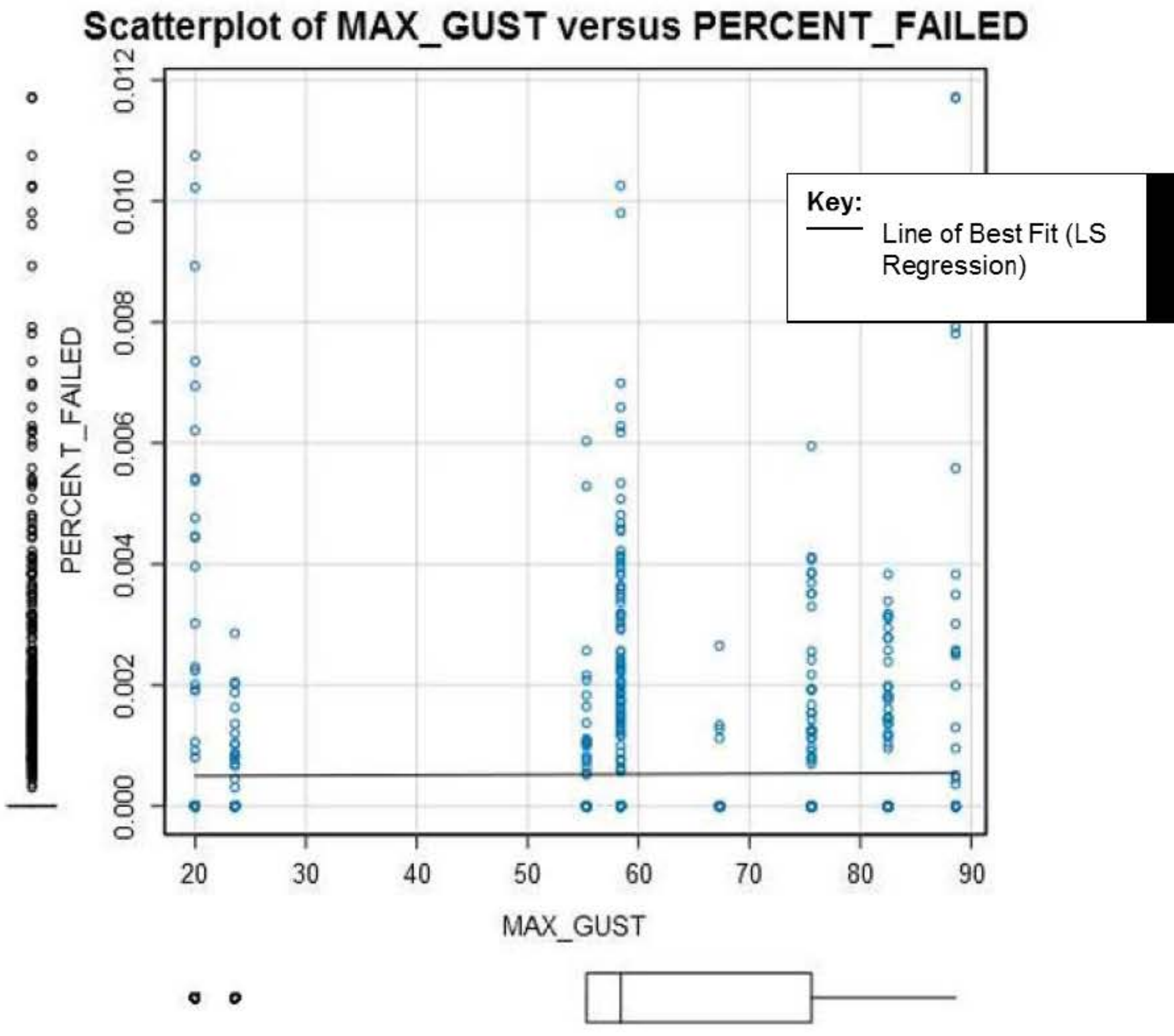
Data Summary

Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111

- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

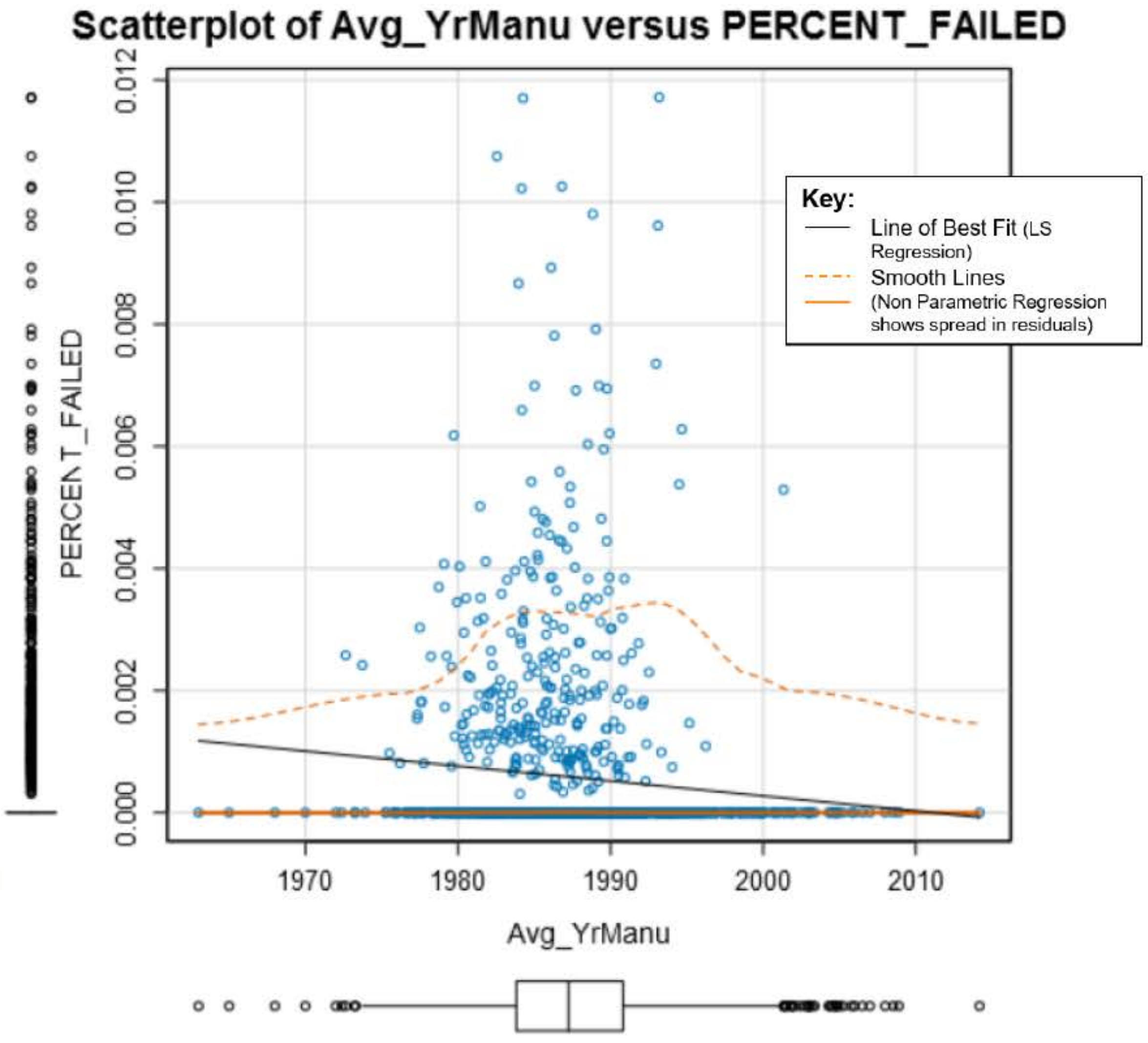
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.



*Note: This analysis does not consider reinforcement of older poles.

SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

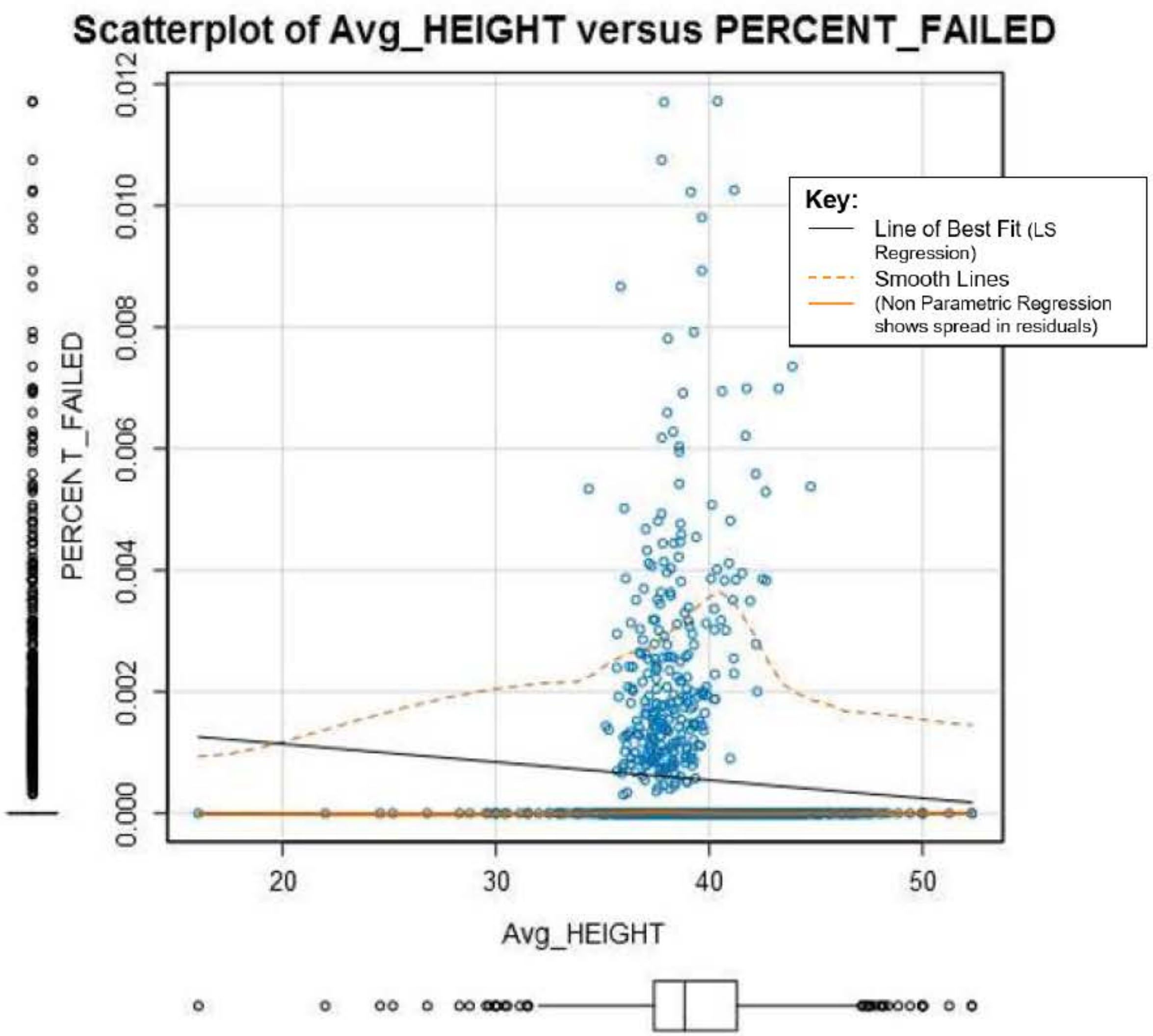
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.



SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

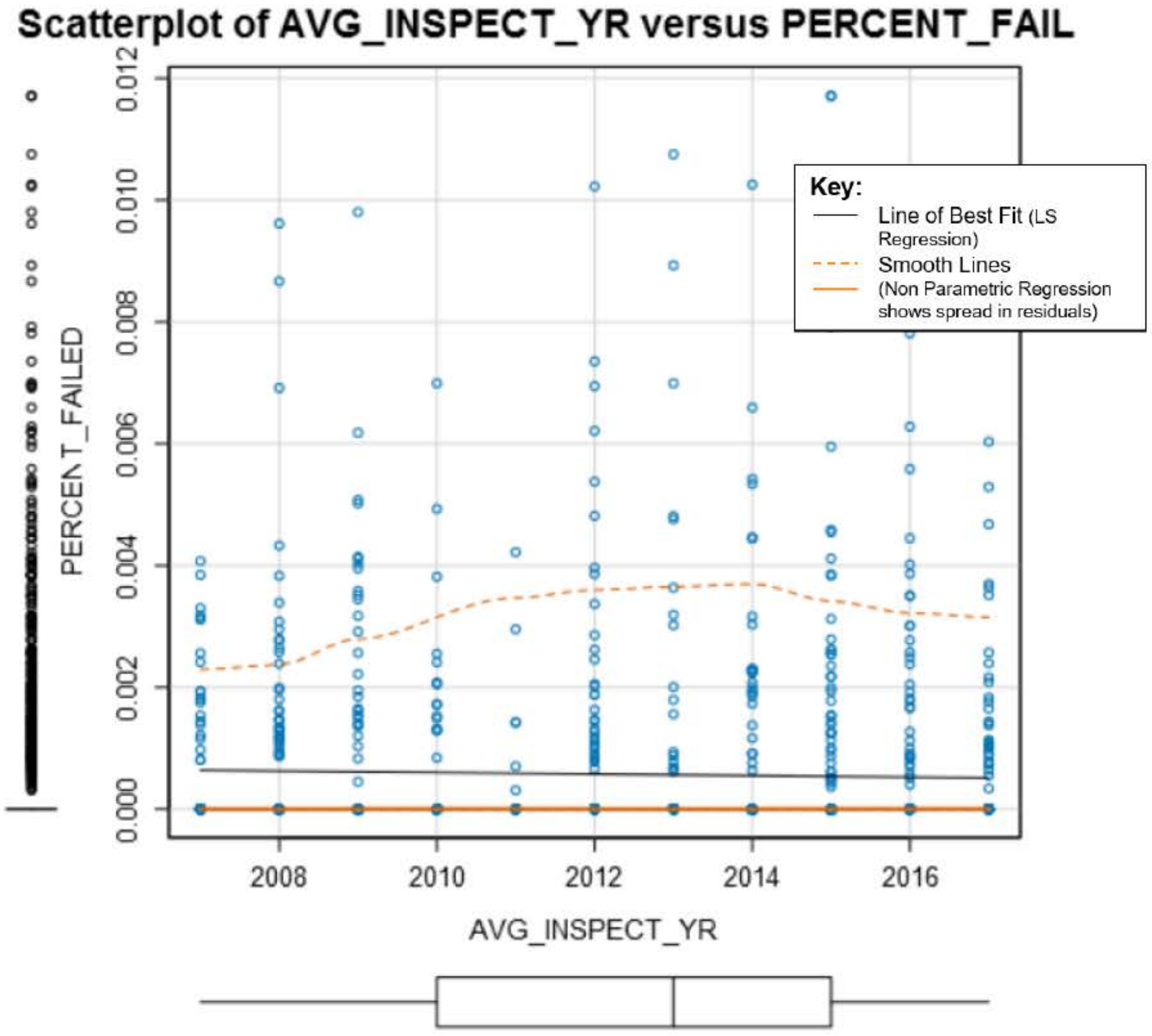
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

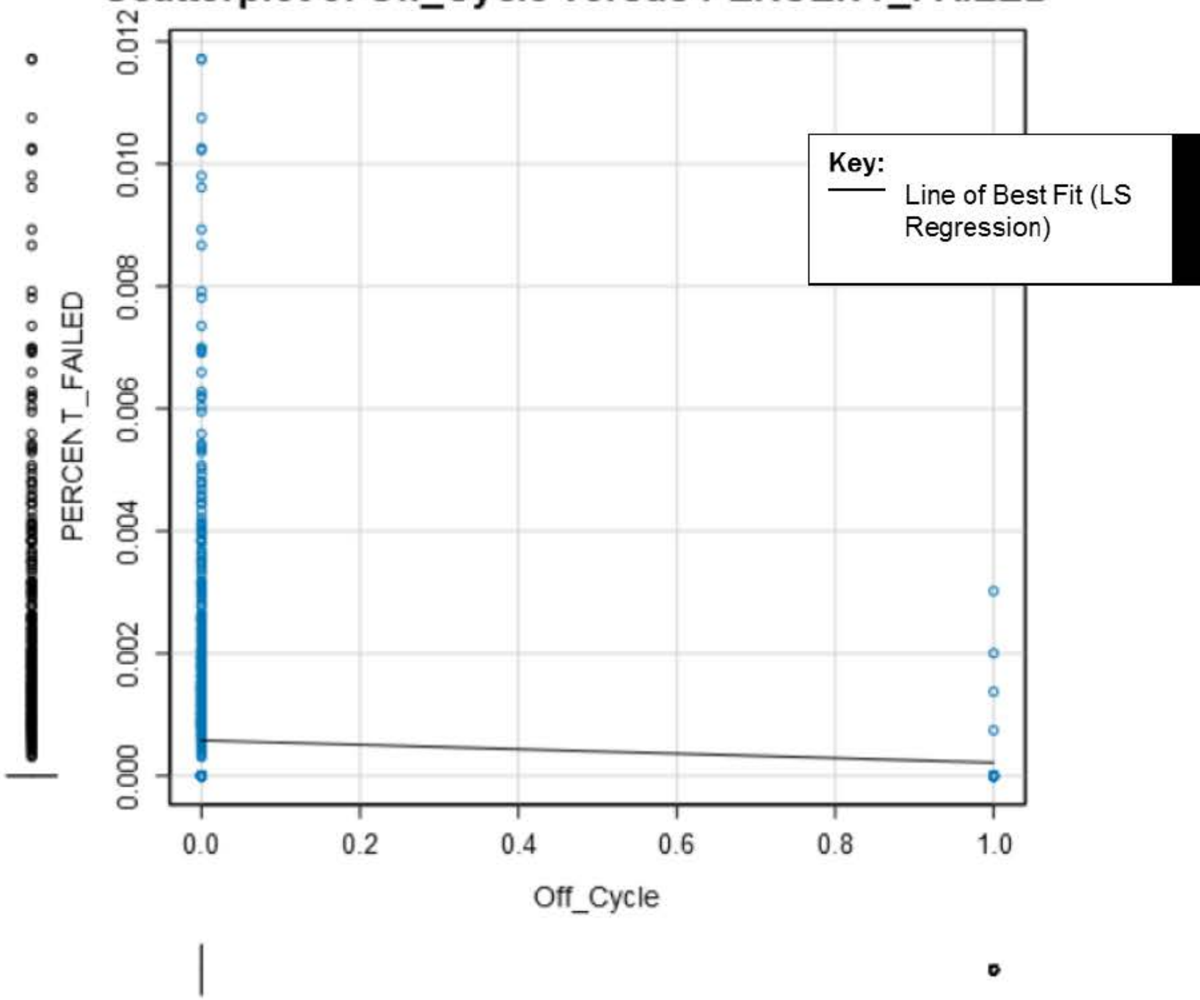
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates (P=0.0025<0.05). Circuits that have newer poles on average are also associated with a lower percent failure rates (P=0.00051<0.05).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

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OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates ($P=0.003<0.05$). Circuits that have newer poles on average are associated with a lower percent failure rates ($P=0.00002<0.05$).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

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MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.
- Circuits with a taller average pole height were more likely to have a lower pole failure rate.
- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.
- Circuits with older poles were associated with higher pole failure rates.
- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.
- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.
- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

STORM HARDENING

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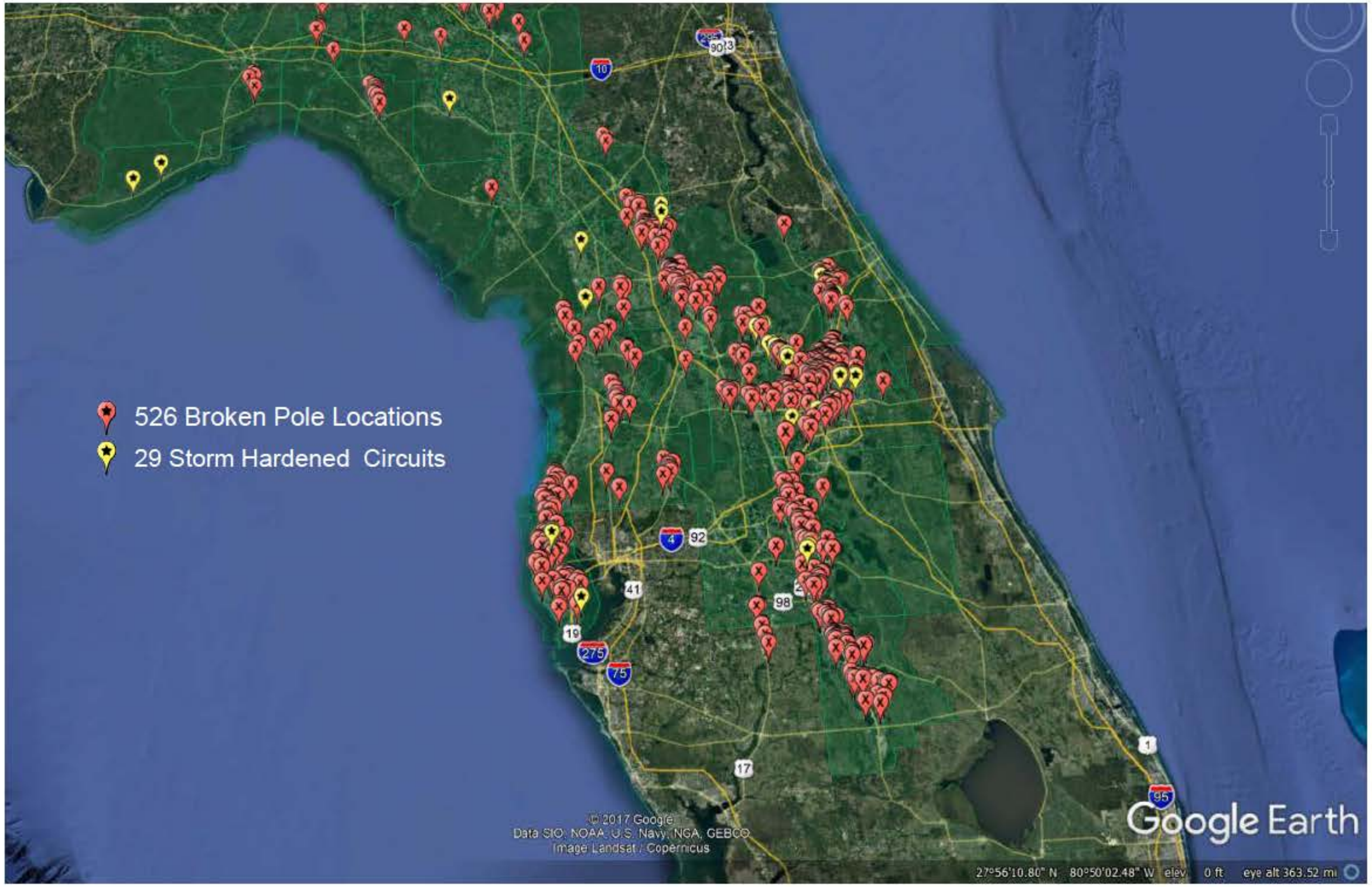
METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

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TABLE OF CONTENTS

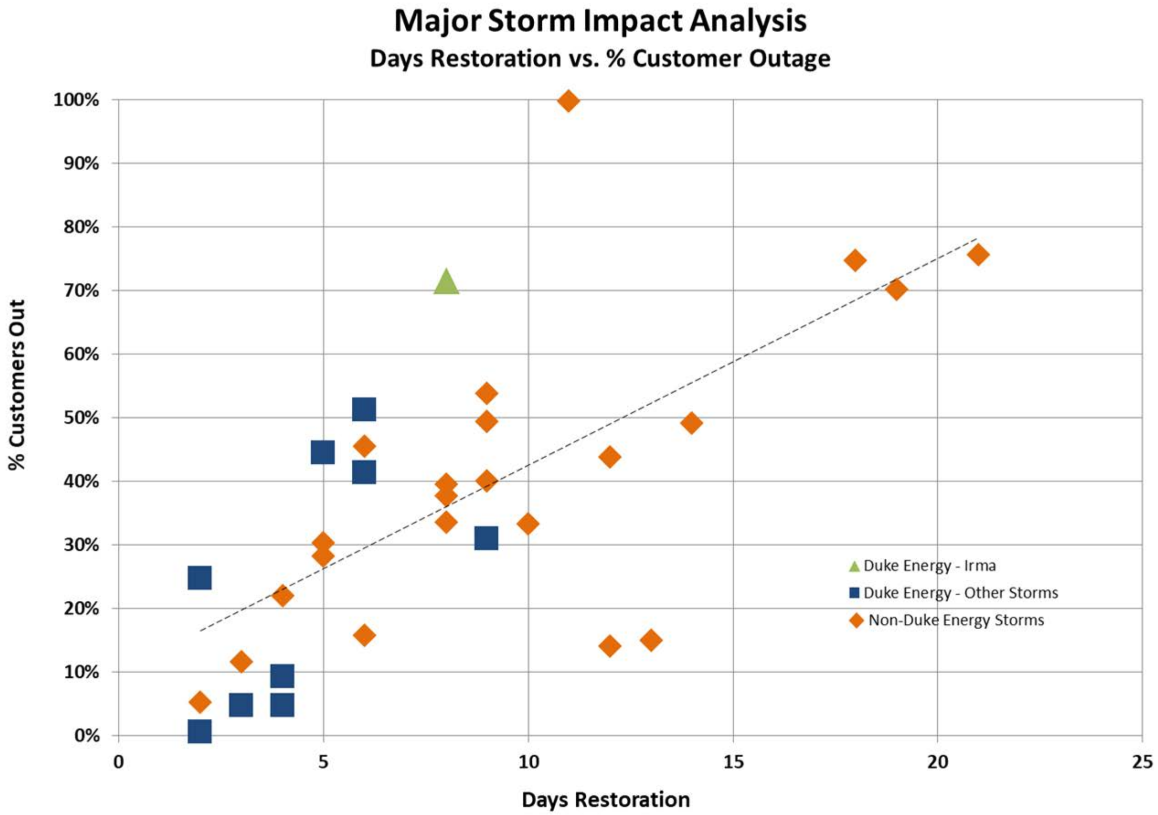
EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging “storm benchmark database” compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

EXECUTIVE SUMMARY – BENCHMARK

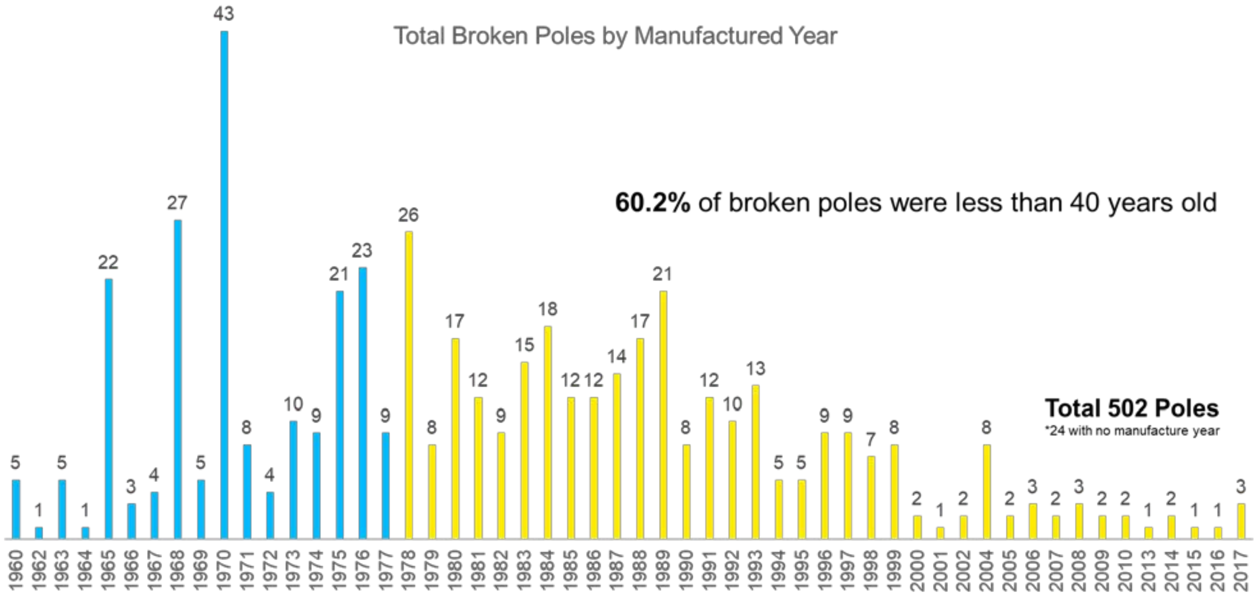
- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



20170272-DEF-OPC-POD 2-14-000070

EXECUTIVE SUMMARY – FORENSIC

- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



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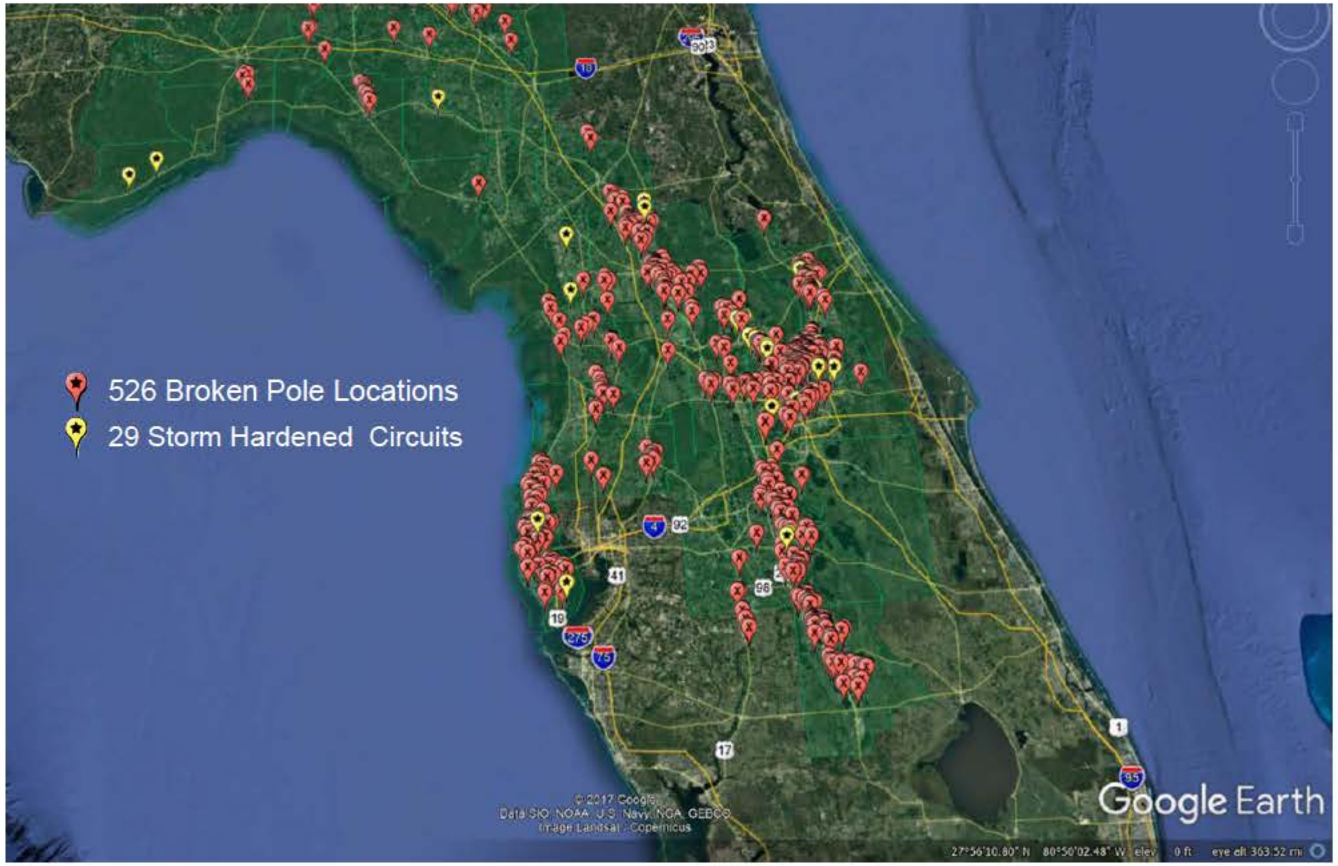

OVERVIEW/ PURPOSE

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OVERVIEW/PURPOSE

- Duke Energy Florida ("Duke FL") conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture's storm benchmarking database to compare against Duke FL's response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL's hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

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METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance

- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL's restoration efforts versus other utility companies captured in Accenture's storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	2,271
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

Restoration Duration	
Restoration Duration (# Days)	8 days

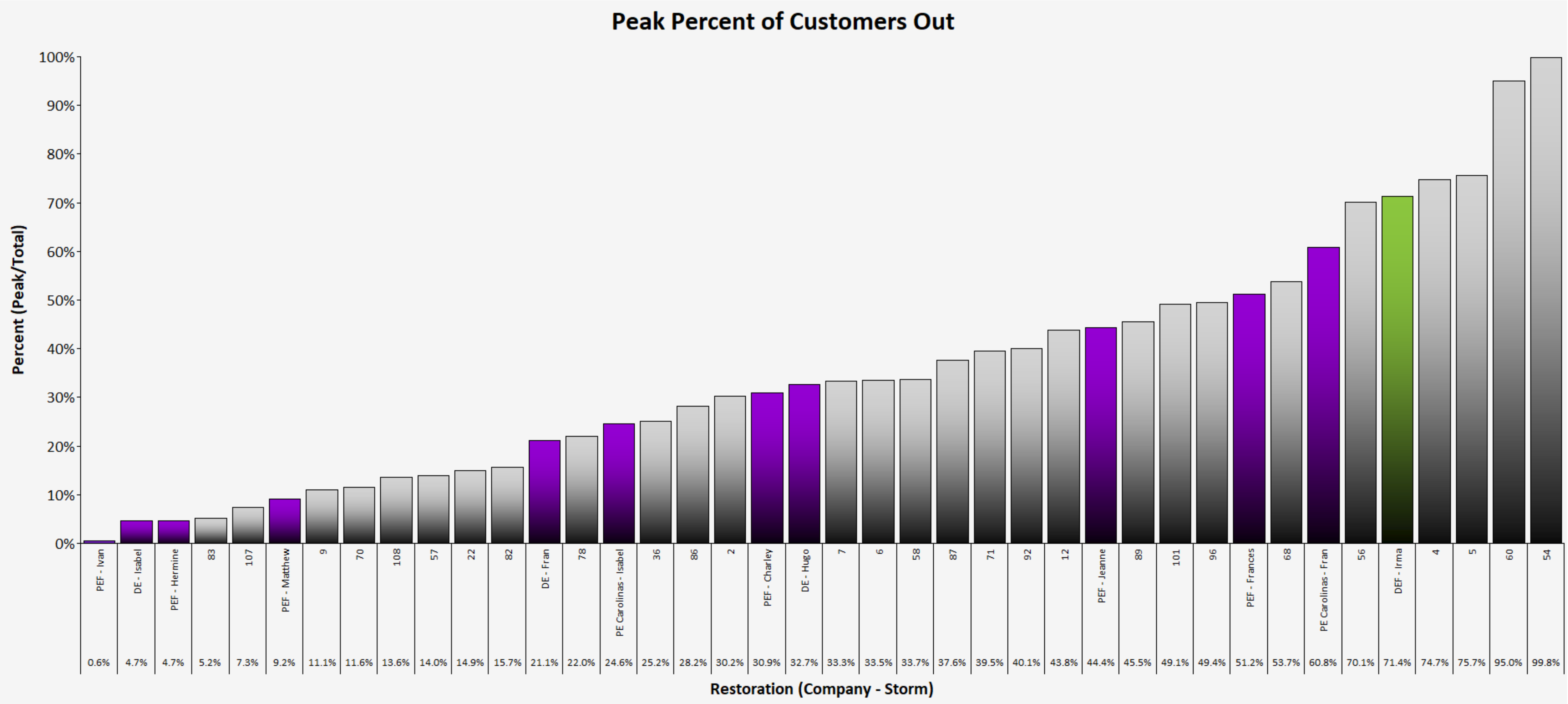
Restoration Costs	
Total Restoration Cost	$500M - $550M

Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

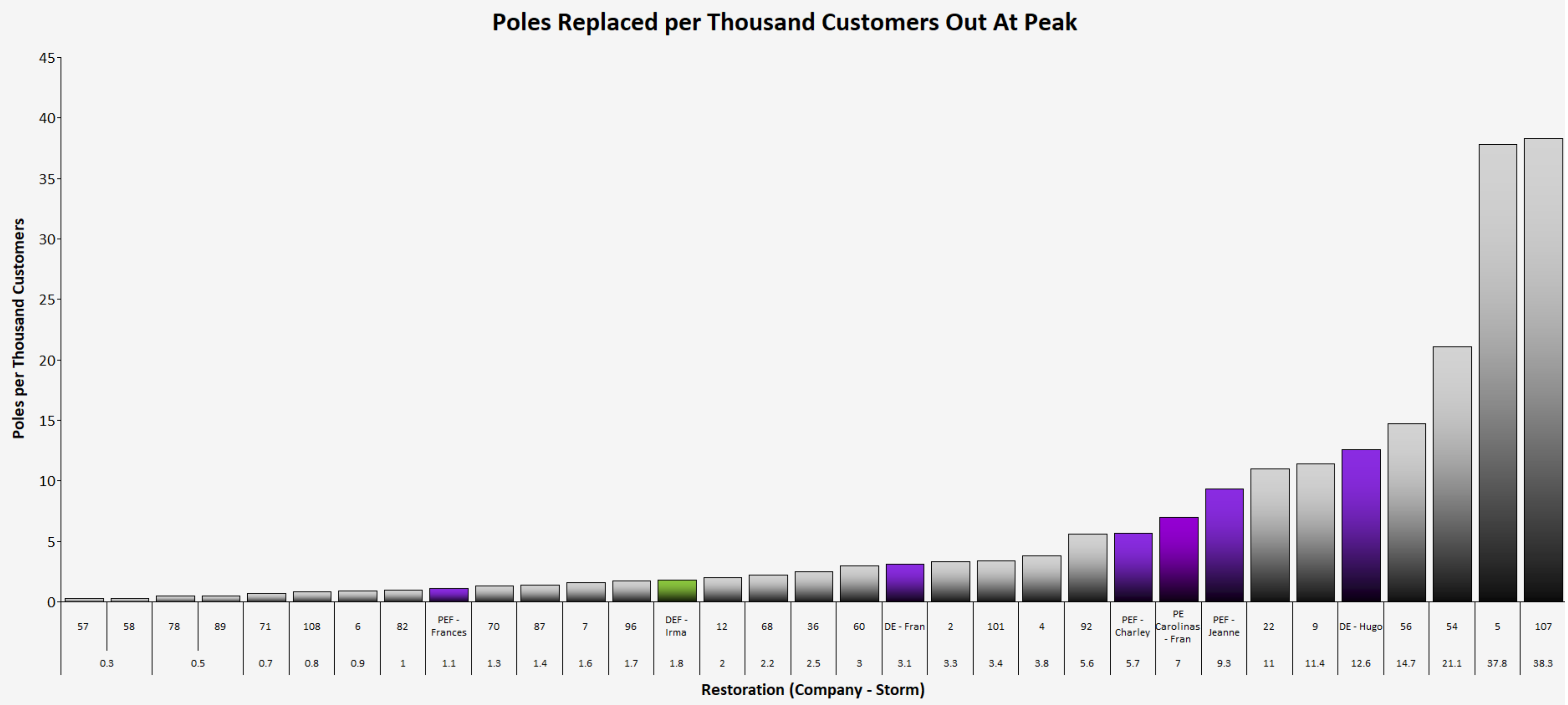
Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

DUKE ENERGY FLORIDA

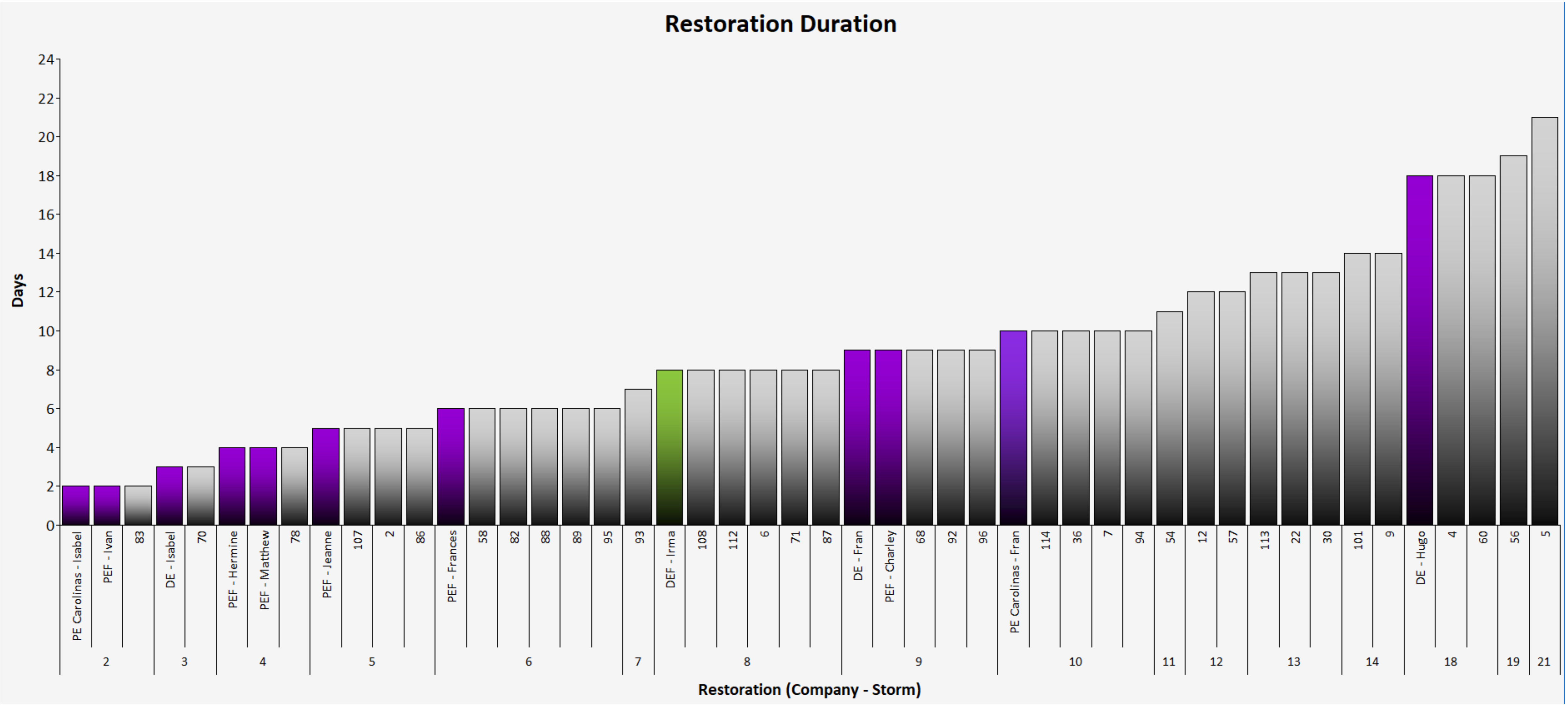
BENCHMARK RESULTS



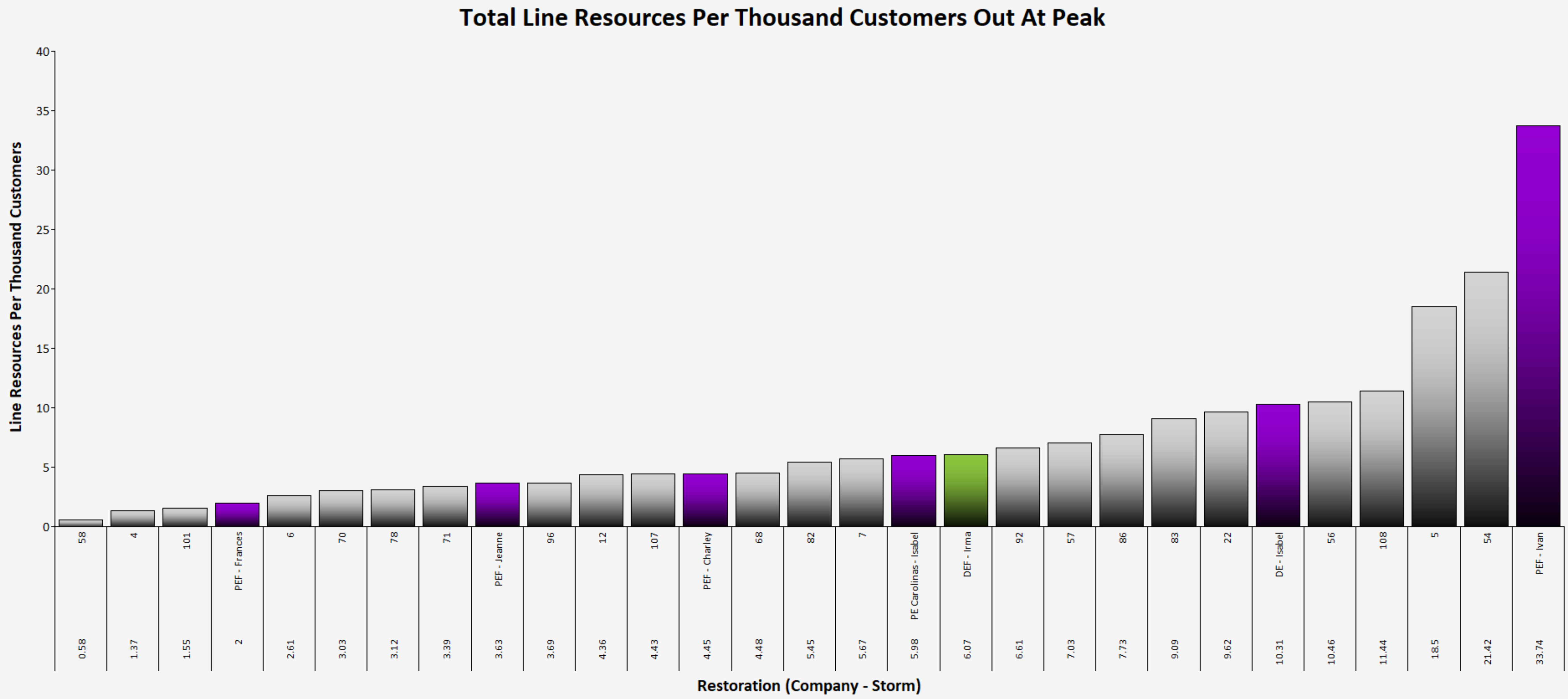
BENCHMARK RESULTS



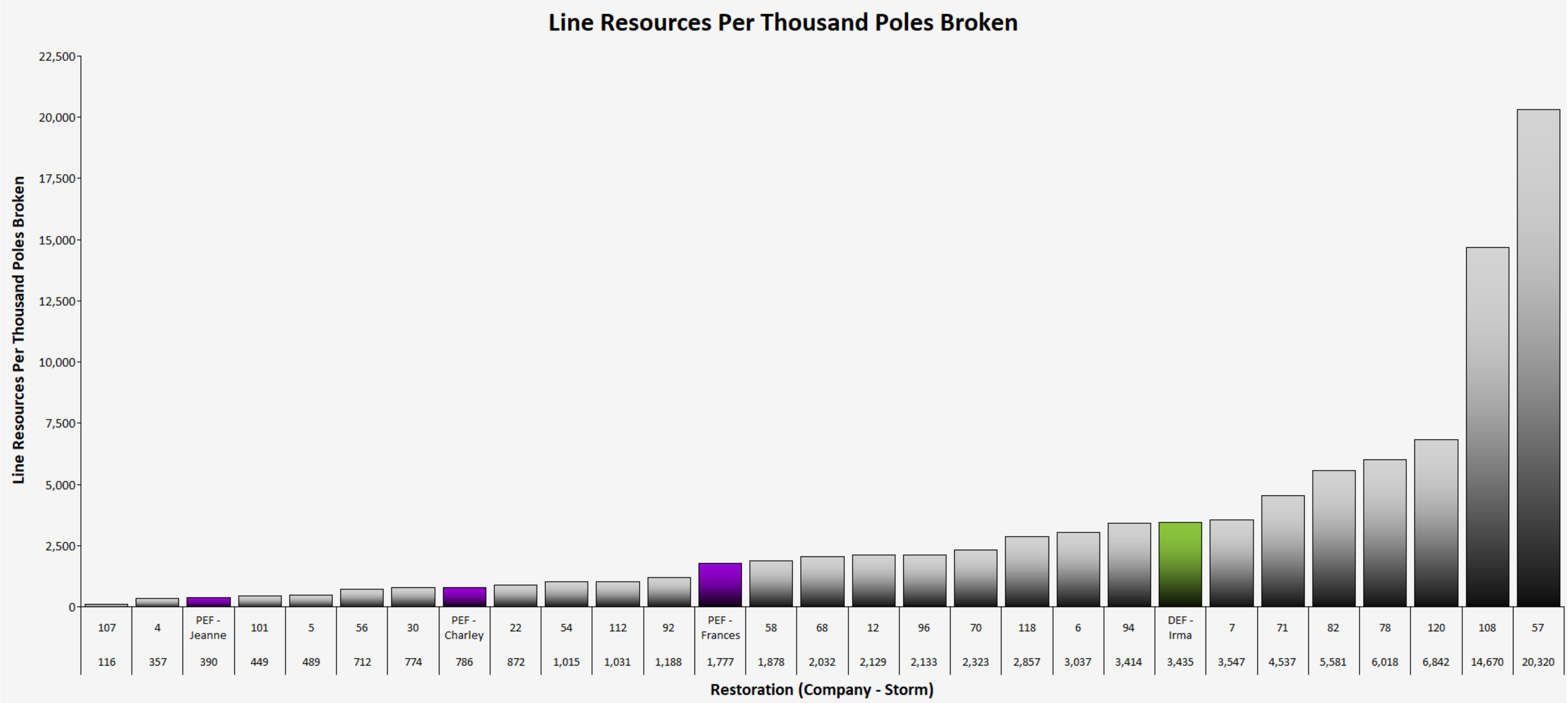
BENCHMARK RESULTS



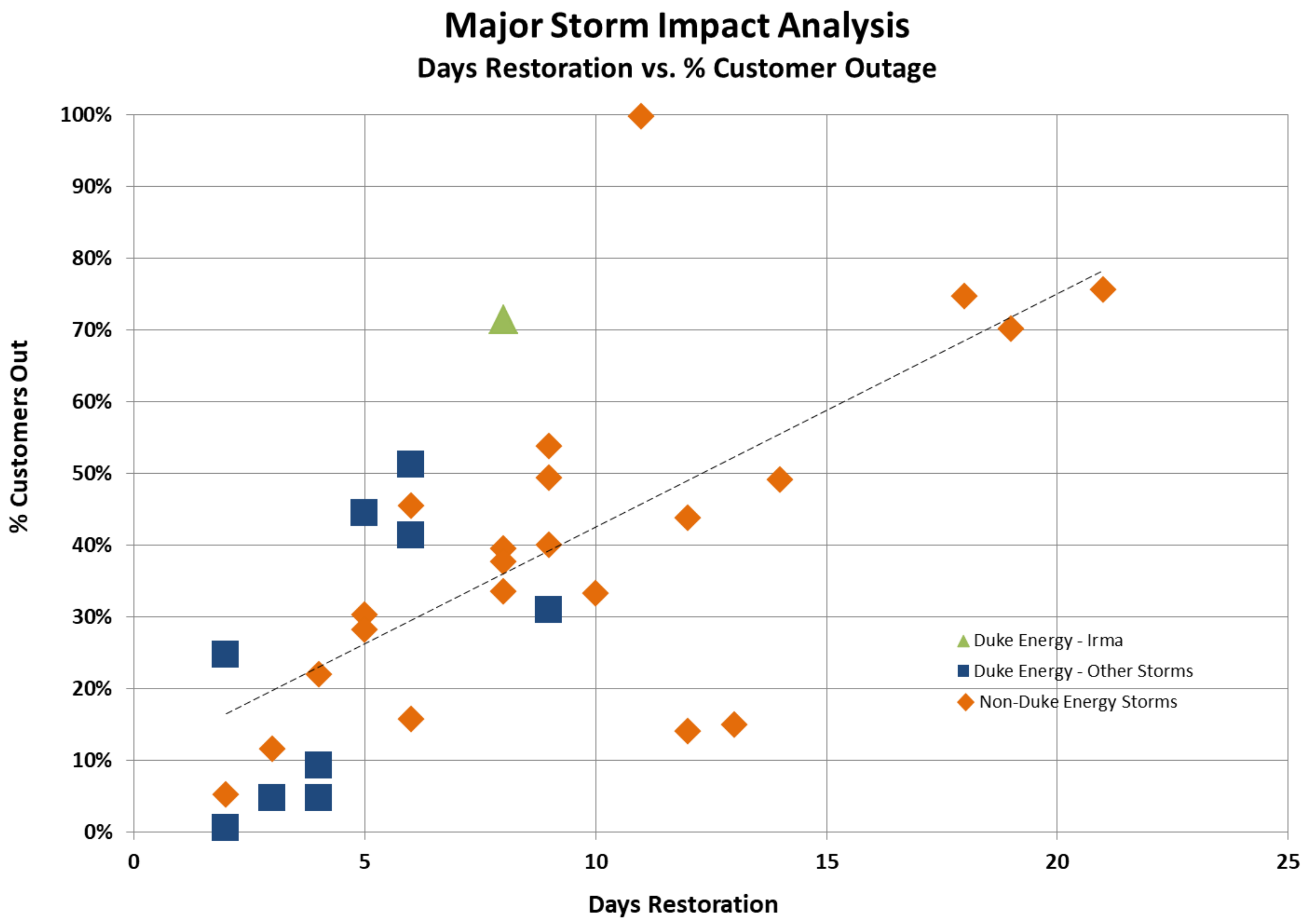
BENCHMARK RESULTS



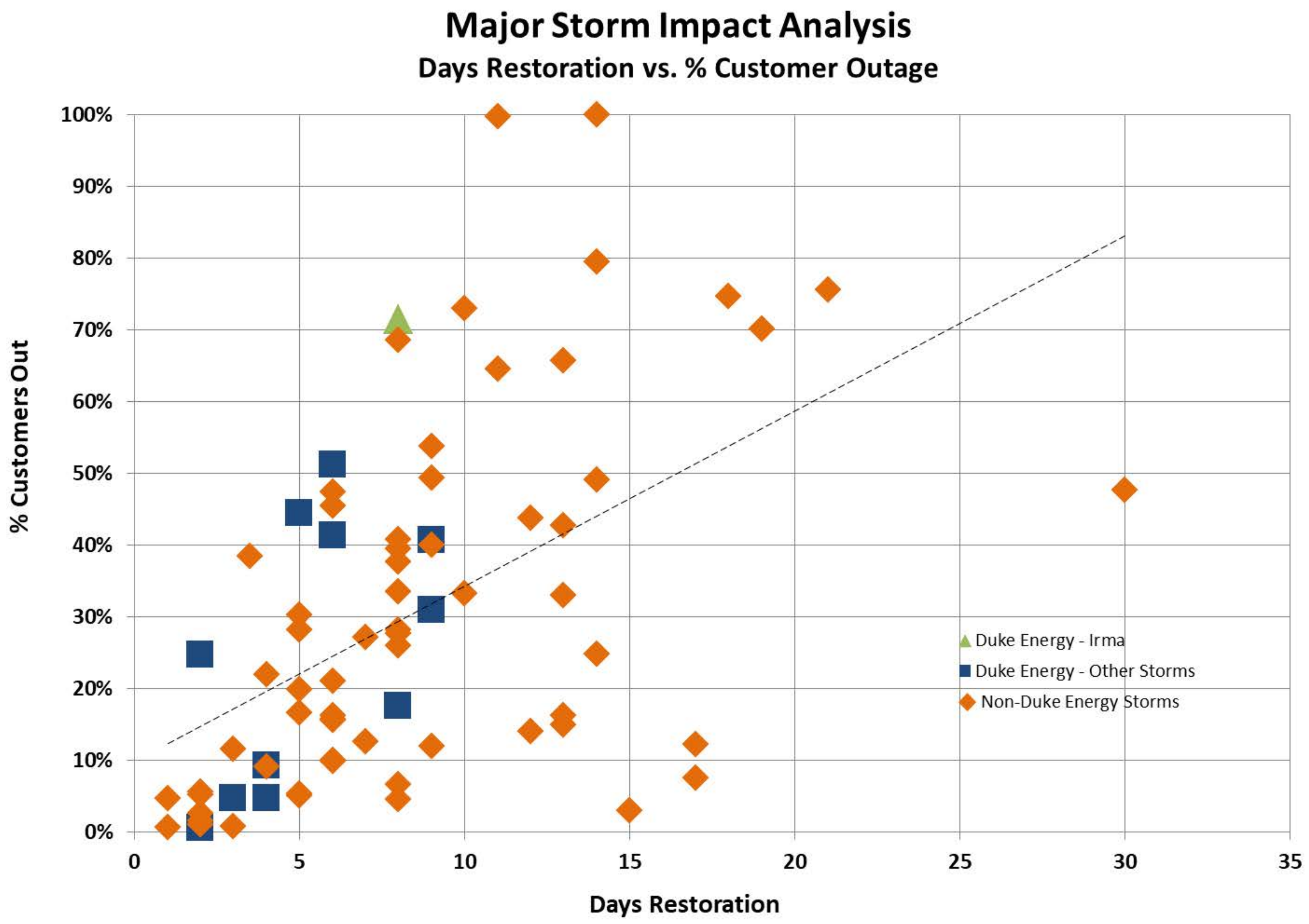
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

FORENSICS ANALYSIS

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METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 2,130 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

Broken Poles Included in Forensic Analysis

2,130 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

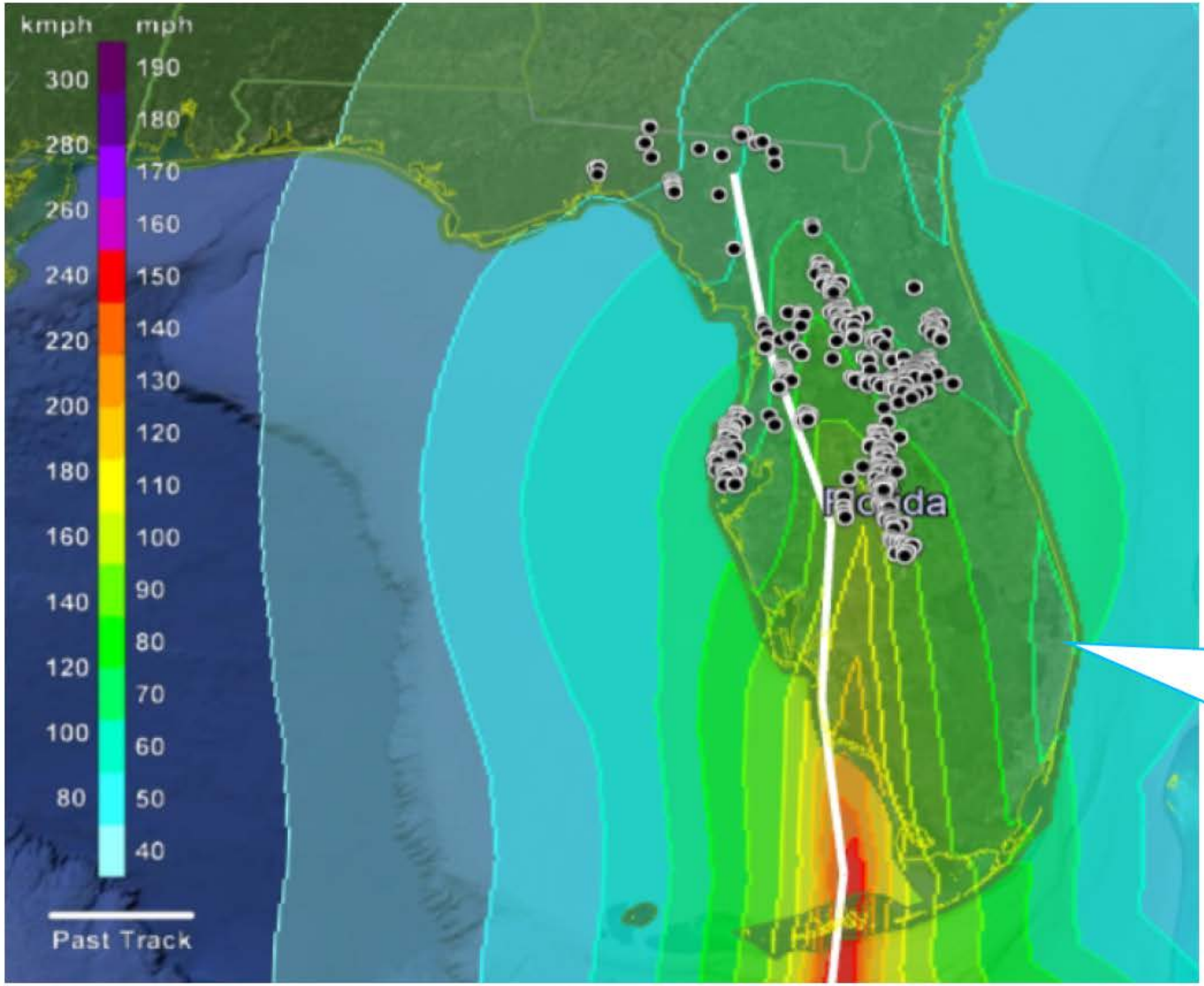
Pole Inventory – Duke Florida

1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS



https://data.humdata.org/dataset/hurricane-irma-windspeed

526 Broken Poles

Irma Path
9/11 12am – 12pm

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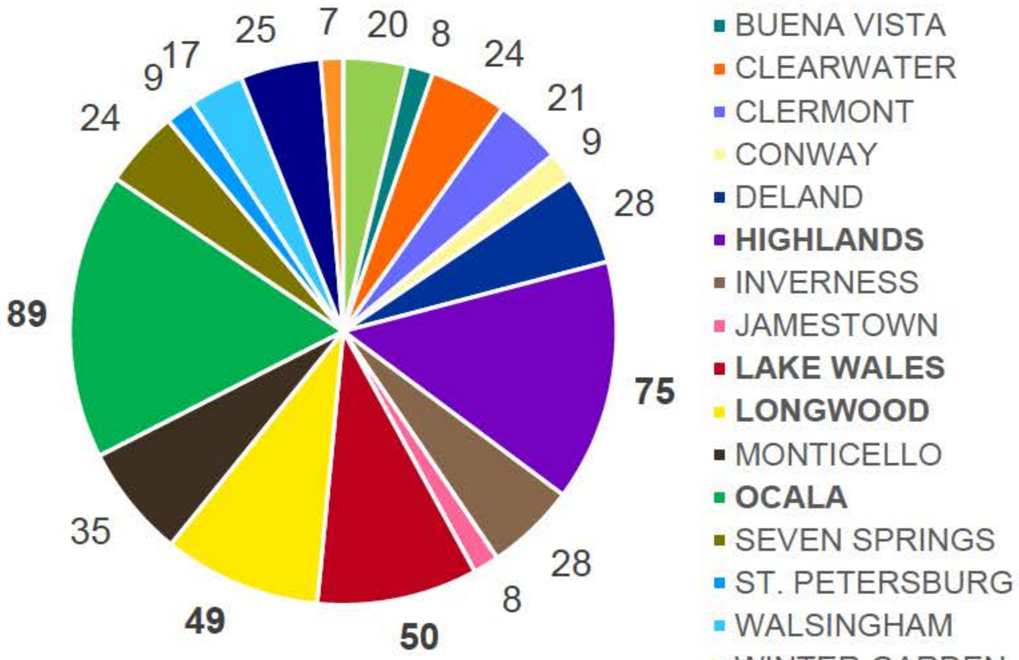
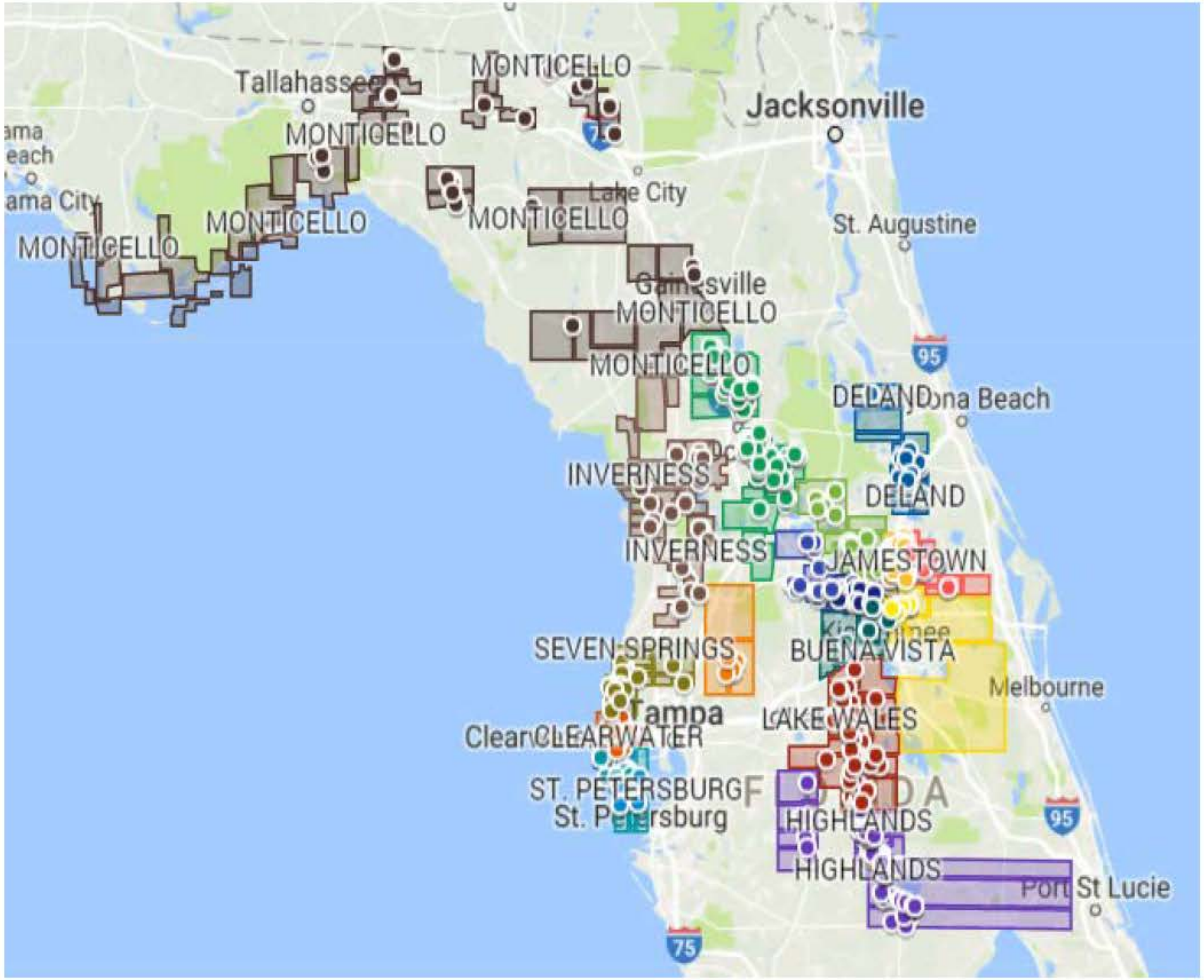
BROKEN POLE VISUALIZATIONS

Broken Poles By OP Center

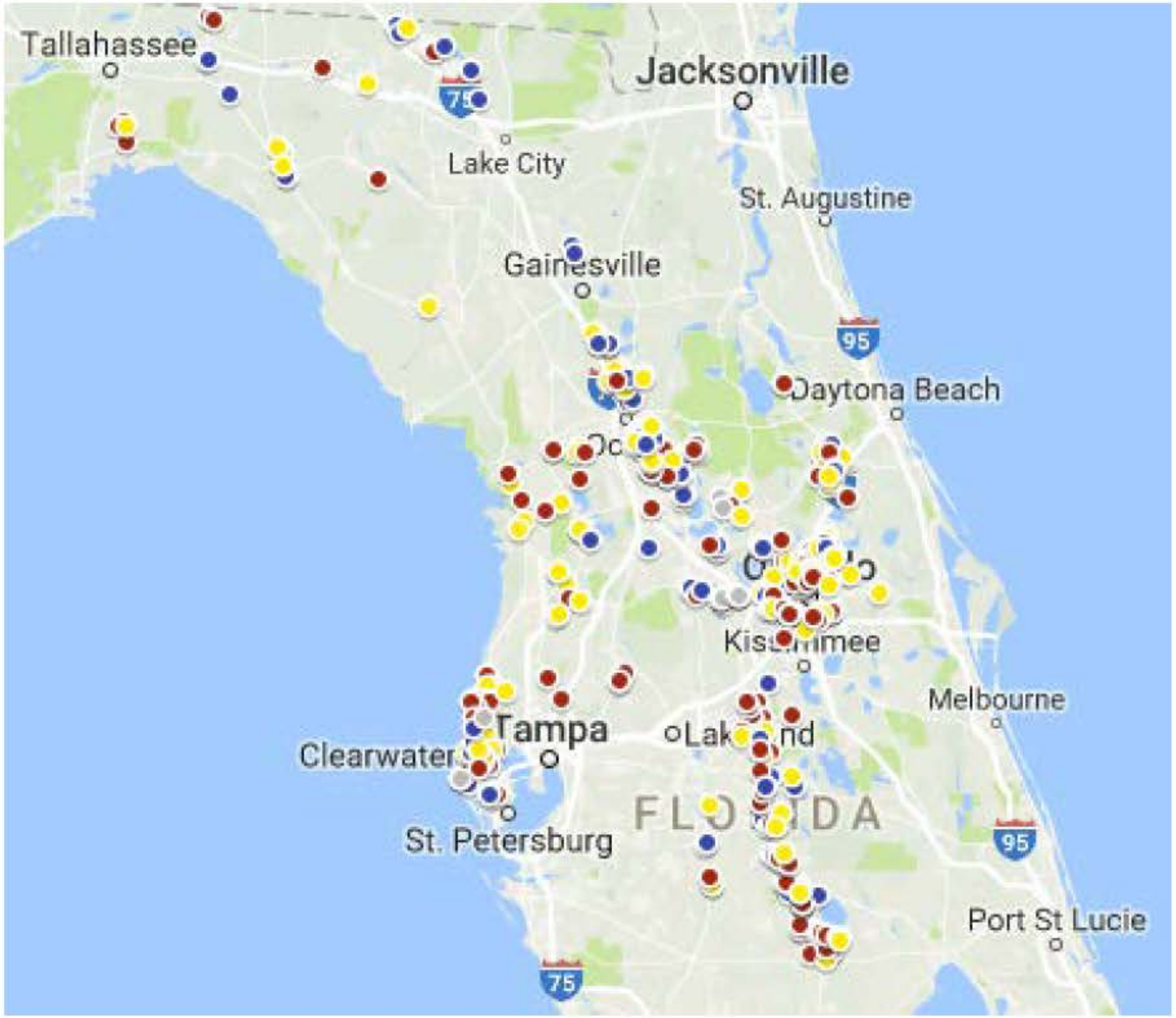


Total 526 Poles

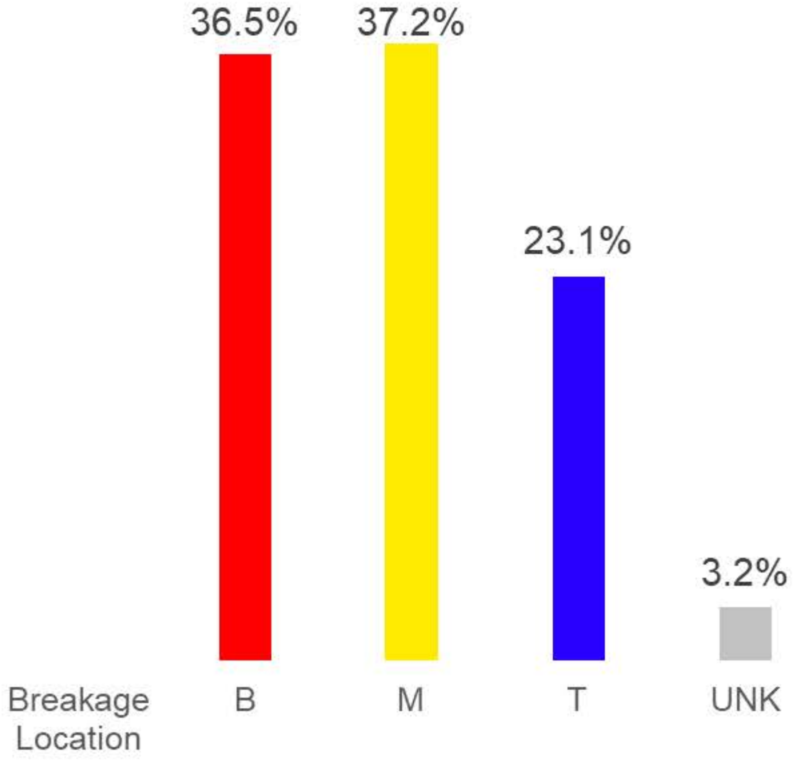


50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS



- **37.2%** of poles broke in the middle

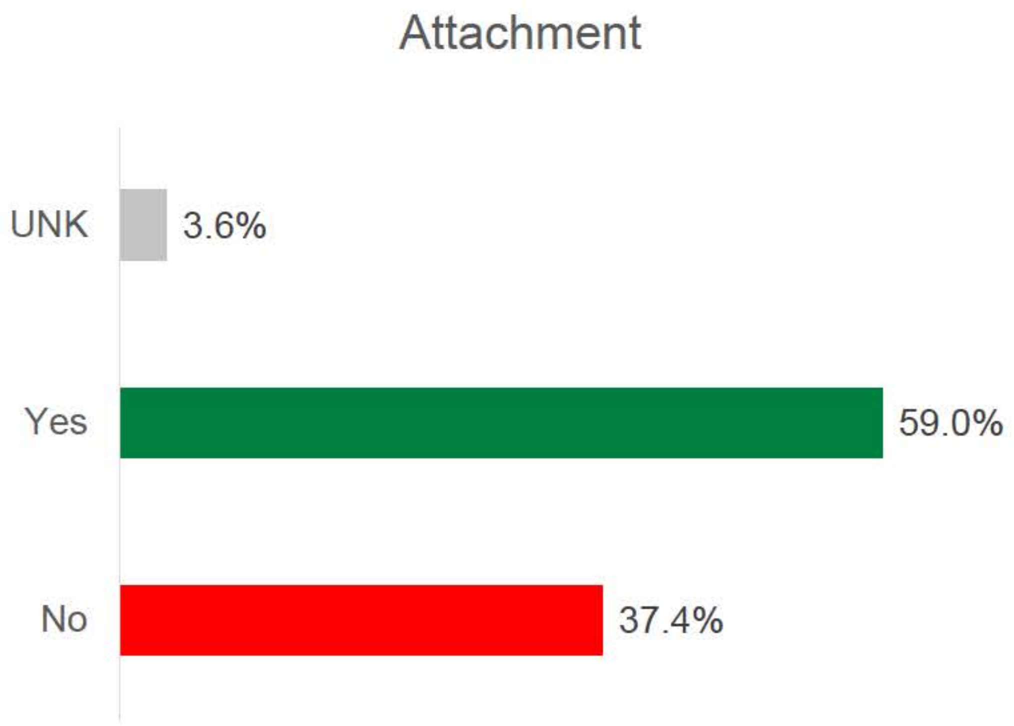


Total 471 Poles

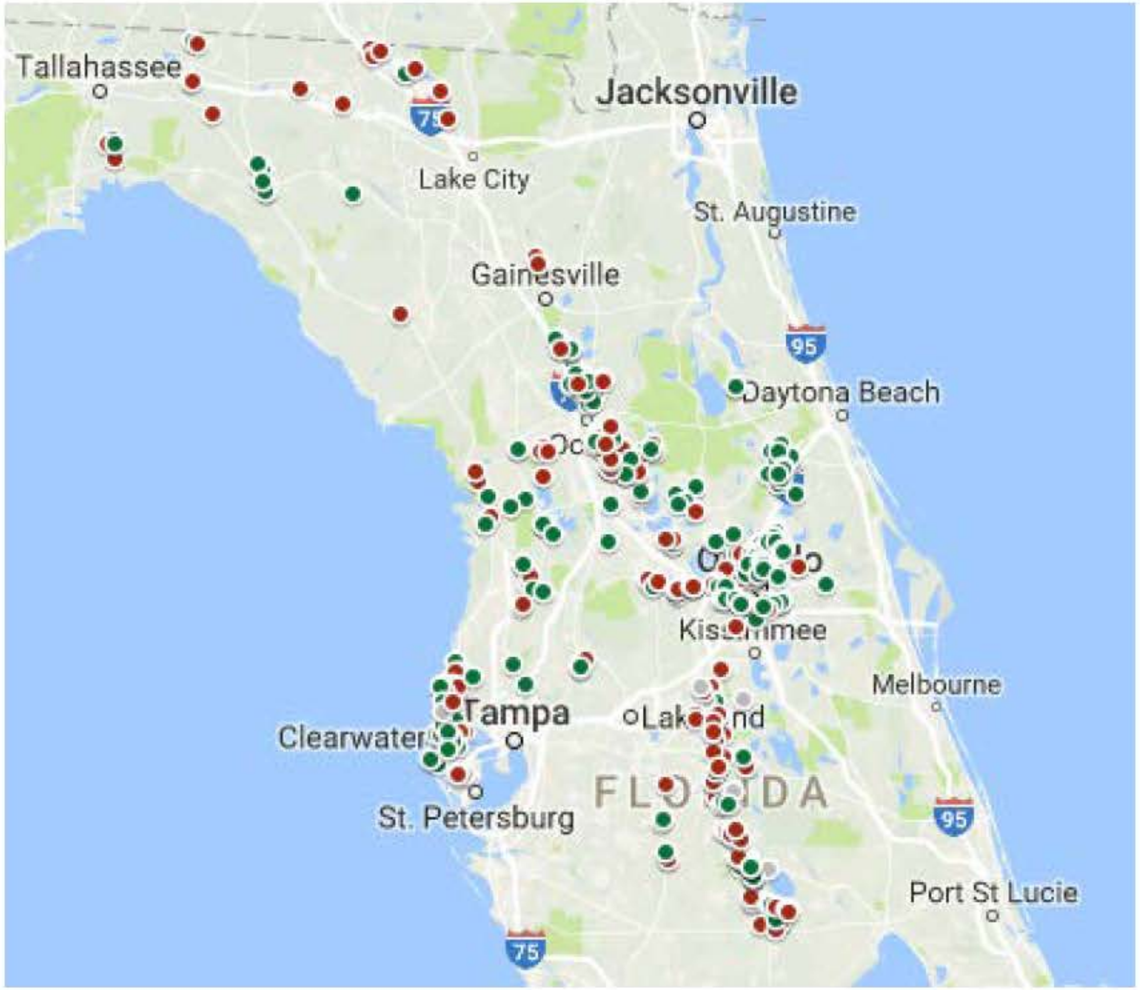
***66 poles that broke at the bottom did not have reject status information**

BROKEN POLE VISUALIZATIONS

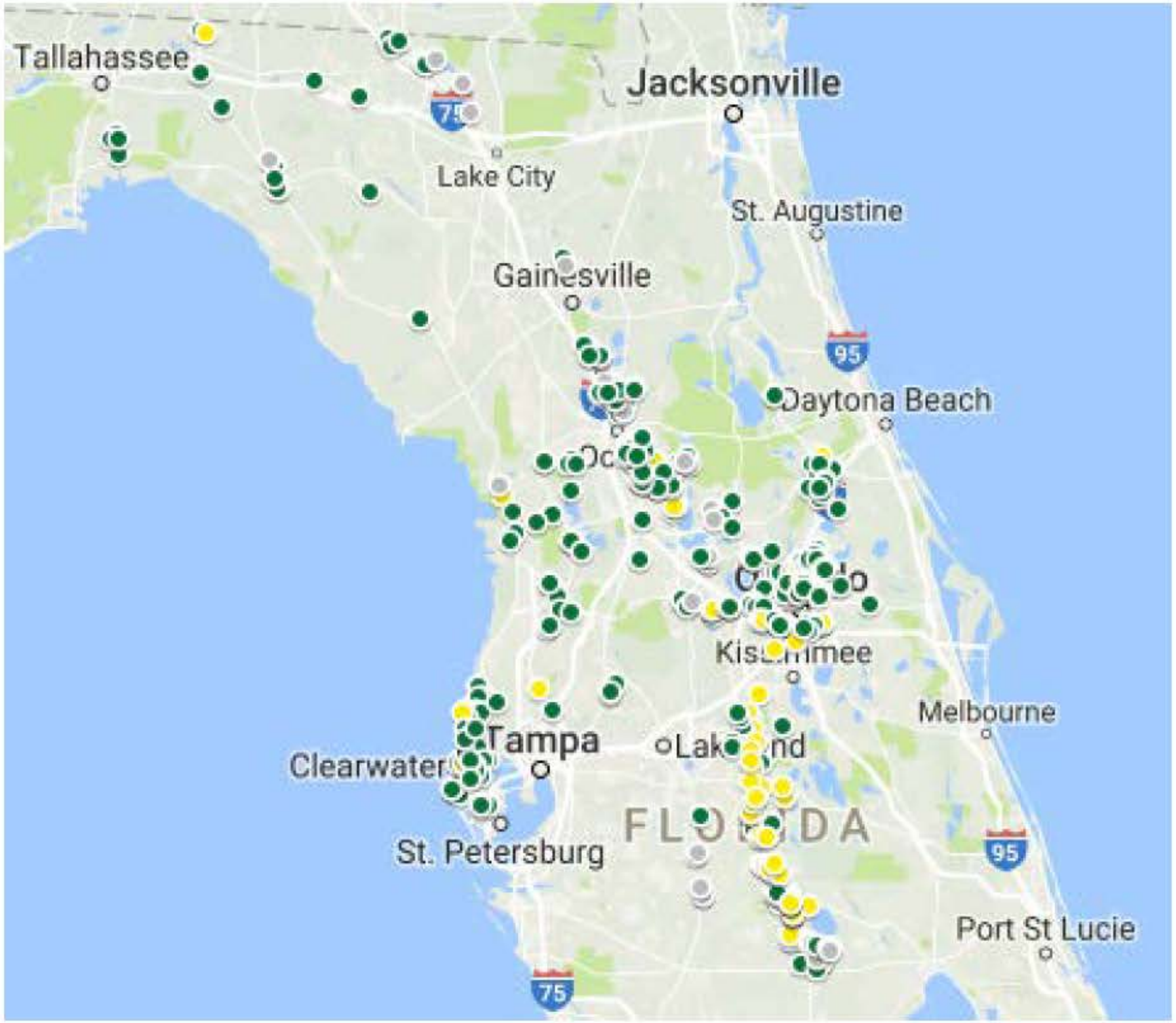
59% of broken poles had an attachment



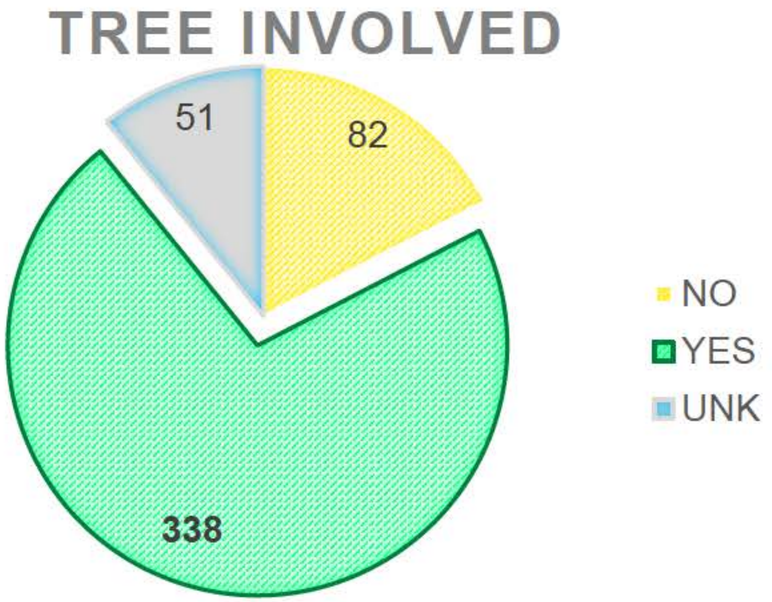
Total 471 Poles



BROKEN POLE VISUALIZATIONS



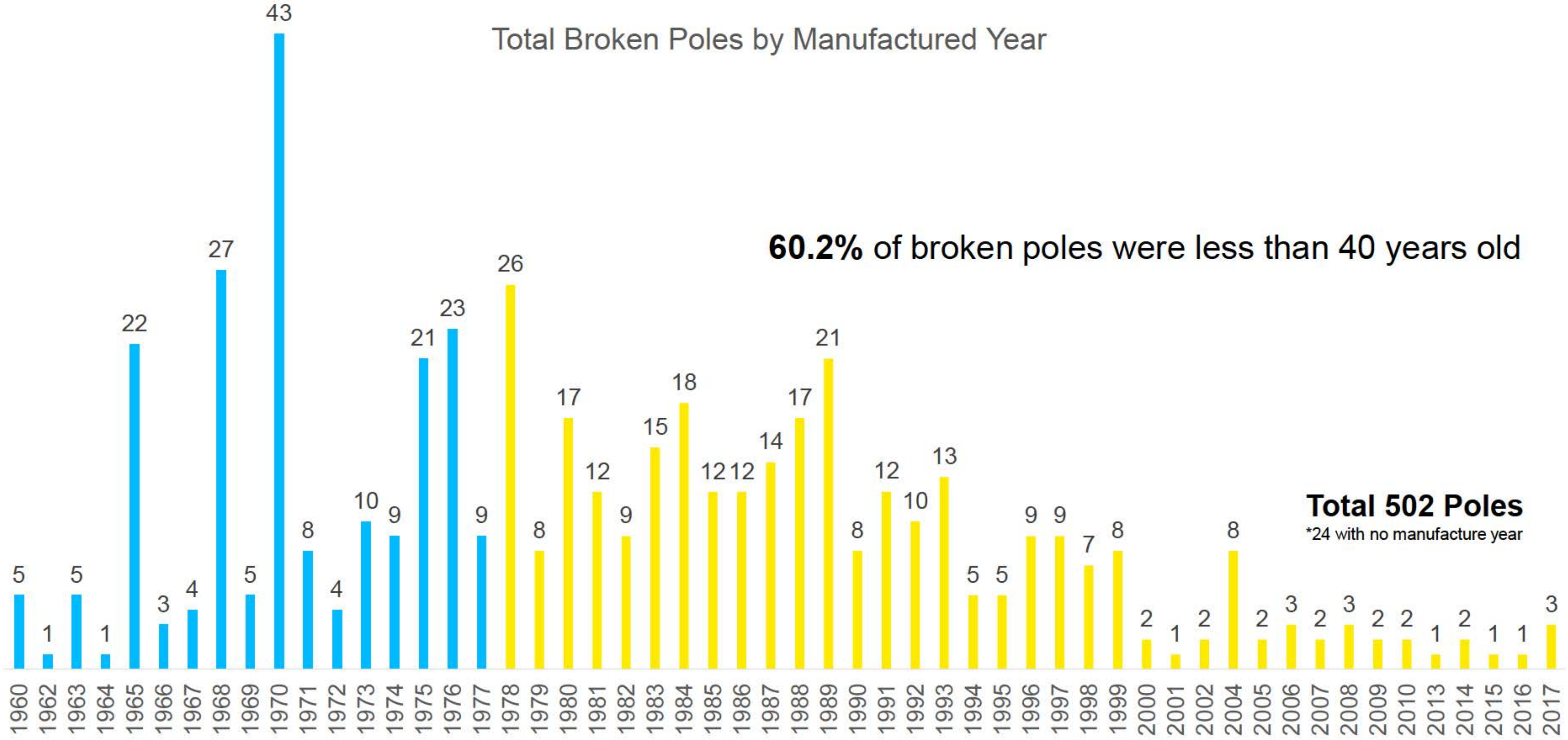
71.8% of broken poles had a tree involved



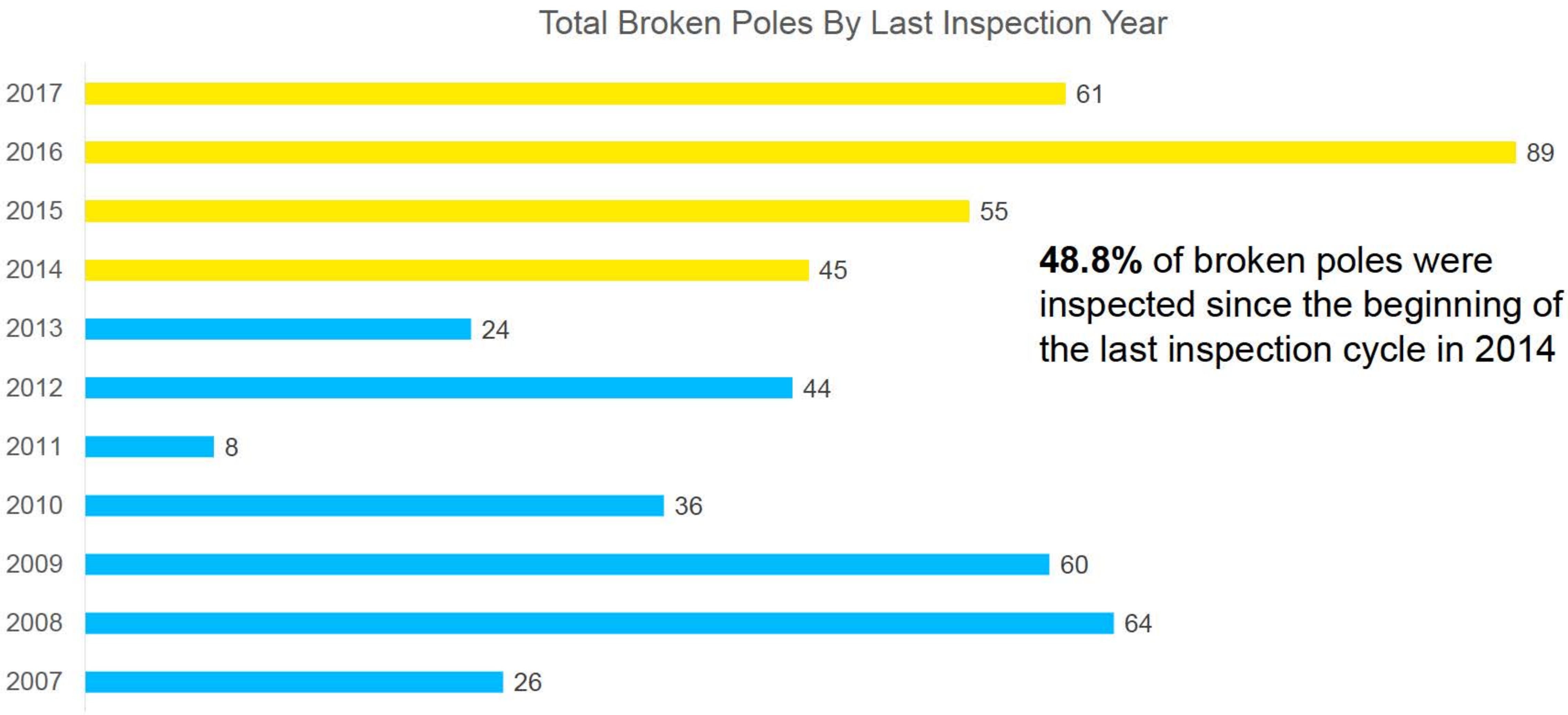
Total 471 Poles

BROKEN POLE VISUALIZATIONS

20170272-DEF-OPC-POD 2-14-000096



BROKEN POLE VISUALIZATIONS



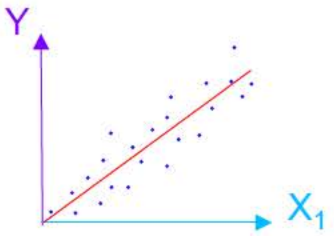
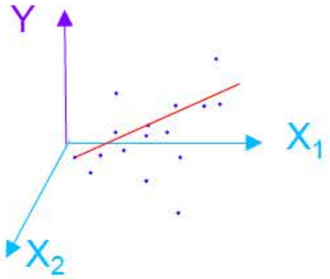
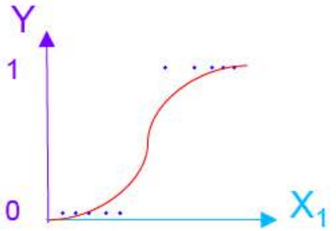
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression	Model Design	Why we use it
Simple Linear Regression 	Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression 	Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression 	$\text{Log}\left(\frac{Y}{1-Y}\right)$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

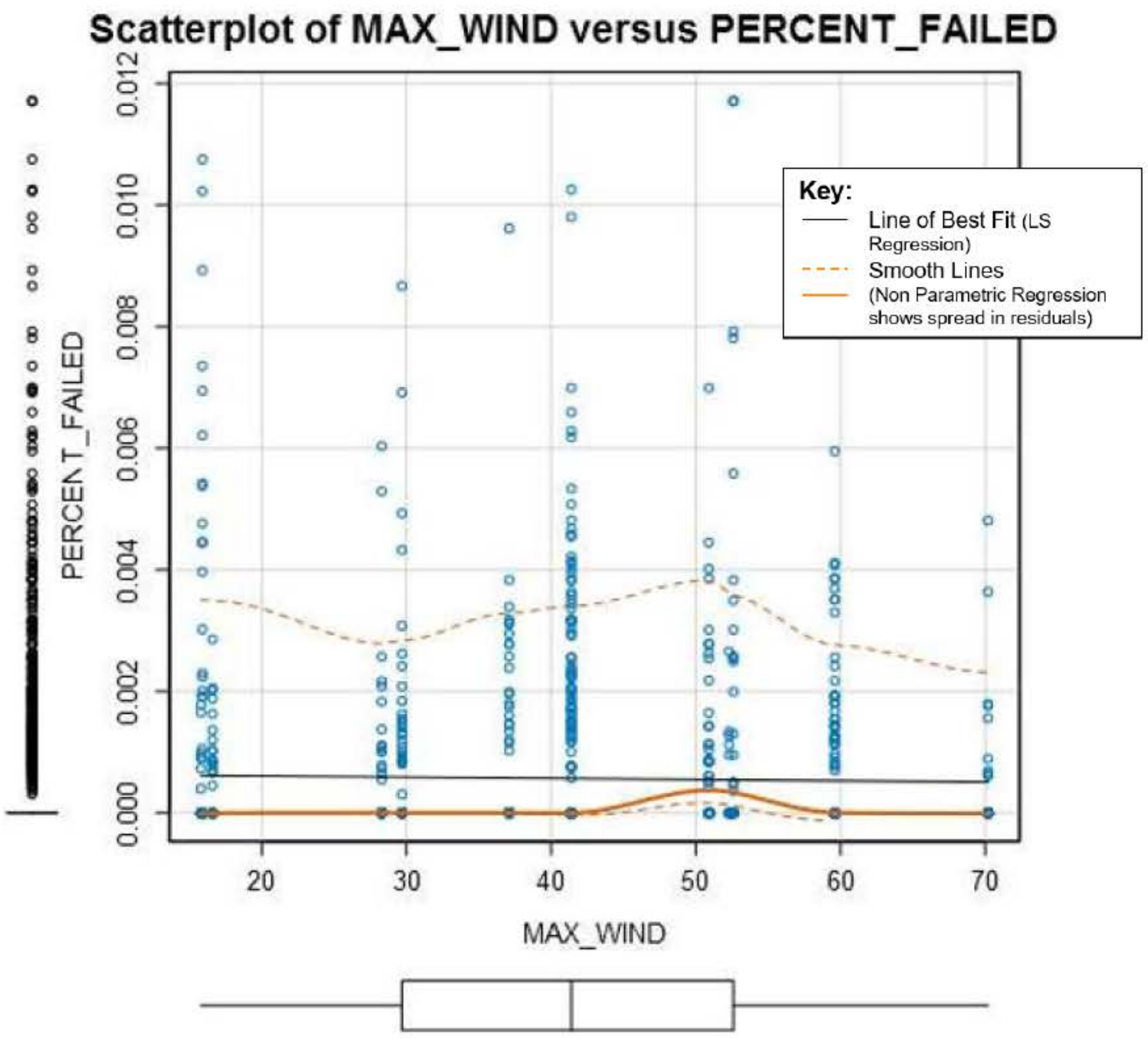
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



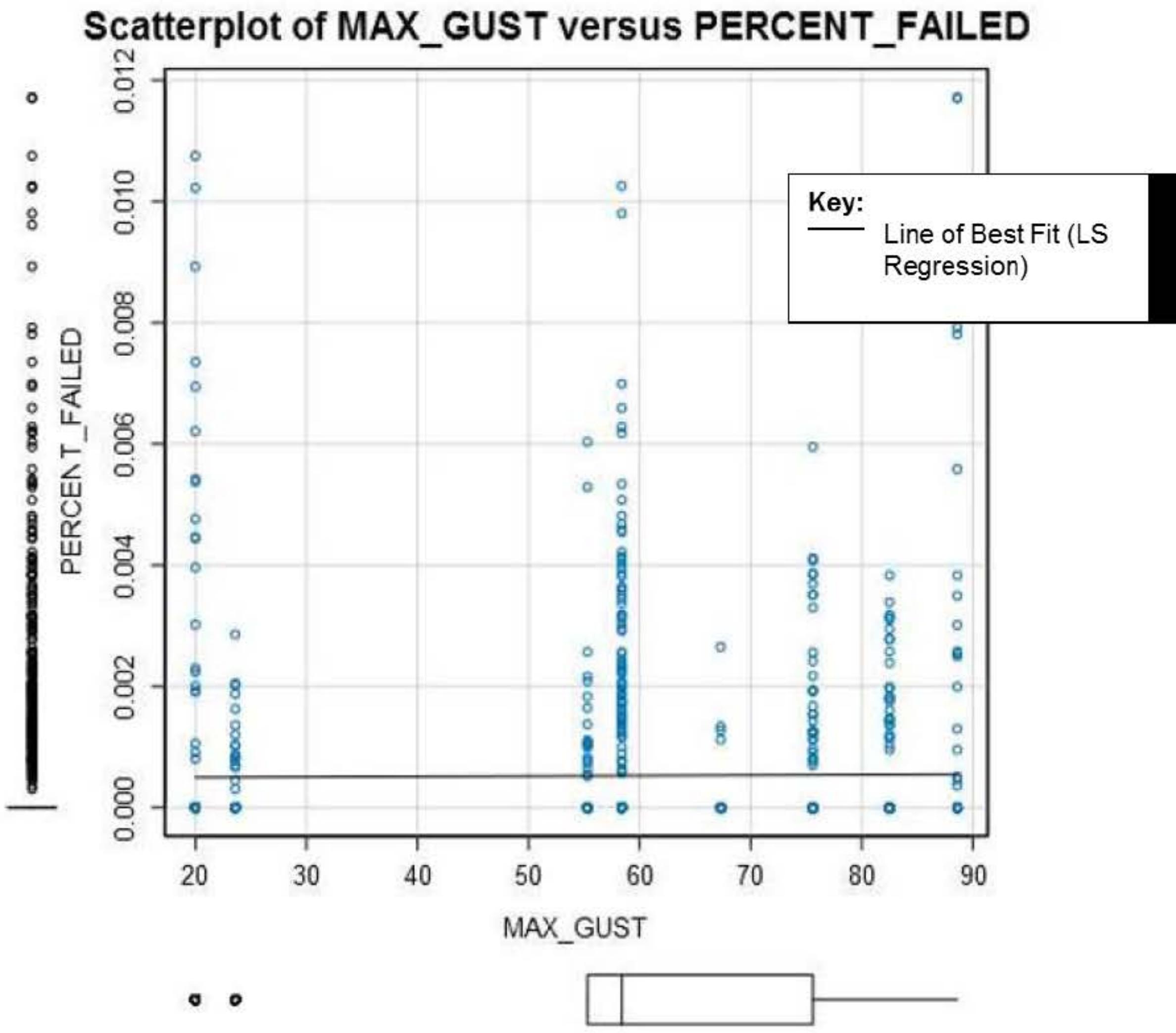
SIMPLE LINEAR REGRESSION: MAX GUST

Data Summary

Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111



- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure

SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

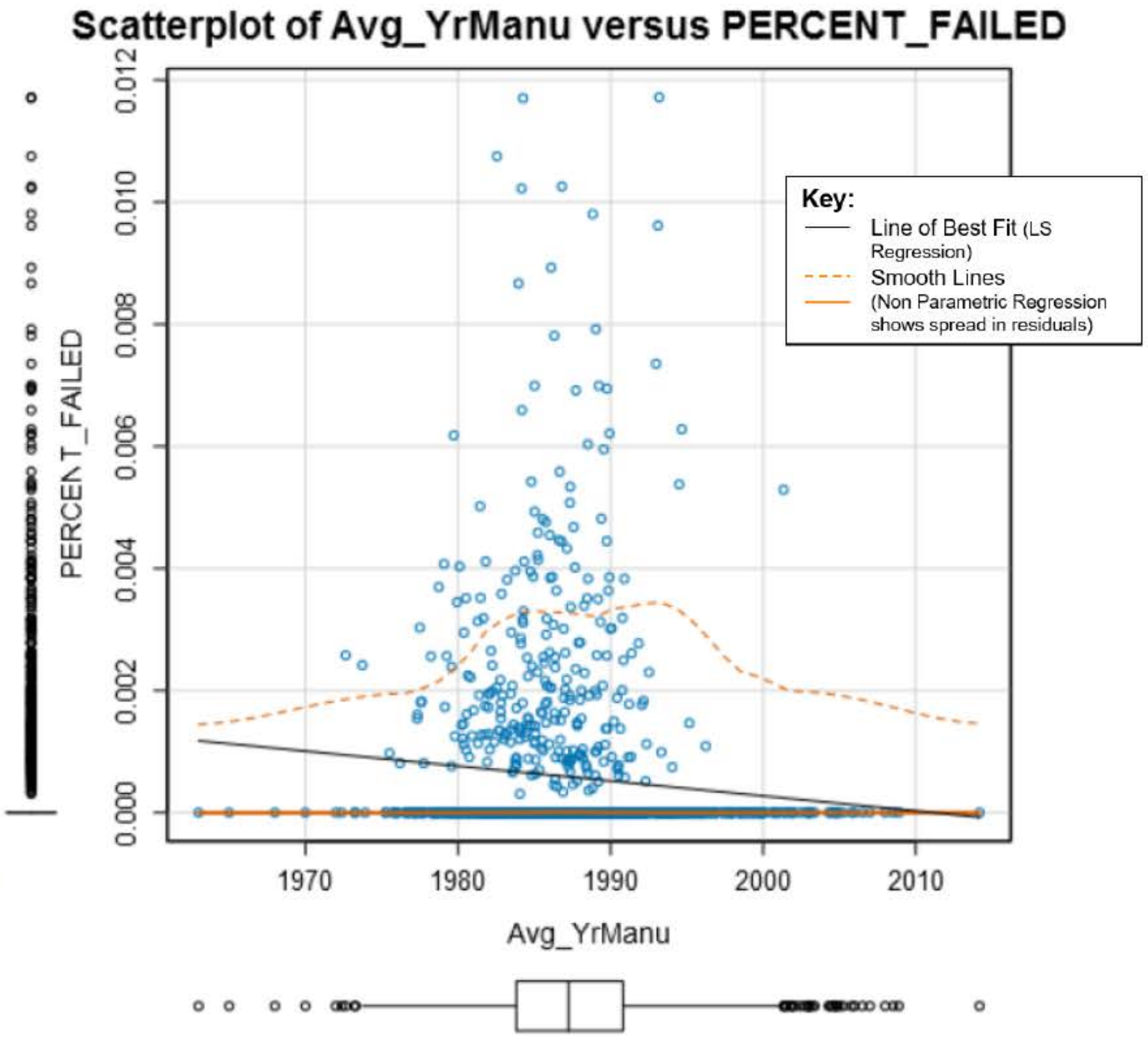
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.



*Note: This analysis does not consider reinforcement of older poles.

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SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

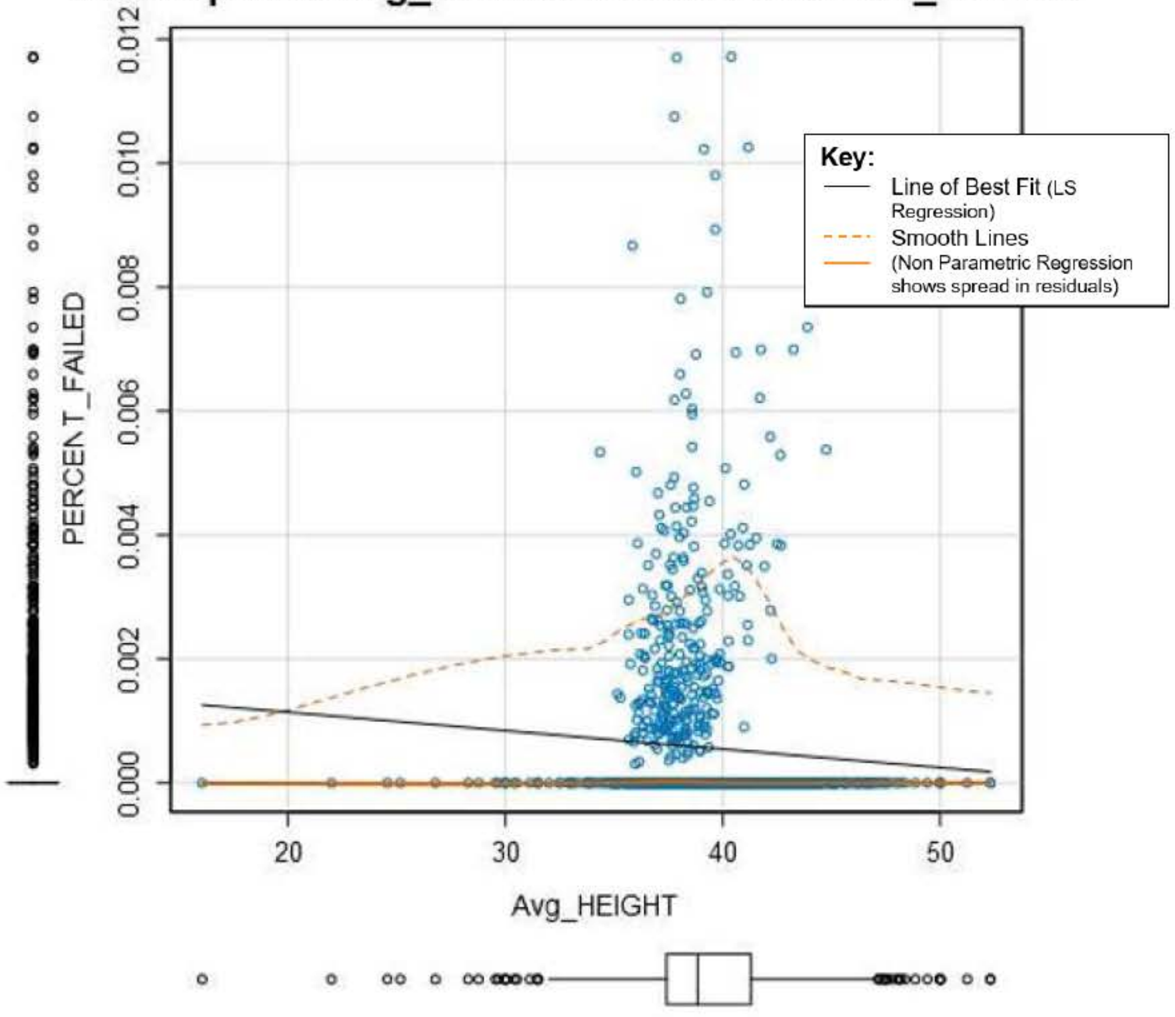
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

Scatterplot of Avg_HEIGHT versus PERCENT_FAILED



- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.

SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

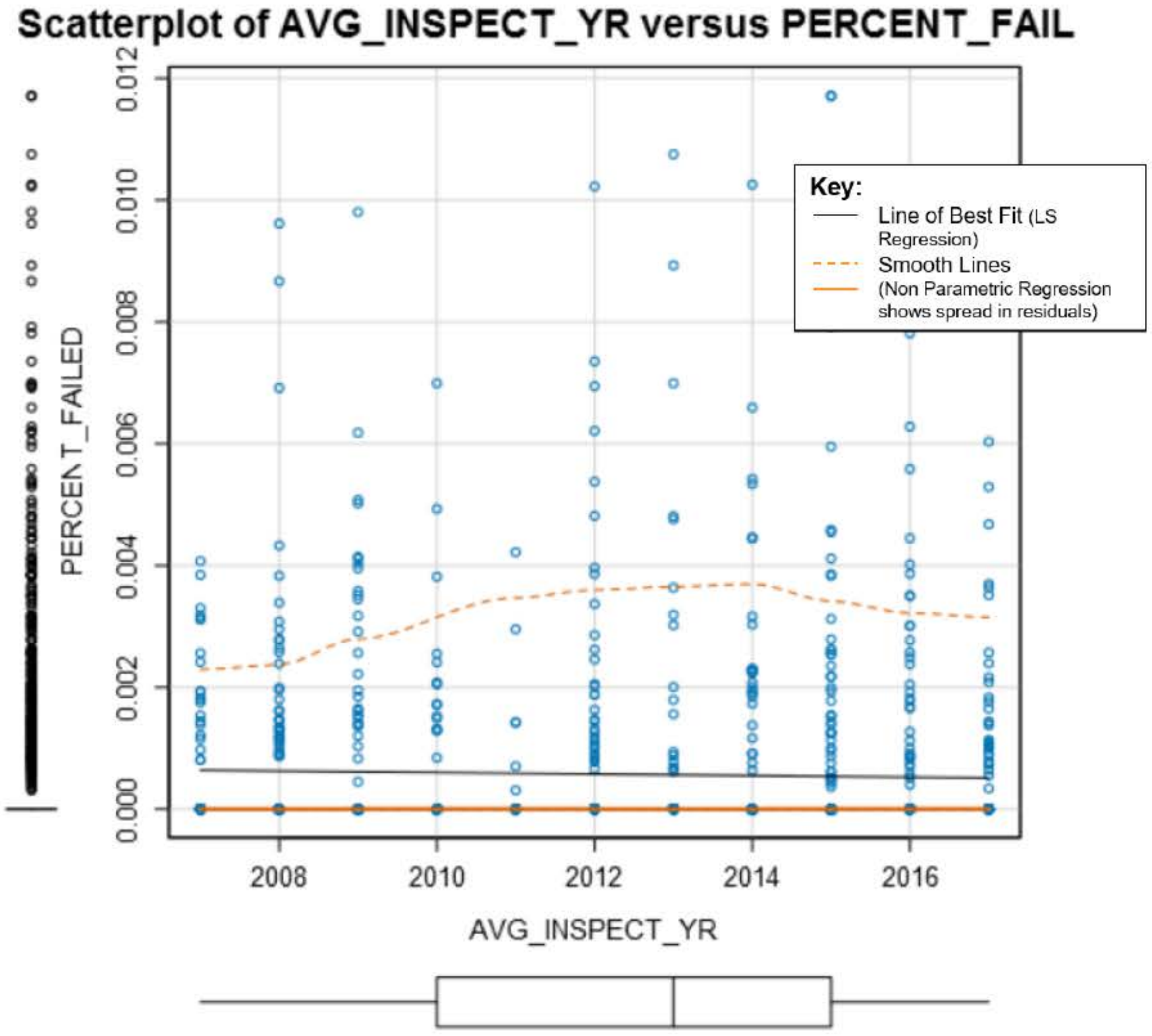
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

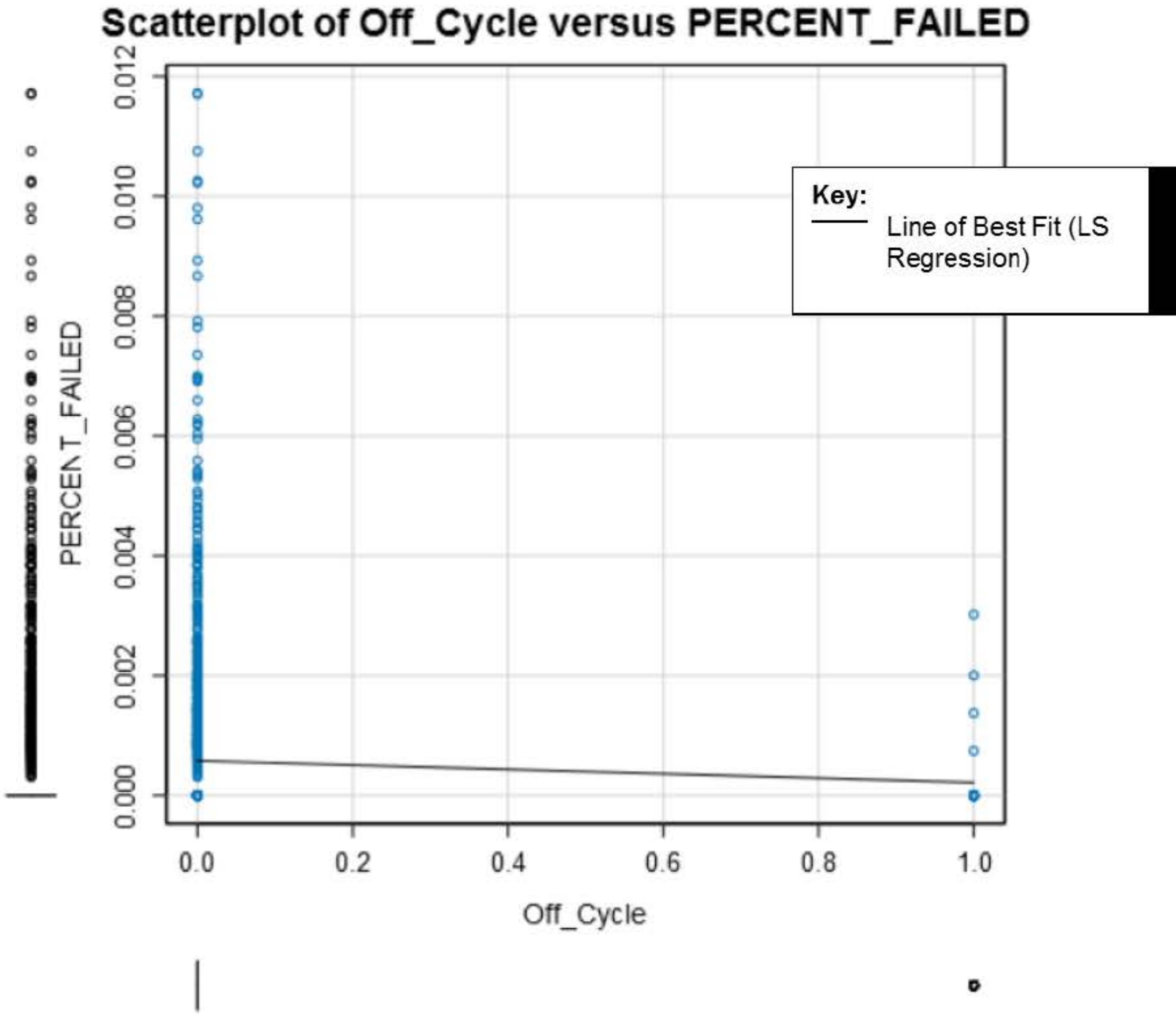
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates (P=0.0025<0.05). Circuits that have newer poles on average are also associated with a lower percent failure rates (P=0.00051<0.05).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates (P=0.003<0.05). Circuits that have newer poles on average are associated with a lower percent failure rates (P=0.00002<0.05).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384 poles	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.
- Circuits with a taller average pole height were more likely to have a lower pole failure rate.
- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.
- Circuits with older poles were associated with higher pole failure rates.
- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.
- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.
- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

STORM HARDENING

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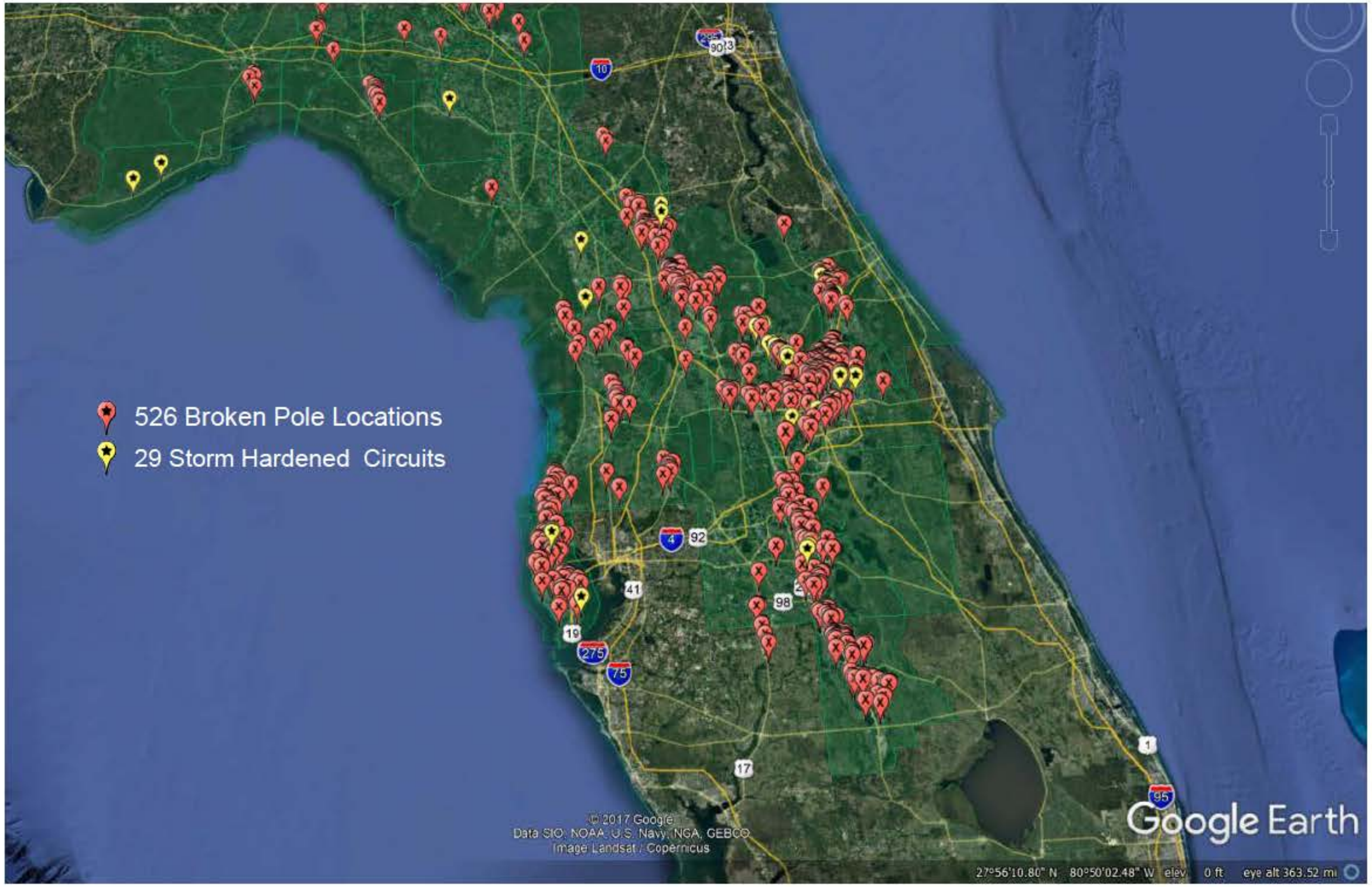
METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

DUKE ENERGY

ACCENTURE

Exhibit 15

WORK STATEMENT NO.

Exhibit 15

WORK STATEMENT

This Work Statement No. (the "**Work Statement**") is entered into by and between Duke Energy Business Services LLC, successor in interest to Duke Energy Shared Services, Inc. ("**Duke Energy**") and Accenture LLP ("**Supplier**"), pursuant to and subject to that certain Master Professional Services Agreement effective as of December 18, 2006 by and between Duke Energy and Supplier (the "**Agreement**"), the terms of which are incorporated herein by reference. Except as expressly set forth in this Work Statement, all applicable terms and conditions of the Agreement shall govern the obligations of Duke Energy and Supplier under this Work Statement.

This Work Statement describes the Services Supplier shall perform and deliver in accordance with this Work Statement and the Agreement.

IN WITNESS WHEREOF, Duke Energy and Supplier have each caused this Work Statement to be executed by its duly authorized representative, effective as of the Work Statement Effective Date set forth in **Section 1** below.

Accenture LLP

By: ____________________________________

Print Name: ____________________________________

Print Title: ____________________________________

Date: ____________________________________

Duke Energy Business Services, LLC

By: ____________________________________

Print Name: ____________________________________

Print Title: ____________________________________

Date: ____________________________________

1. **Introduction**.

Supplier has carefully reviewed Duke Energy's requirements and has performed the due diligence it deems reasonably necessary prior to execution of this Work Statement.

2. **Work Statement Term.**

The term of this Work Statement shall begin on November 10, 2017 ("**Work Statement Effective Date**") and continue until December 31, 2017, unless extended or terminated earlier in accordance the terms of the Agreement ("**Work Statement Term**"). For purposes of this Work Statement, the Work Statement Commencement Date shall be the date set forth in **Schedule E** (WS Transition Plan) to this Work Statement.

3. **Definitions.**

Any capitalized terms used in this Work Statement or its Schedules or Attachments but not defined herein or in **Schedule A** (WS Definitions) shall have the meaning ascribed to such terms in the Agreement or **Exhibit 1** (Profile Definitions).

4. **Services.**

Supplier shall provide the Services to Duke Energy and the Eligible Recipients in accordance with the Agreement (including Exhibits and Attachments thereto) as it may be modified and/or supplemented in this Work Statement (including the Schedules and Attachments hereto).

5. **Master Professional Services Agreement**

The Agreement contemplates that certain terms and conditions (i) will not apply to this Work Statement, or will be limited in their application to this Work Statement, unless the Parties affirmatively indicate herein that such terms and conditions shall apply or specify the extent to which they are applicable (each an "**Opt-In**" term or condition), or (ii) will apply to this Work Statement unless the Parties affirmatively indicate herein that such terms and conditions are modified in their application to this Work Statement (each an "**Opt-Out**" term or condition). **Annex 1** to this Work Statement contains certain Opt-In and Opt-Out terms and conditions. If an Opt-In provision is checked, the applicable terms and conditions specified in the indicated Section of the Agreement shall apply to this Work Statement as such terms and conditions may be modified herein. If an Opt-Out provision is checked in **Annex 1**, the applicable terms and conditions specified in the indicated Section of the Agreement shall be modified as specified in **Annex 1**.

In addition to the foregoing, the Agreement is modified as and to the extent provided below:

Modifications

N/A

Additions

N/A

6. **Schedules and Attachments.**

The following Schedules and Attachments that are indicated with a checkmark are appended to this Work Statement and are hereby incorporated by reference:

Included Attachments	Schedule or Attachment	Title of Schedule or Attachment
☐	Schedule A	WS Definitions
☒	Schedule B	WS Service Description
☐	Schedule C	WS Service Levels
☐	WS Attachment C.1	Service Levels Matrix
☐	WS Attachment C.2	Service Level Definitions
☐	WS Attachment C.3	Critical Deliverables
☒	Schedule D	WS Pricing
☒	WS Attachment D.1	Pricing Forms
☐	WS Attachment D.2	Financial Responsibility Matrix
☐	WS Attachment D.3	Duke Energy Base Case
☐	WS Attachment D.4	Resource Units/Resource Baselines
☐	WS Attachment D.5	Termination Charges
☐	Schedule E	WS Transition Plan
☐	Schedule F	WS Duke Energy Facilities
☐	Schedule G	WS Supplier Facilities
☐	Schedule H	WS Software
☐	Schedule I	WS Equipment
☐	WS Attachment I.1	Duke Energy Provided Equipment
☐	Schedule J	WS Third Party Contracts
☐	Schedule K	WS Key Supplier Personnel
☐	Schedule L	WS Subcontractors

☐	Schedule M	WS Managed Third Parties
☐	Schedule N	WS Termination/Expiration Rights
☐	Schedule O	WS Reports
☐	Schedule P	WS Satisfaction Survey
☐	Schedule Q	WS Termination Assistance Services

Work Statement No: __

Annex 1

1. **OPT-IN Provisions.**

a. ☐ **<u>Sections 4.1(a)(iii)</u>. Services to be Performed by Supplier**.

Indicate whether a Duke Energy Base Case is attached for the purpose of Section 4.1(a)(iii). N/A

b. ☐ **<u>Section 4.2(d)</u>: Transition Meeting; Reports.**

Indicate frequency of transition meetings; reports. Parties may choose to reference Schedule E if the relevant informaiton is contained therein. N/A

c. ☐ **<u>Section 4.3(b)(4)</u>: Right to Purchase Equipment.**

Indicate whether Duke Energy will have the right to purchase/assume lease for Equipment as provided in Section 4.3(b)(4). N/A

d. ☐ **<u>Section 9.4(d)</u>: Industry Standards.**

Indicate any industry standards for which Supplier must achieve and/or maintain certification or compliance (in addition to any such requirements expressly specified in the Agreement). N/A

e. ☐ **<u>Section 13.3(d)</u>: Personal Data/Business Associate Agreement.**

Indicate whether Supplier must execute a Business Associate Agreement due to having access to "protected health information" as specified in Section 13.3(d). N/A

2. **OPT-OUT Provisions**

a. **<u>Section 4.3(b)(2); Right to Hire Supplier Personnel</u>**

Indicate any Supplier employees that are not eligible for hiring by Duke Energy or the Eligible Recipients N/A

b. ☐ **<u>Sections 9.1(b) and 9.4(c)</u>: Policy and Procedures Manual.**

Indicate the extent to which the update to the umbrella Policy and Procedures Manaual will be limited with respect to this Work Statement; see Sections 9.1, 9.4(c) of the Agreement. N/A

c. ☐ **<u>Section 14.2(b)</u>: Ownership of Duke Energy–Specific Developed Materials**

Indicate any exceptions to the default ownership of Duke Energy-Specific Developed Materials; see Section 14.2(b). N/A

d. ☐ **<u>Section 15.7</u>: Compliance with Laws**

Note any exceptions to the Parties respective obligations with respect to compliance with Laws as specified in Section 15.7 of the Agreement. N/A

e. ☐ **<u>Section 20.2</u>: Termination for Convenience**

Note any change to the default notice period for termination for convenience. N/A

DUKE ENERGY

ACCENTURE

Schedule B

Work Statement No.

WS Service Description

Schedule B

WS Service Description

This is **Schedule B** to the Work Statement No. ______ ("**Work Statement**") under the Master Professional Services Agreement by and between Duke Energy and Supplier (the "**Agreement**"). All capitalized terms used but not defined in this Schedule shall have the meanings given them in the Agreement or the Work Statement.

The terms and conditions of Sections 1 and 2 of **Exhibit 2** and all Attachments and appendices to **Exhibit 2** are incorporated herein by reference. In addition, each Section of Exhibit 2 indicated below with a checkmark is also incorporated herein by reference, as the terms of such Sections may be modified as indicated below the applicable Section number.

Section 1. General

Section 2. Application Methodologies, Standards and Architecture

---

☐ **Section 3. Application Planning and Analysis Services**

N/A

☐ **Section 4. Application Development Services**

N/A

☐ **Section 5. Application Testing Services**

N/A

☐ **Section 6. Application Implementation Services**

N/A

☐ **Section 7. Application Maintenance and Support Services**

N/A

☐ **Section 8. ADM Management**

N/A

☒ Section 9. Staff Supplementation and Project Services

Project Overview

Duke Energy is looking to conduct a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma. The purpose of the study is to determine the correlations and major causes of failure in support of the report that Duke Energy is expected to submit to the Florida PSC in 2018. The specific analyses that Duke Energy wants to conduct are listed below:

Op Center comparisons

- Total vs Broken Pole Population
- Statistical Projection vs Actual Broken Poles
- Broken Poles by Vintage
- Broken Pole vs Projected Winds

System Comparisons

- Broken Poles vs. Inventory Used
- Broken Poles by Failure Mode
- Common Failure Modes
- Poles w/ attachments vs w/o attachments
- The impact of vegetation
- Historical comparisons 2004 vs 2017
- Impact to Storm Hardened circuits
- Performance of Storm Hardened Circuits
- Comparative Analytics of Storm Hardened feeders juxtaposed with the impact of both DE Standards and the ongoing pole replacement program.

Industry Benchmarking Comparisons

- Southeast Electric Exchange Companies
- Other EEI Companies
- Other US Electric Utilities
- Comparative trends and analytics from documented weather events.

Project Services

Supplier will perform the services described below and such tasks, responsibilities and obligations may be revised, supplemented or changed during the period of this WS pursuant to the Change Control Procedures described in the Agreement (collectively, the “Services”).

i. **Initiative mobilization**
   a. Confirm project deliverables and hypothesis with the Duke Energy FL team
   b. Understand the available forensic and weather data available

c. Organize the available data into a single electronic database (tables) to allow for analysis
d. Identify any gaps in the data and develop strategies to gather the missing information

ii. **Conduct data analysis**

a. Define the analytic process for each of the hypothesis
b. Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
c. Identify the key drivers or pole failures and determine the overall cause and effect
d. Develop conclusions based on the statistical analysis

iii. **Perform Benchmark Comparison (Supplier has a storm performance database that includes more than 100 utility responses to major weather events over the last 15 years)**

a. Gather key statistics from the Duke Energy FL response to Hurricane Irma using a pre-developed template
b. Identify the comparable events from the database to benchmark Duke Energy FL response against
c. Conduct benchmark comparison and identify key metrics
d. Develop conclusions based on the benchmark analysis

iv. **Synthesize and Summarize**

a. Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison.
b. Ensure that the summary is suitable for inclusion in the 2018 Duke Energy Report to FPSC and possible hearings regarding the Hurricane Irma restoration.

Project Deliverables

The Project team will work on the Deliverables described below during the term of this WS.

Ref.	Deliverables	Description	Duke Energy	Supplier
1.	Consolidate and Organize Forensic Data	• Gather the available information and organize it in the electronic format that can be easily analyzed (database of forensic data)	Assist	Primary
2.	Regression Analyses	• Confirm the specific hypotheses that Duke Energy wants the analysis to focus on (start with the list provided in the project description above) • Conduct regression and other statistical analysis to answer the hypotheses (assume up to 20 hypotheses)	Assist	Primary
3.	Conduct Benchmark Analysis	• Gather the key statistics related to the Duke Energy FL response to Hurricane Irma (using the template for the Supplier storm benchmark database) • Conduct the benchmark analysis of the Duke Energy FL performance against the comparable events in the database.	Assist	Primary

Ref.	Deliverables	Description	Duke Energy	Supplier
4.	Executive Summary Report	• Summarize the findings in a brief report format that is suitable for inclusion in the • The final deliverable should be in a format that is suitable for inclusion in the 2018 Duke Energy report to the Florida Public Service Commission (FPSC) and possible hearings regarding the 2017 storm season.	Assist	Primary

The Party with "Primary" responsibility shall have the obligation of completing the Deliverable and directing the "Assist" responsibility.

The Party with "Assist" responsibility shall assist the Party with "Primary" responsibility.

Project Final Acceptance

Supplier will provide a Project Final Acceptance form to Duke Energy for signature to acknowledge acceptance of the Project Services and Deliverables and completion of the Project.

Deliverable Acceptance

Supplier shall, upon completion of a Deliverable, notify Duke Energy that such Deliverable has been completed and is ready for review and sign off. Promptly after receipt of such notice, Duke Energy shall evaluate the Deliverable for acceptance to determine whether it substantially conforms to the description contained in the WS Deliverables table contained in the WS. The only basis for Acceptance of a Deliverable will be substantial conformance to such Deliverable description. The only basis for rejection of a Deliverable will be the failure of the Deliverable to substantially conform to such Deliverable description. A Deliverable shall be deemed Accepted if Duke Energy has not signed off on the Deliverable after five (5) business days or has not provided, in writing, a written basis for rejection of the Deliverable within five (5) business days from notification that a Deliverable is ready for sign off. This provision shall override the Deliverables Acceptance provision in the Agreement.

Deliverables Sign Off

The appropriate individuals required to sign off will be identified for each Deliverable by the Engagement Managers. The individuals signing off must include at a minimum one (1) Duke Energy team member and one (1) Supplier team member.

☐ **Section 10. Systems Integration Services**

N/A

☐ **Section 11. Problem Management and Help Desk Support**

N/A

☐ **Section 12. Application Quality Assurance**

N/A

☐ **Section 13. Application Metrics and Productivity**

N/A

☐ **Section 14. Third Party Relationships**

N/A

Additional Services –

None

DUKE ENERGY
ACCENTURE

Schedule D

Work Statement No. _____

WS Pricing

Schedule D

WS Pricing

This is **Schedule D** to the Work Statement No. _____ ("**Work Statement**") under the Master Professional Services Agreement by and between Duke Energy and Supplier (the "**Agreement**"). All capitalized terms used but not defined in this Schedule shall have the meanings given them in the Agreement or the Work Statement.

This **Schedule D** is subject to all of the conditions set forth in **Exhibit 4** of the Agreement, unless specifically modified herein or by one of the Attachments specified in Section 2.

1. **Modifications/Additions to Exhibit 4**:

- *None*
- **Limitations on Section 4.6 Rights (Right to In-source or Use of Third Parties).**
- *None.*

2. **Included Attachments**.

Attachment	Attachment Name	Attachment Status	Comment
WS Attachment D.1	**Pricing Forms**	**Attached**	
WS Attachment D.2	**Financial Responsibilities Matrix Exceptions**	**Deleted**	
WS Attachment D.3	**Duke Energy Base Case**	**Deleted**	
WS Attachment D.4	**Resource Units / Resource Baselines**	**Deleted**	
WS Attachment D.5	**Termination Charges**	**Deleted**	

DUKE ENERGY
MASTER PROFESSIONAL SERVICES AGREEMENT

WORK STATEMENT ATTACHMENT D.1

Attachment to Exhibit 15 (Form of Work Statement)
Attachment to Schedule D (Work Statement Pricing Forms)

Duke WCR__

2-Nov-17

DUKE ENERGY	2015	2016	2017	2018	TOTAL
Time and Materials Pricing					
T&M Detail Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]
Volume Discount	$ -	$ -	$ [redacted]	$ -	$ [redacted]
T&M Pass-through Expenses	$ -	$ -	$ [redacted]	$ -	$ [redacted]
					$ -
Sub-Total T&M Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]
					$ -
T&M estimated taxes					$ -
					$ -
Grand Total T&M Charges	$ -	$ -	$ [redacted]	$ -	$ [redacted]

REDACTED

Table 1:

Resource Summary						WS Annual Summary			
Name or Project Skill (if TBD)	Skill Category (Rate Card)	Rate Type	Rate Type (Short)	Location	Role Duration	Work Statement	Discount %	WS Term Year	Bill Rates
2017 - Consulting Discount 13.0%									
miki.deric		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
justin.b.wagaman		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
emma.tobey		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
TBD Analyst		Consulting	Consulting	Onshore		Original	[redacted]	2017	$ [redacted]
							Total Hours	695.00	

Table 2:

Volume Discount Summary									
WS Term Year	Annual Benefit	January	February	March	April	May	June	July	August
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	[redacted]	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
Total Discount Amount	[redacted]								

Table 3:

Total Fees by Month	Work Statement Term								
WS Term Year	WS Annual Charge	January	February	March	April	May	June	July	August
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	$ [redacted]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table 4:

Total Expenses by Month	Work Statement Term								
WS Term Year	WS Annual Charge	January	February	March	April	May	June	July	August
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	$ [redacted]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

REDACTED

Work Statement Term														
		Role Quantity (Supplier to input quantity of Skill Category Role)												
WS Annual Quantity	WS Annual Extended Charge	January	February	March	April	May	June	July	August	September	October	November	December	Total Hours
														-
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
[redacted]	[redacted]											[redacted]	[redacted]	[redacted]
-	$ -													-
-	$ -													-

September	October	November	December
-	-	-	-
-	-	-	-
-	-	[redacted]	[redacted]
-	-	-	-

September	October	November	December
$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -
$ -	$ -	$ [redacted]	$ [redacted]
$ -	$ -	$ -	$ -

September	October	November	December
$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -
$ -	$ -	$ [redacted]	$ [redacted]
$ -	$ -	$ -	$ -

RED ACTED

January	February	March	April	May	June	July	August	September	October	November	December	TOTAL	Volume Discount
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

REDACTED

DUKE FL POLE FORENSICS SUPPORT REPORT

FINAL ANALYSIS

DUKE ENERGY FLORIDA

accentureconsulting

TABLE OF CONTENTS

EXECUTIVE SUMMARY

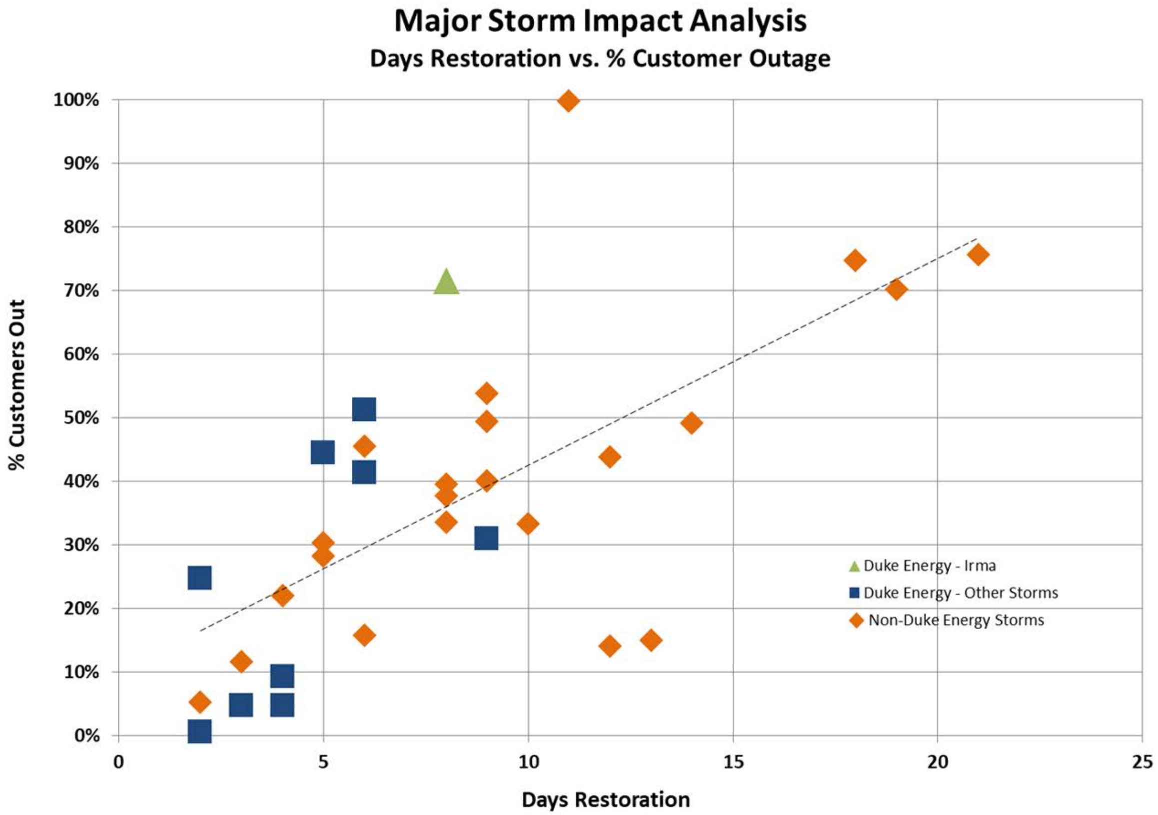
EXECUTIVE SUMMARY

- Hurricane Irma impacted Duke Energy Florida (DEF) service territory on September 10, 2017 as a Category 4 storm causing more than 70% of customers to lose power
- DEF collected forensic information on the broken poles in the early stages of the restoration and retained Accenture to conduct statistical and benchmark analysis using that data
- Accenture analysis focused on three key components:
  - **Benchmark Analysis** – leveraging “storm benchmark database” compared DEF performance against comparable storms
  - **Forensic Analysis** – using simple regression, multiple regression and multiple logistic analyses assessed the cause and effect of pole failures
  - **Storm Hardening Effectiveness** – applying visual and locational analysis evaluated the association of any broken poles to the hardening program established in 2006

EXECUTIVE SUMMARY – BENCHMARK

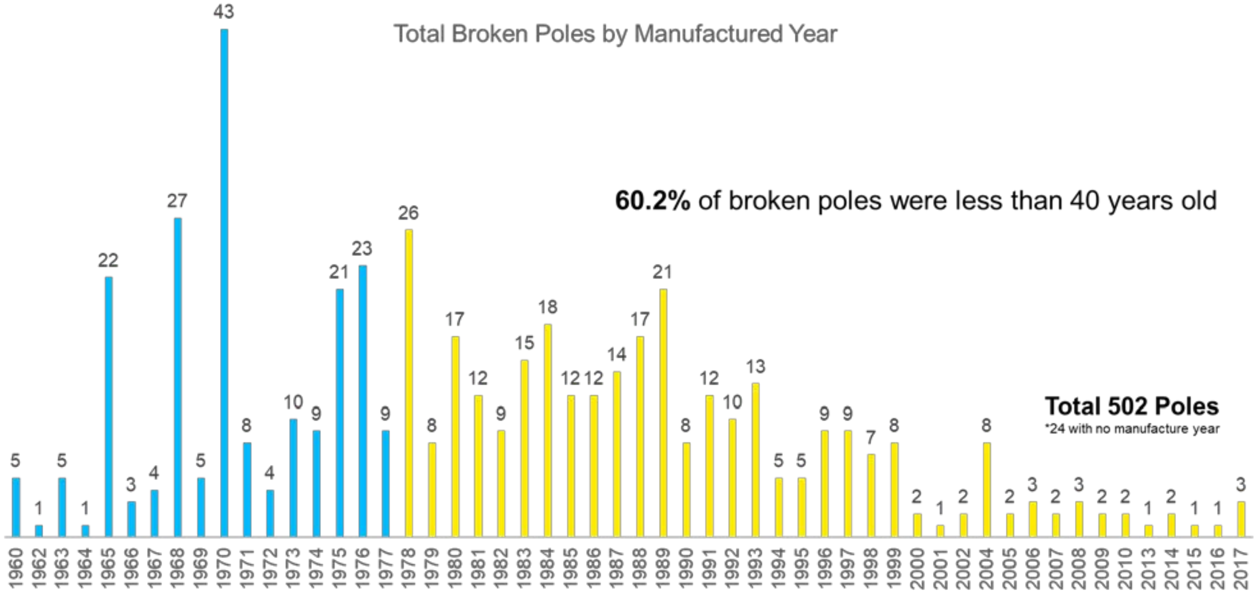
DUKE ENERGY. FLORIDA

- DEF deployed a large contingent of resources to this storm to ensure fast restoration
- DEF experienced less damage to its pole infrastructure when compared to similar events
- The number of poles replaced per customers out at peak was relatively low despite the high percentage of customers being affected
- DEF's Hurricane Irma restoration restored power to all customers faster than previous hurricane events as well as previous major storm events



EXECUTIVE SUMMARY – FORENSIC

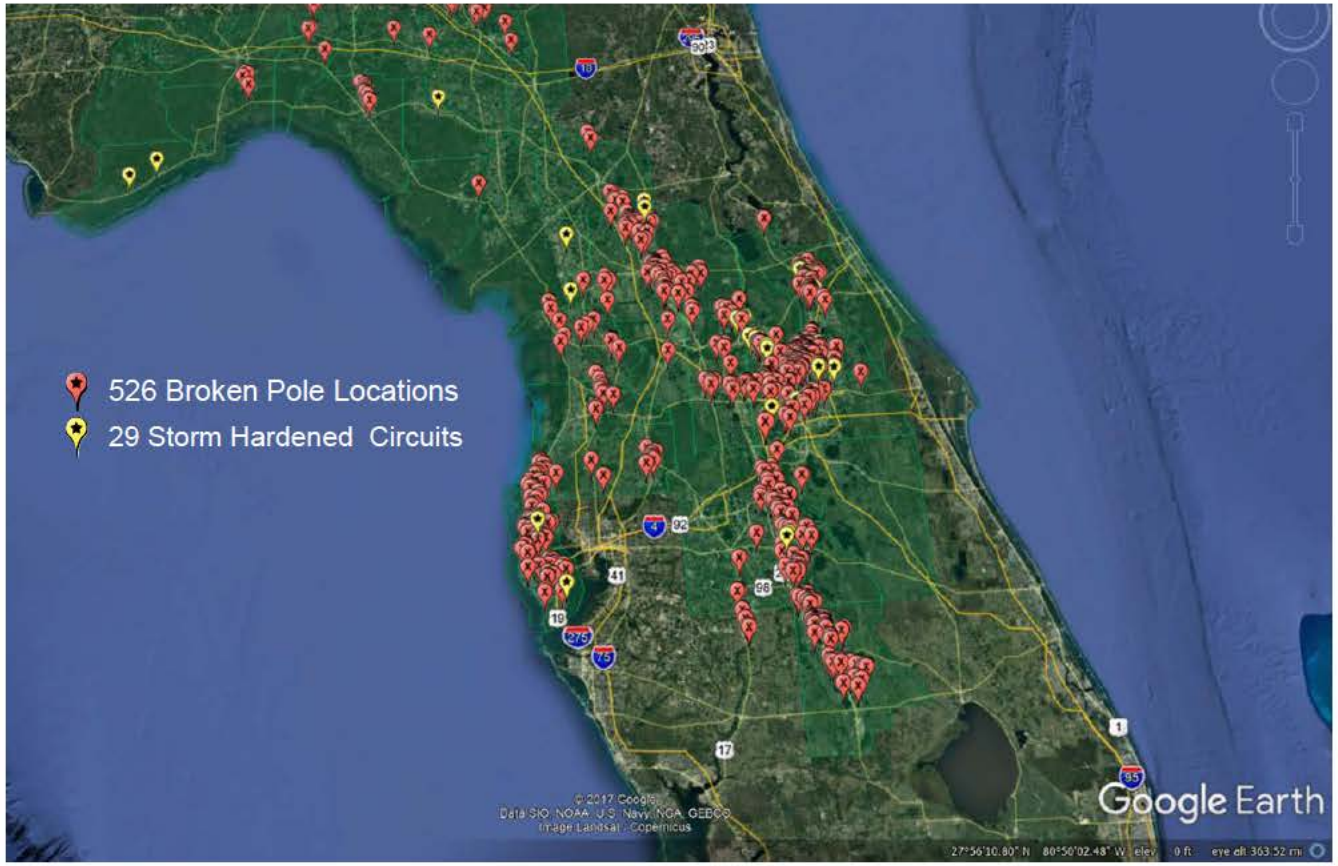
- Linear regression results indicated that age and pole height were correlated with failure rate.
- Multiple linear regression results suggested that the last inspection year and vegetation maintenance were not good indicators of pole failure rates.
- Results from both the simple and multiple analyses did not have a high correlation with the actual cause of pole failures. This suggests that other causal factors contributed to pole failures, e.g., damage to surrounding vegetation and additional loading on distribution facilities.
- The practice of conducting pole failure forensic analyses during major events is not yet widely used within the utility industry.



DUKE ENERGY. FLORIDA

EXECUTIVE SUMMARY – SYSTEM HARDENING

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.



OVERVIEW/ PURPOSE

OVERVIEW/PURPOSE

- Duke Energy Florida (“Duke FL”) conducted a comprehensive analysis of forensic data on pole failures that the company collected in the aftermath of Hurricane Irma
- The purpose of the study is to determine the correlations and major causes of failure
- Accenture was retained to perform the analysis and performed the following tasks:
  - **Mobilized the Project**
    - Organize the available data into a single electronic database (table) to allow for analysis
    - Identify any gaps in the data and develop strategies to gather the missing information
  - **Performed Storm Benchmark Comparison**
    - Gather key statistics from the Duke FL response to Hurricane Irma
    - Identify the comparable events from Accenture’s storm benchmarking database to compare against Duke FL’s response
    - Conduct benchmark comparison and identify key metrics
    - Develop conclusions based on the benchmark analysis
  - **Conducted data analysis**
    - Define Duke FL’s hypotheses
    - Conduct the regression analysis or apply other analytic methods to allow for statistically valid assessment of the correlations of the different factors
    - Identify the key drivers or pole failures and determine the overall cause and effect
    - Develop conclusions based on the statistical analysis
  - **Synthesize and Summarized**
    - Prepare a summary report that describes the methodology and conclusions based on the pole failure data analysis and the benchmark comparison

BENCHMARKING COMPARISON

METHODOLOGY/APPROACH

Two methods were used to collect data for benchmarking:

- Surveys
  - Duke FL provided metrics surrounding the restoration efforts of Hurricane Irma
  - Additional surveys were completed by other utilities for storms over the past 25+ years
  - The survey focused on three areas:
    - System Information
    - Storm Magnitude
    - Restoration Performance

- Historical/Archival Research
  - Additional research completed to enhance the benchmarking for restorations performed by other North American utilities that was not collected through surveys
  - These sources were collected from public filings with the commission and archival news feeds from the utility websites

METHODOLOGY/APPROACH

- Identified similar category 1 – 4 hurricanes to perform the analysis of Duke FL's restoration efforts versus other utility companies captured in Accenture's storm benchmarking database from 1989 – 2017
- Highlighted restoration performances from Duke Energy and Progress Energy
- Accenture is using statistics that allow comparison without disclosing specific system information

DATA COLLECTION DEMOGRAPHICS

- 26 of 51 utilities included in the benchmarking
- 23 of 56 major events are included in the analysis
- 45 out of 119 unique restorations

Storm Type	Storm Name	Total
Hurricane Category 1	Fran	2
	Frances	2
	Hermine	1
	Hugo	1
	Humberto	1
	Irene	10
	Katrina	1
	Sandy	5
Hurricane Category 2	Elvis	1
	Georges	1
	Gustav	1
	Gustav + Ike	3
	Juan	1
	Isabel	2

Storm Type	Storm Name	Total
Hurricane Category 3	Ivan	2
	Jeanne	2
	Rita	2
	Wilma	1
Hurricane Category 4	Charley	2
	Hugo	1
	Irma	1
	Matthew	1
Hurricane Category 5	Floyd	1
Grand Total		**45**

Customers Served Range	# of Companies
0 – 500k	8
500k – 1 mil	2
1 mil – 1.5 mil	5
1.5 mil – 2 mil	2
2 mil – 2.5 mil	6
Over 2.5 mil	3
Grand Total	**26**

DATA COLLECTION
DUKE FL - IRMA STATISTICS

Company Information	
Total Number of Customers Served	1.8M
Total Overhead Distribution Line miles	18,000 miles
Total Underground Distribution Miles	14,000 miles

Storm Description	
Storm Name	Hurricane Irma
Storm Type	Hurricane
Storm Category	4
Start Date	September 10, 2017

Storm Damage Information	
Number of Customers Out at Peak	1,284,816
Number of Customers Out	1,738,030
Number of T&D Poles Replaced	1982
Number of Transformers Replaced	1,106
Number of Conductor Feet Replaced	939,840 feet
Total Spans of Wire Down	> 26,000

Restoration Resources	
Total Line FTEs	7,500
Total Veg. Management FTEs	2,500
Total Damage Assessment Resources	2,408
Peak Number of Field Resources Deployed	12,500

Restoration Duration	
Restoration Duration (# Days)	8 days

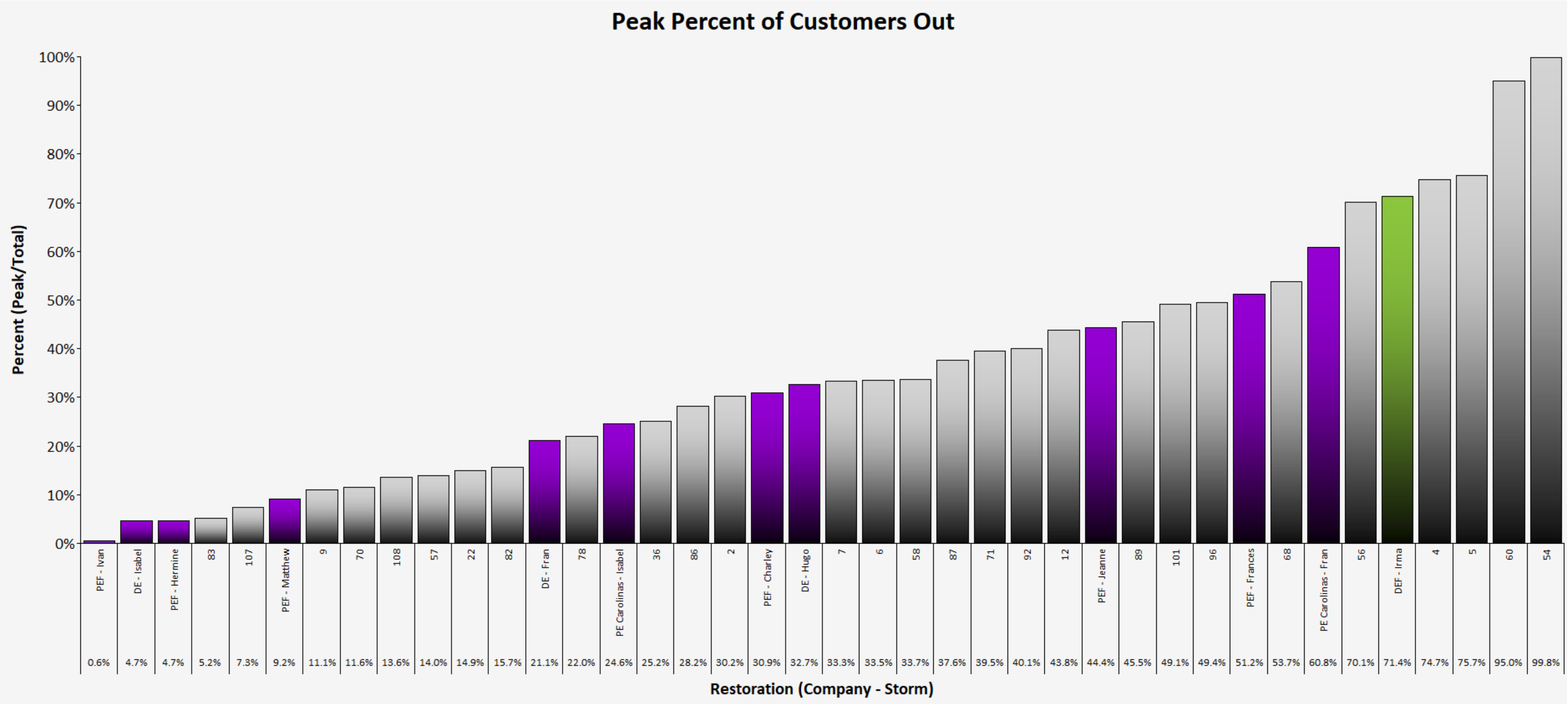
Restoration Costs	
Total Restoration Cost	$500M - $550M

Storm Drills	
Number of Storm Drills Per Year	1
Number of Table Top Exercises Per Year	2

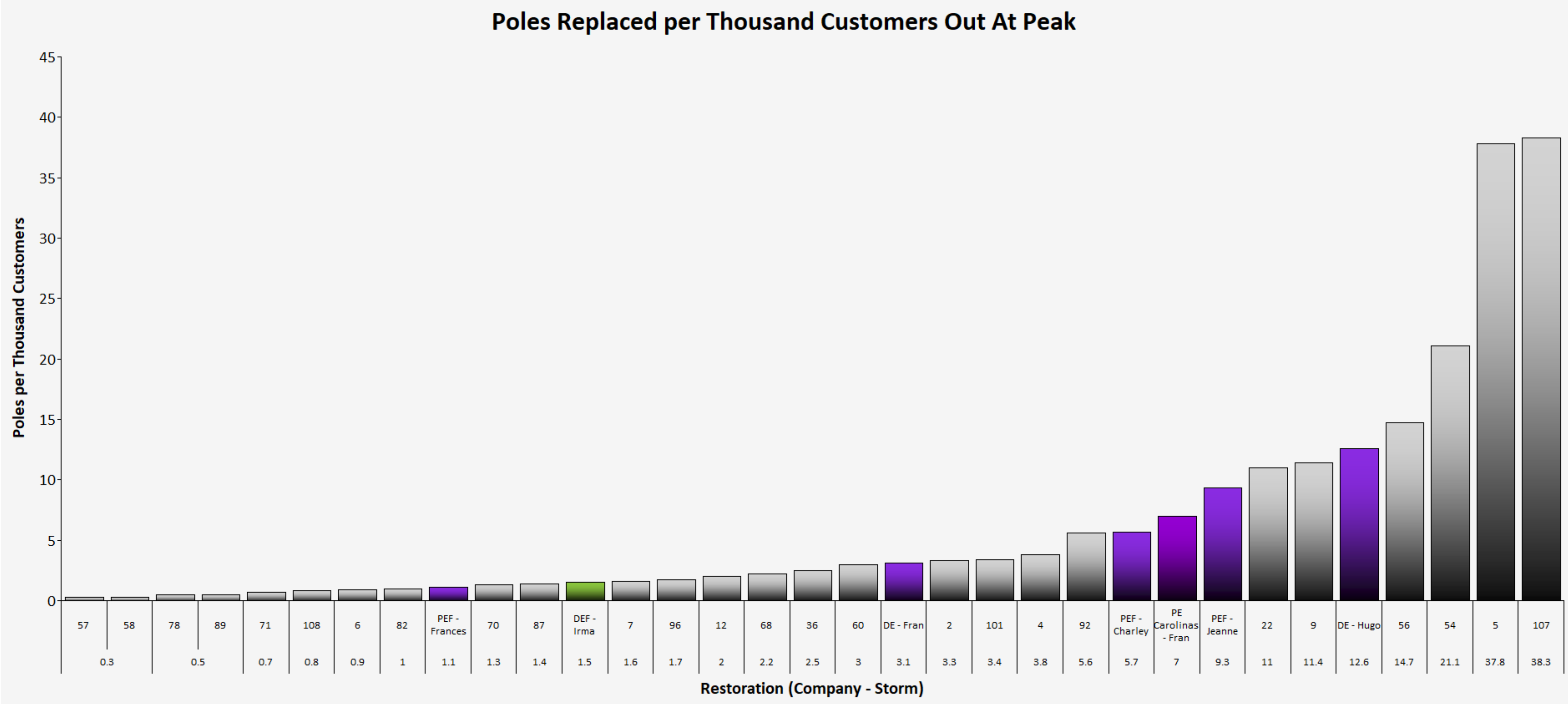
Vegetation Management	
Average Tree-Trimming Cycle	3yr backbone / 5yr branchlines

BENCHMARK RESULTS

20170272-DEF-OPC-POD 2-14-0000149

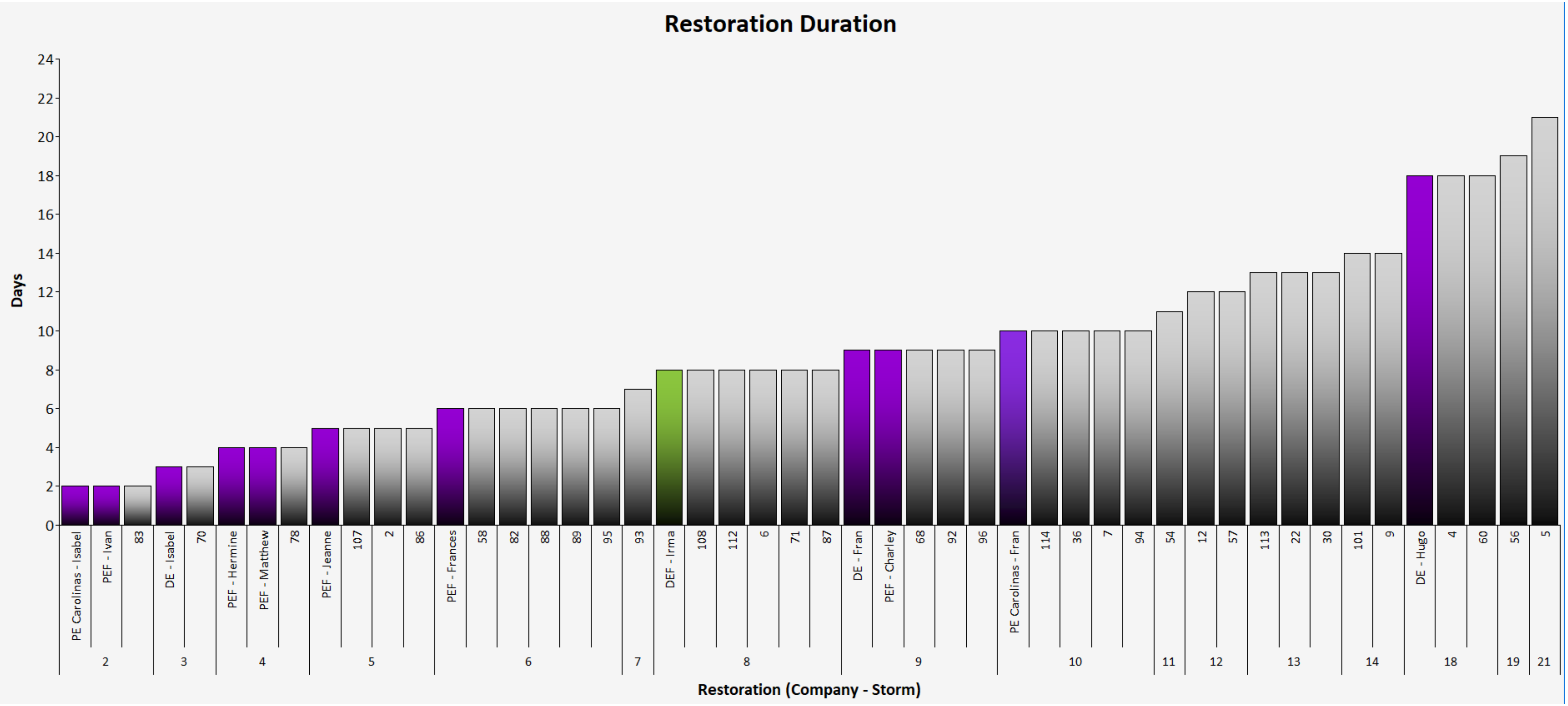


BENCHMARK RESULTS

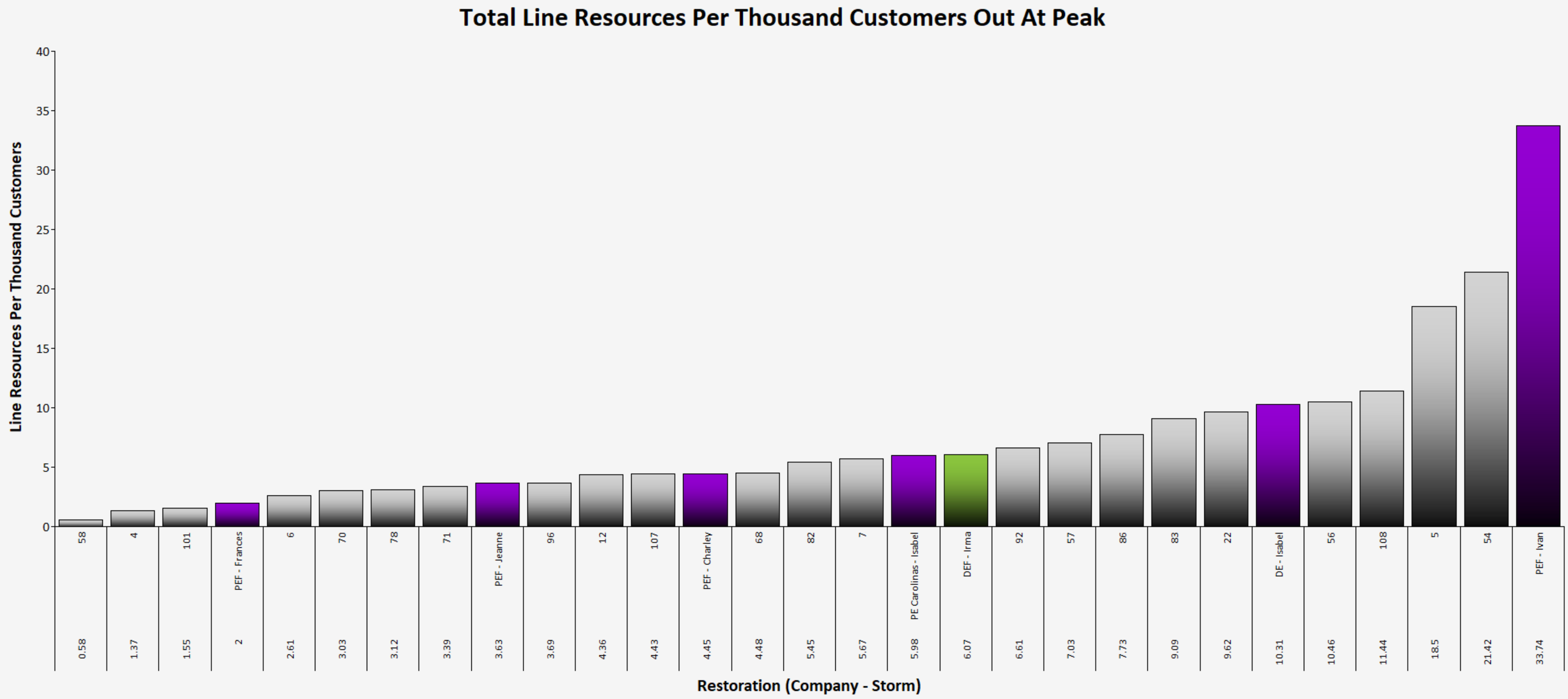


DUKE ENERGY FLORIDA

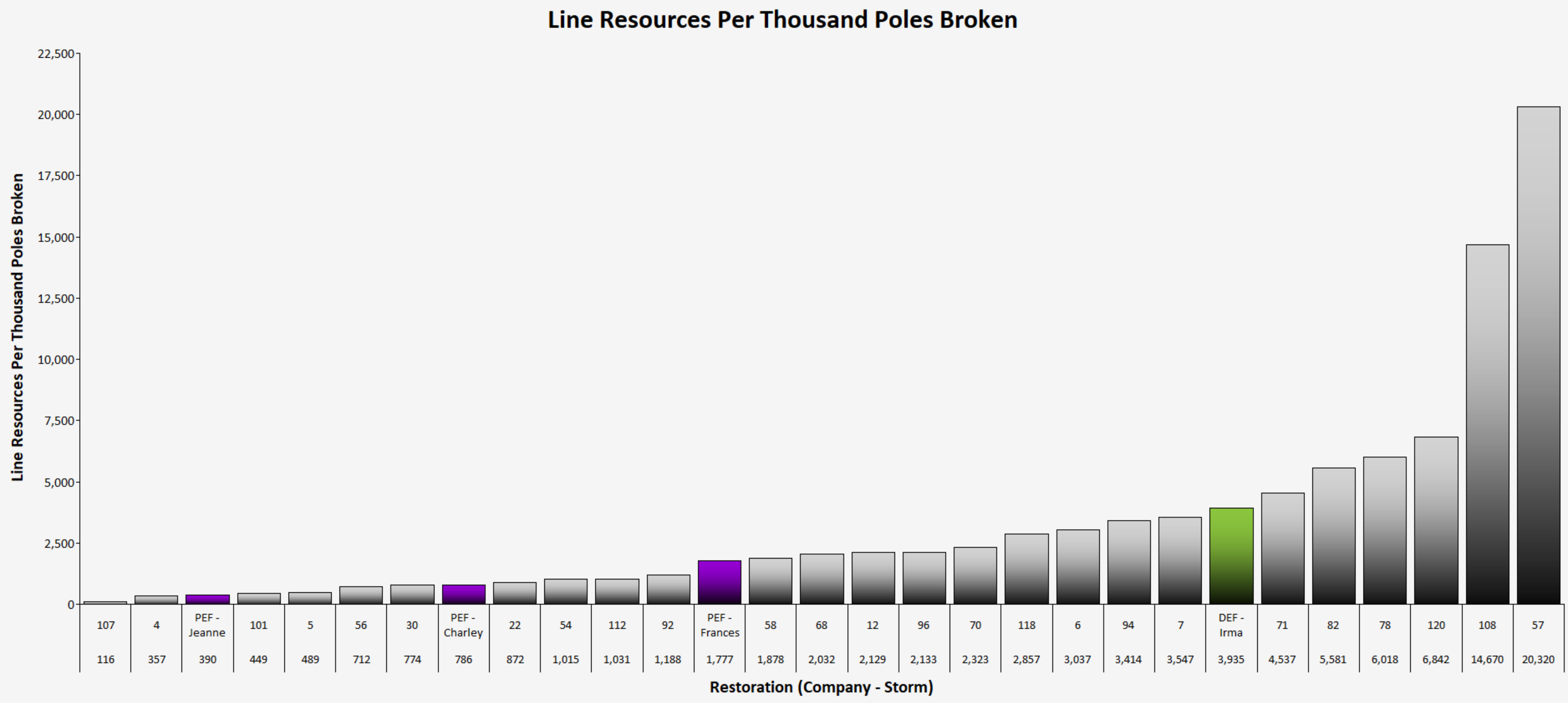
BENCHMARK RESULTS



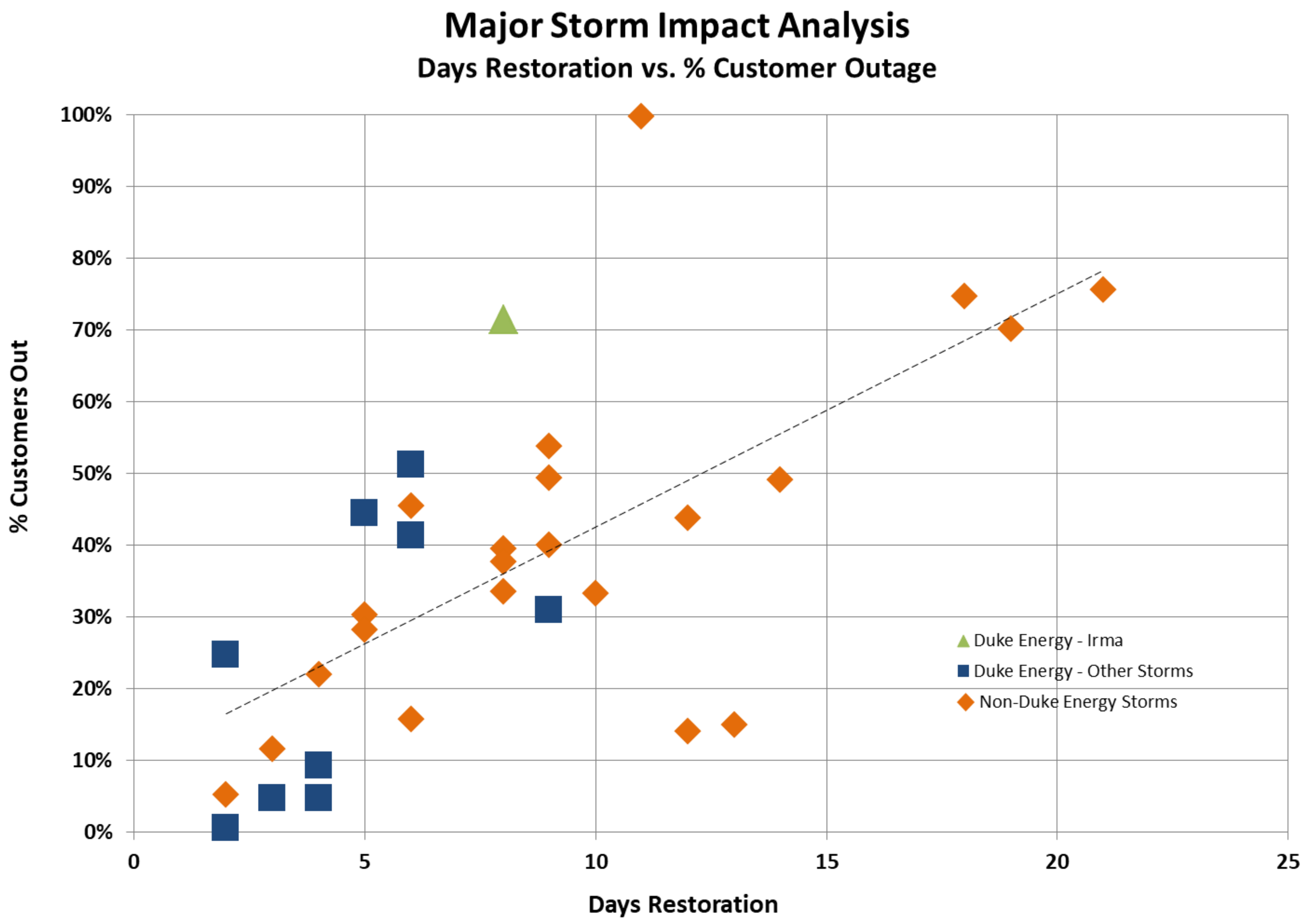
BENCHMARK RESULTS



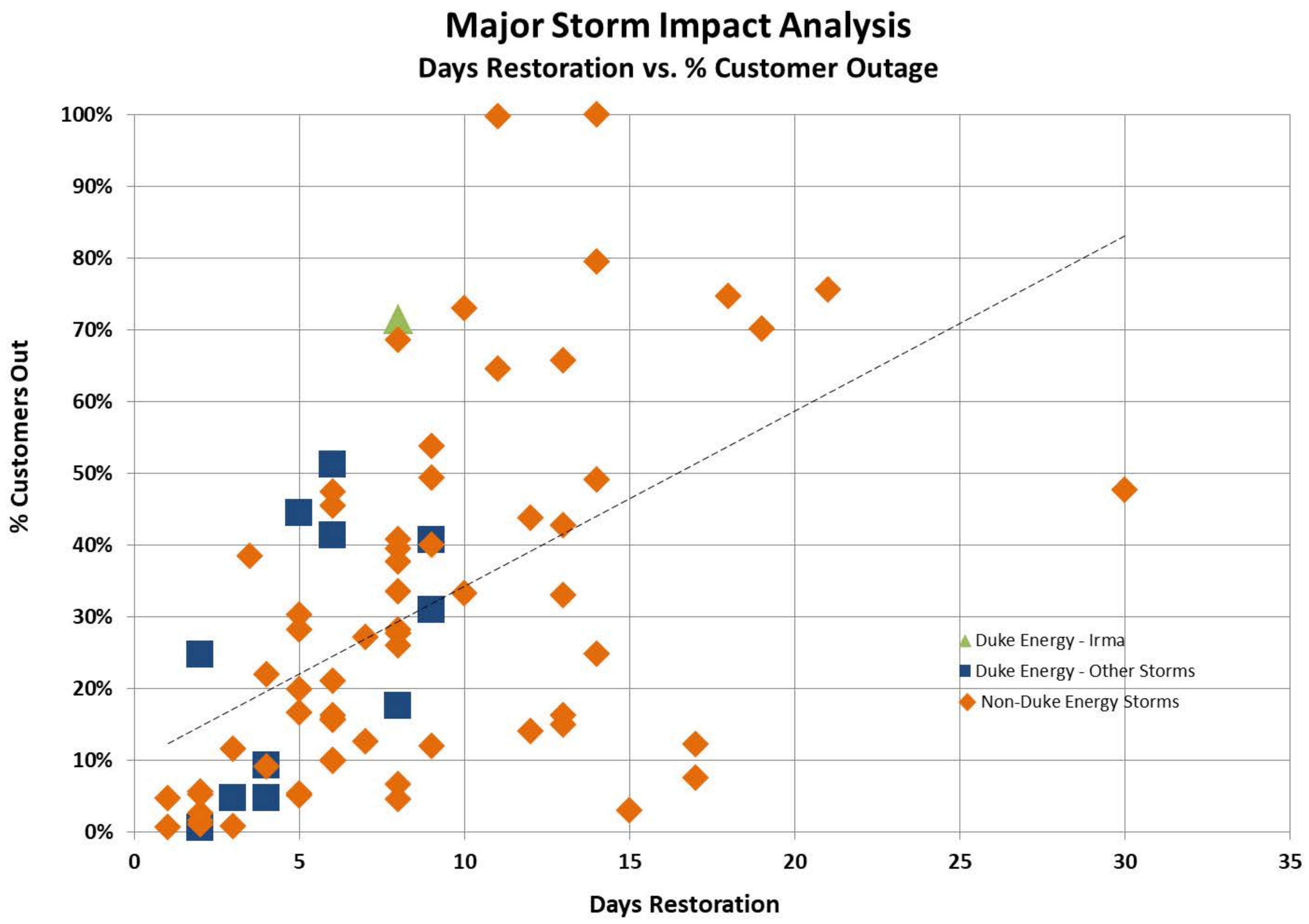
BENCHMARK RESULTS



BENCHMARK RESULTS– ALL HURRICANES



BENCHMARK RESULTS– ALL RESTORATIONS



FINDINGS

Based on the high-level benchmark analysis:

- Duke Florida experienced less damage to its infrastructure when compared to similar events
  - Number of poles replaced per customers out at peak is relatively low despite the high percentage of customers being affected
  - This could indicate that the storm caused more of “wire” damage than “pole” failures, which can be interpreted that the infrastructure withstood the storm fairly well
- Duke Florida’s Hurricane Irma restoration cost per customer out and per pole replaced was higher but the company restored power to all customers faster than comparable events
  - In comparison to other hurricanes in Accenture’s database, The Company aggressively deployed a large contingent of resources for this storm.

FORENSICS ANALYSIS

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METHODOLOGY

Analyze **broken pole data** through visualizations

Compare **broken pole data to distribution wood pole inventory** to identify factors that contributed to pole failure

Use **regression analyses** to test the correlations between potential pole failure factors and the rate of pole failure by circuit

Factors Considered:

- wind
- gust
- manufactured year
- pole height
- last inspection date
- vegetation level

ASSUMPTIONS

- ✓ All data used including Broken Pole Forensics, GIS Inventory and Inspection data provided by Duke Energy
- ✓ Used Equip_ID and Cust_Data_ID to integrate Broken Pole Forensics, GIS Inventory and Inspection data
- ✓ Assumed that GIS contains a full inventory of Duke owned poles
- ✓ **526** broken wood poles were included in the forensic analysis out of a total of 1,841 distribution poles that were broken during the event
- ✓ Poles that had incomplete data were excluded from this population

DATA COLLECTION

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Broken Poles Included in Forensic Analysis

1,841 Total Broken Distribution Poles

687 Total Unique Broken Poles Sampled
— **114** Broken Poles not Duke, not Distribution, or not made of wood =

573 Distribution Broken Poles

- **47** Not Matched to GIS data =

526 Broken Poles Total
471 Broken Poles with Forensic Data

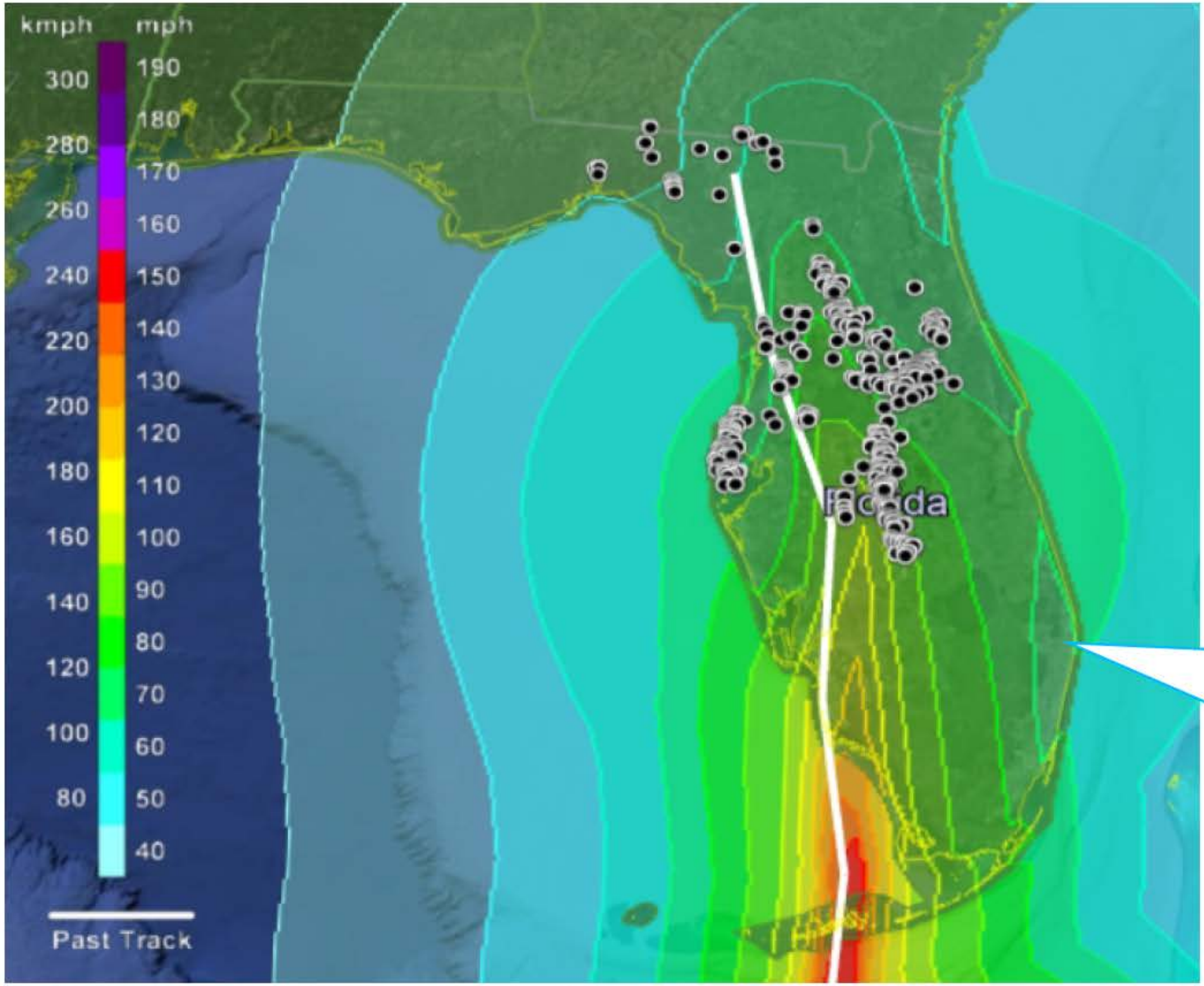
Pole Inventory – Duke Florida

1,083,388 Total Unique Pole Records

— **257,655** Transmission
— **99,469** Not Wood
— **624** Non Duke =

725,640 Total Distribution wood poles

BROKEN POLE VISUALIZATIONS



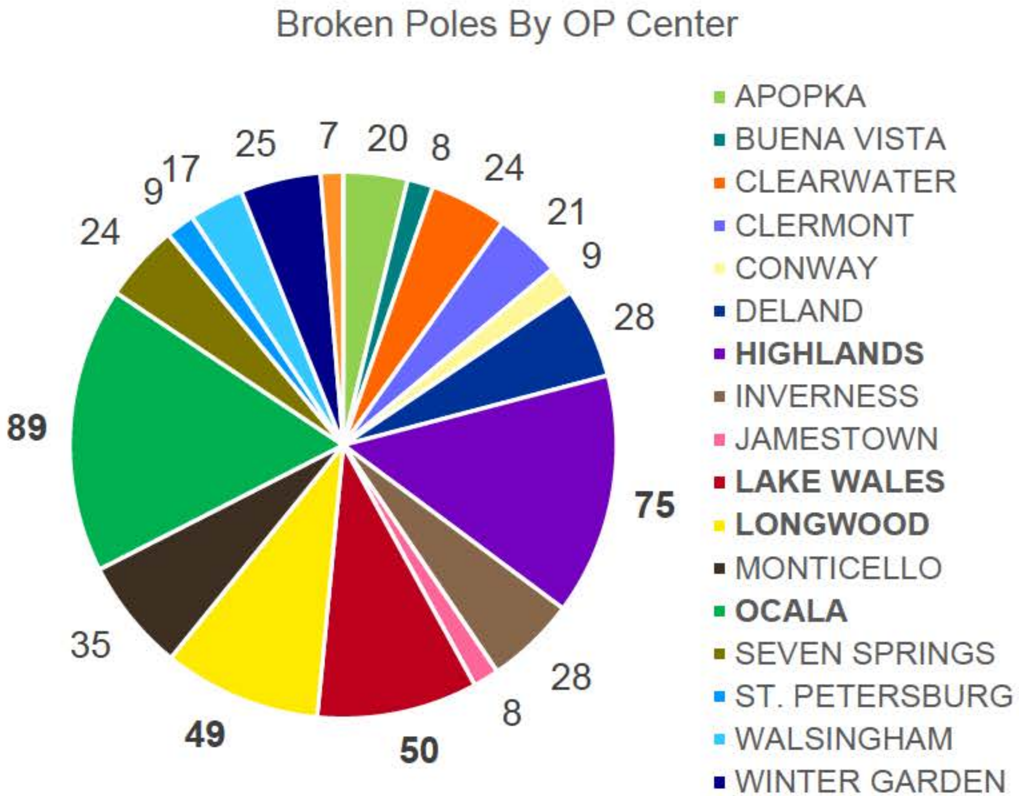
https://data.humdata.org/dataset/hurricane-irma-windspeed

526 Broken Poles

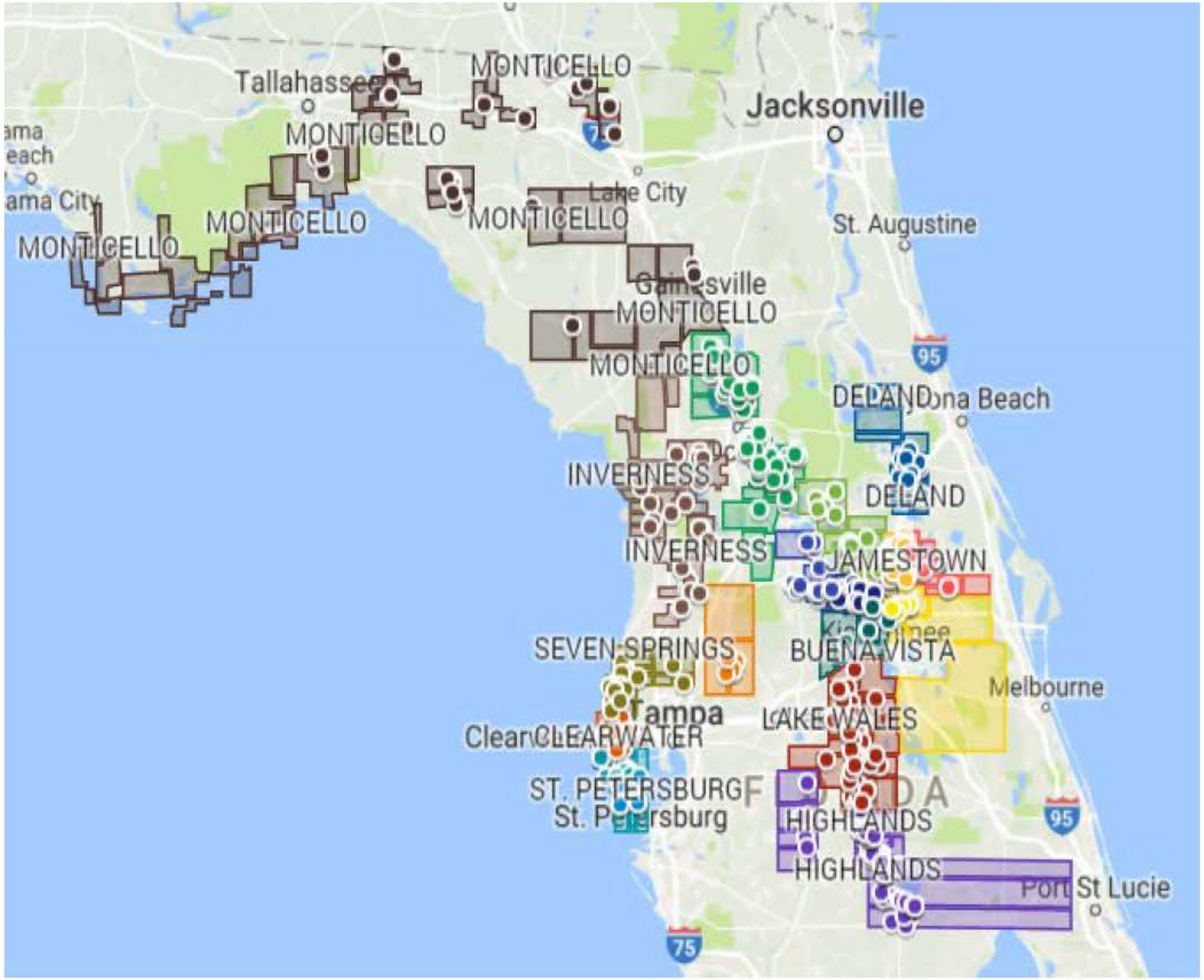
Irma Path
9/11 12am – 12pm

BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA



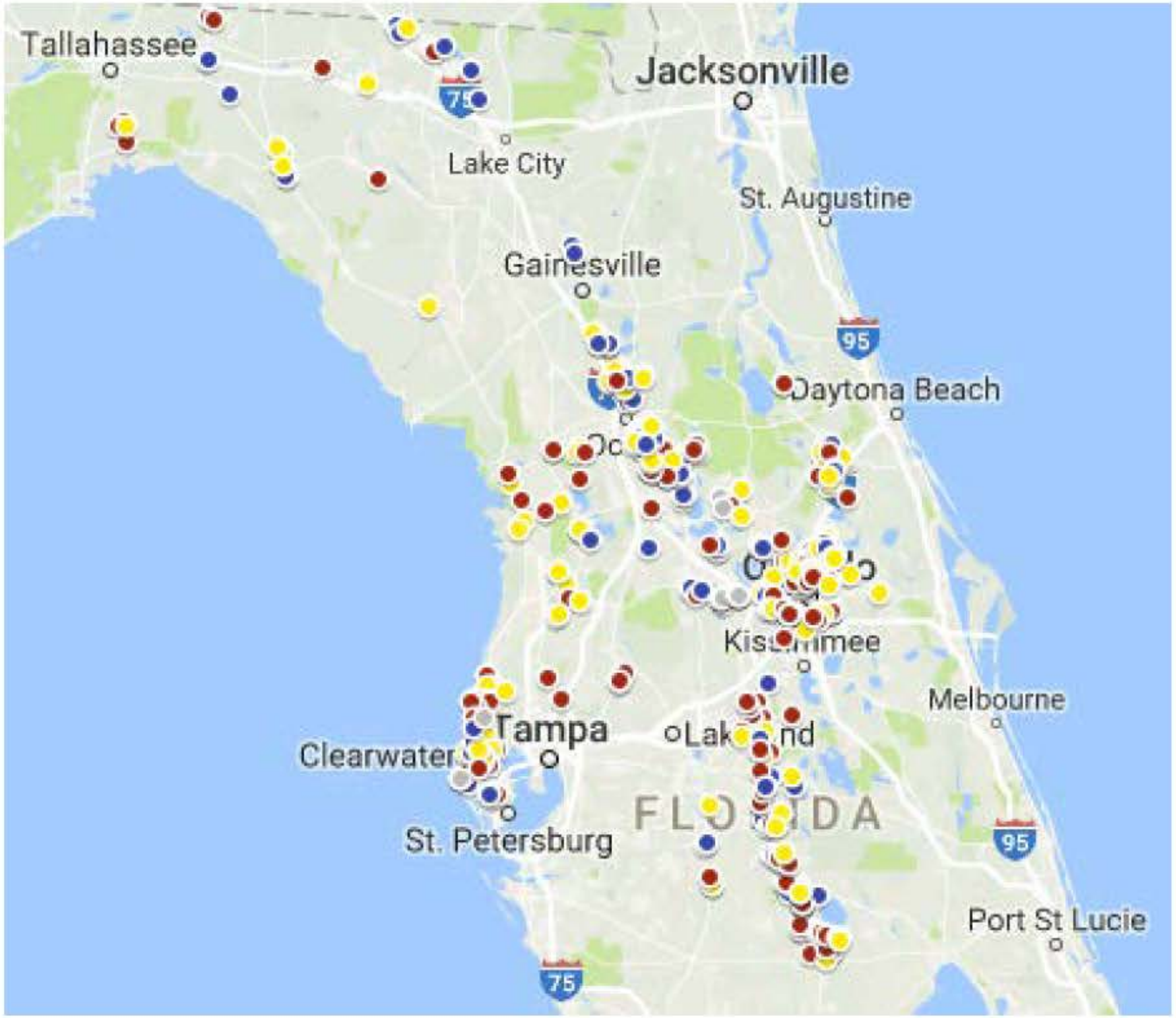
Total 526 Poles



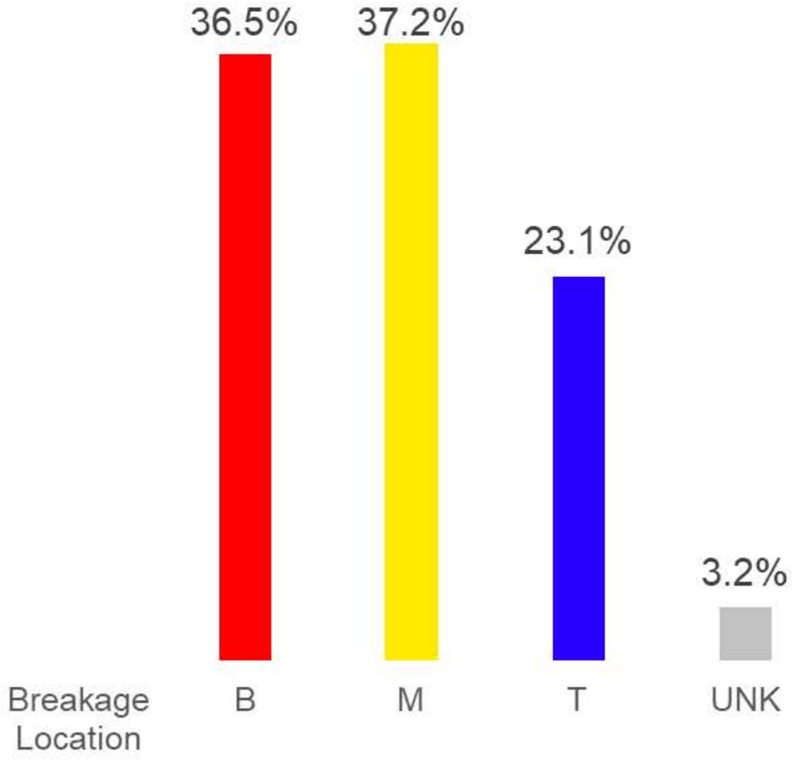
50% of broken pole data came from **Ocala**, **Highlands**, **Lake Wales** and **Longwood** OP Centers

BROKEN POLE VISUALIZATIONS

DUKE ENERGY FLORIDA



- **37.2%** of poles broke in the middle

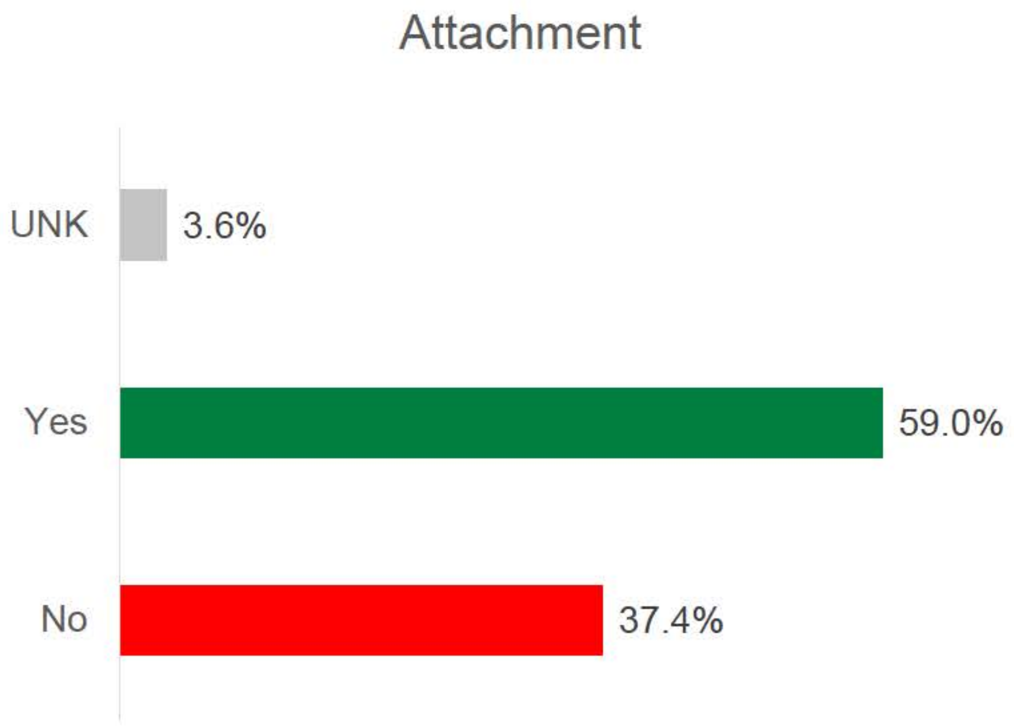


Total 471 Poles

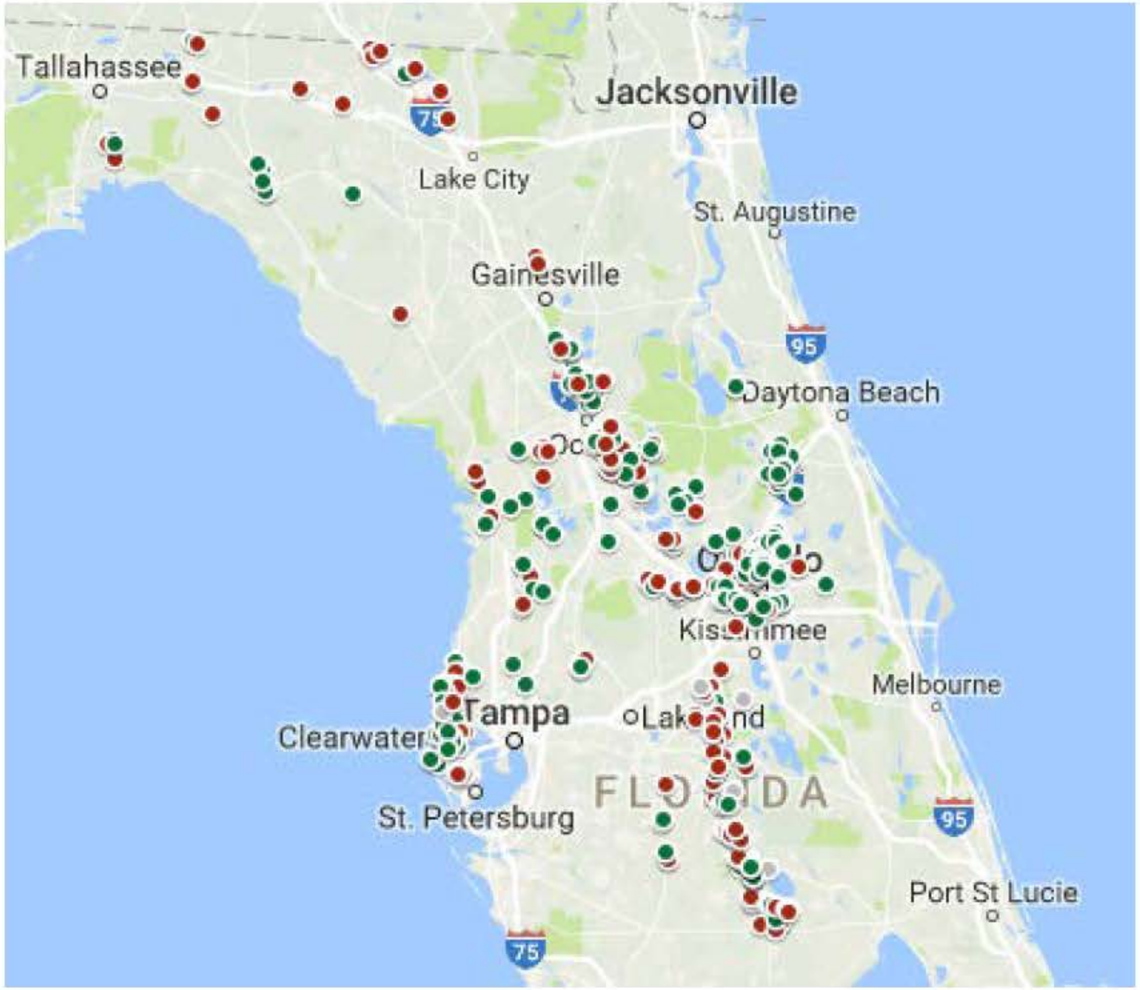
***66 poles that broke at the bottom did not have reject status information**

BROKEN POLE VISUALIZATIONS

59% of broken poles had an attachment

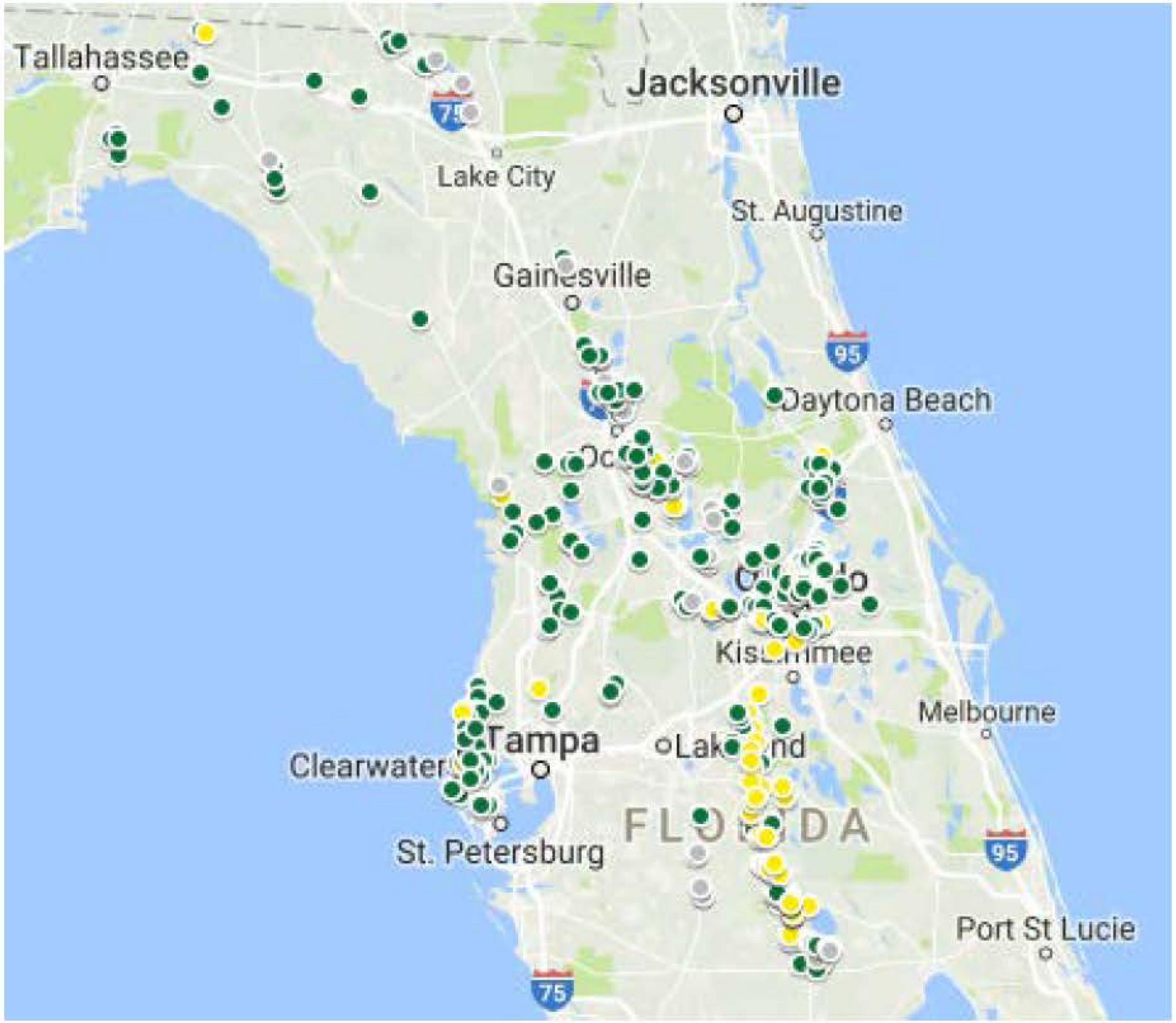


Total 471 Poles

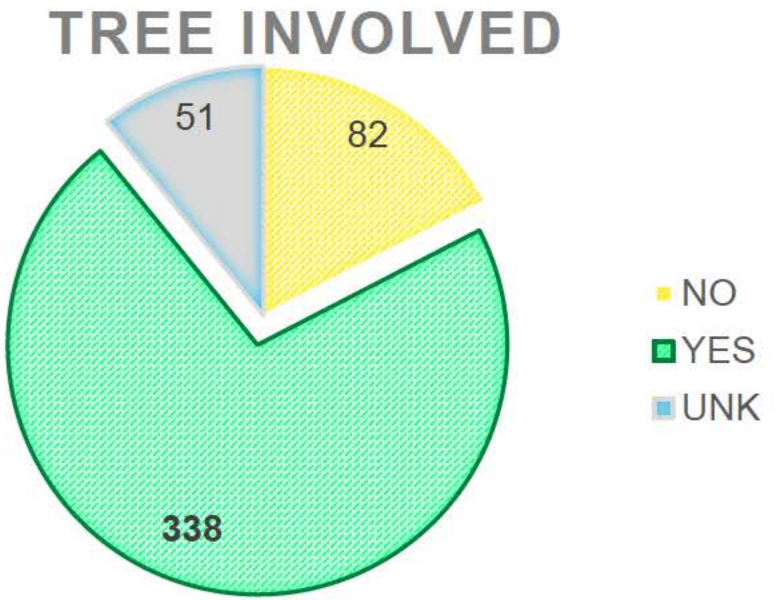


BROKEN POLE VISUALIZATIONS

DUKE ENERGY. FLORIDA

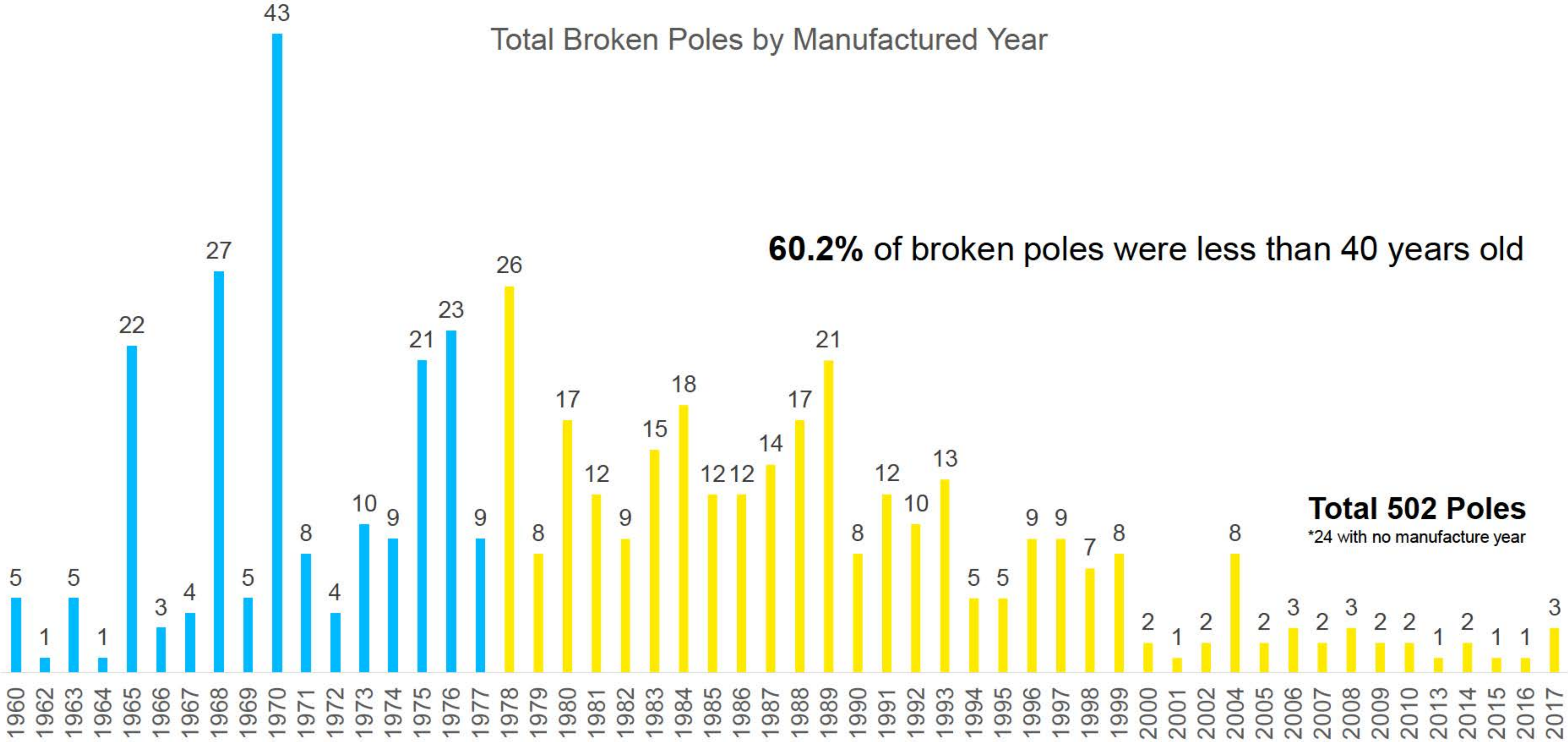


71.8% of broken poles had a tree involved

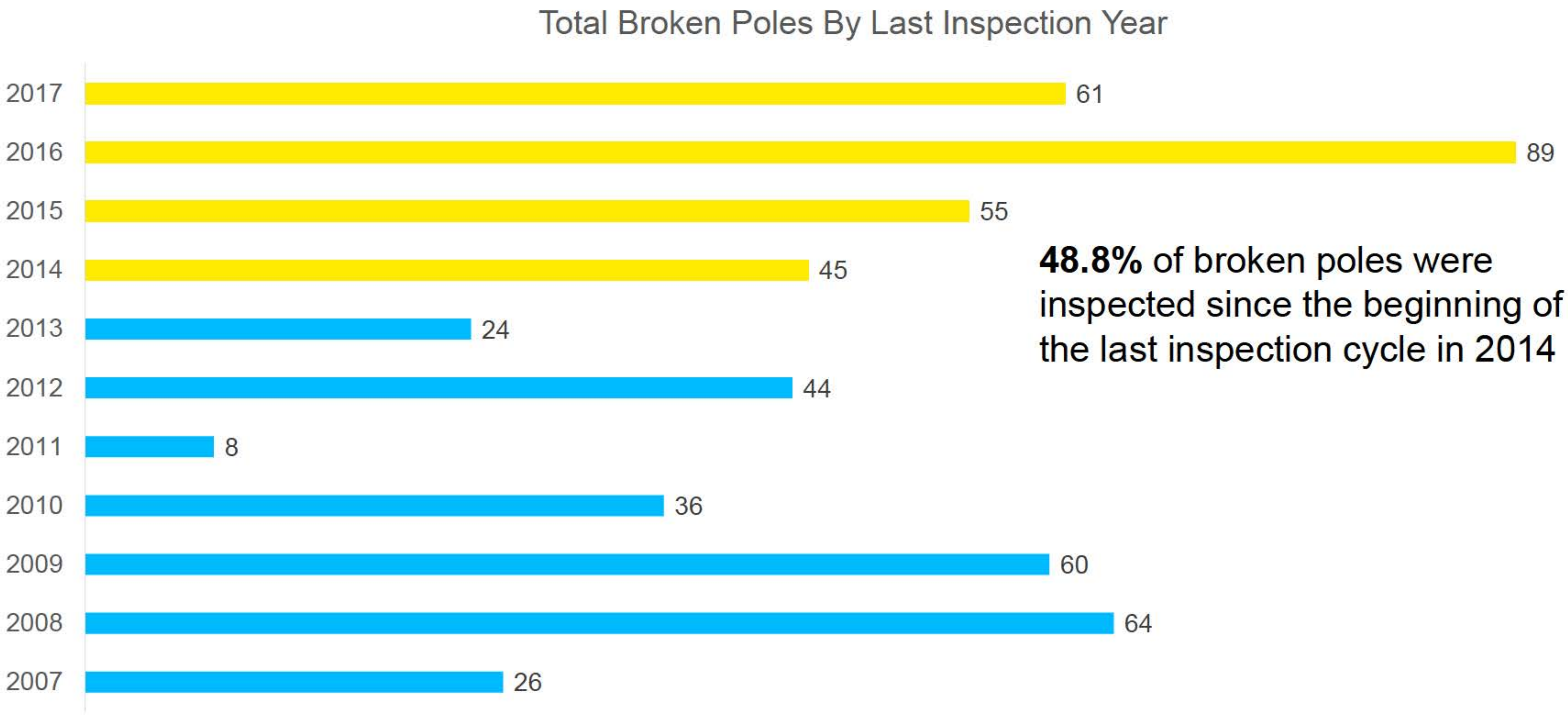


Total 471 Poles

BROKEN POLE VISUALIZATIONS



BROKEN POLE VISUALIZATIONS



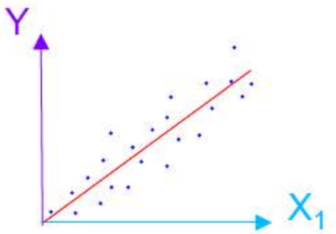
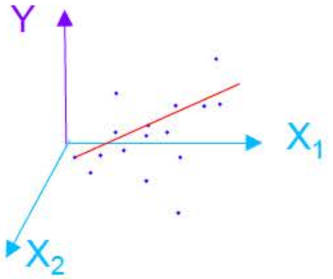
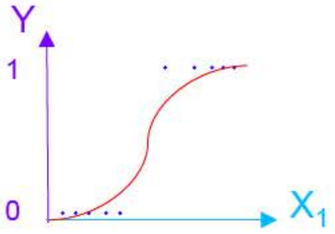
48.8% of broken poles were inspected since the beginning of the last inspection cycle in 2014

Total 512 Poles

*14 with no inspection year

INTRO TO REGRESSION ANALYSES

Regression analysis is a way of mathematically determining the relationship between two or more variables. In our analysis we employ three types of regression analyses.

Type of Regression	Model Design	Why we use it
Simple Linear Regression 	Y = Intercept + Correlation * X_1 + Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor (wind, gust, manufactured year, last inspection, off cycle)	▪ Determine correlation between each individual pole failure factor and pole failure rate
Multiple Linear Regression 	Y = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Percent Pole Failure by Circuit X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. max off cycle	▪ Consider the impact of the combination of all pole failure factors on percent pole failure rate ▪ Determine which factors compared to others have the most predictive power
Multiple Logistic Regression 	$\text{Log}\left(\frac{Y}{1-Y}\right)$ = Intercept + Correlation * X_1 + Correlation * X_2+ …+ Error Y = Likelihood of failing with tree involved X_1 = Pole Failure Factor i.e. wind speed … X_n = Pole Failure Factor i.e. attachment	▪ Given that a pole fails, determine what factors were contributed to it having a tree involved

INTERPRETING REGRESSION RESULTS

There are multiple measures we can look at to understand the results of linear regression, including the **Correlation Coefficient Estimate**, associated **P Values**, and **R^2 Value**. Consider the example below:

Example Results:

Y = Intercept + **Correlation** * X_1 +…+ Error

Y = Percent Pole Failure by Circuit
X_1= Pole Failure Factor i.e. Avg Pole Height

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	**-2.979e-05**	**0.01267***

Correlation Coefficient Estimate – This value denotes the relationship between the potential pole failure factor and pole failure rate. A positive value indicates that factor and pole failure are directly related (i.e. taller poles are associated with a higher pole failure rate). A negative value indicates that the factor and pole failure are inversely related (i.e. taller poles are associated with a lower pole failure rate).

P Value – The P value of a correlation coefficient estimate helps us understand how confident we can be in the correlation coefficient estimate. In our regression analysis, it is the probability that we falsely determine a correlation between the pole failure factors and pole failure rate with our sample data, given that there is no correlation. A small p value (typically <0.05) indicates a statistically significant correlation coefficient estimate.

In our results if:

P <.05 the p value is marked with a '*'
P < .01 the p value is marked with a '**'
P < .001 the p value is marked with a '***'

R^2 Value – The R^2 value is a measure that is used to determine how well the regression model fits the observed data set. It is the proportion of variance in percent pole failure that is explained by the model. R^2 values range from 0-1. The closer this value is to 1, the higher the model's predictive power of observed pole failure rates.

POLE FAILURE FACTORS CONSIDERED

In our regression analysis, we measure the following pole failure factors against the **average percent pole failure by circuit**.

Factor (by circuit)	Description	Minimum	Maximum	Median	Sample
Max Wind (mph)	Maximum wind speed experienced by a pole on the circuit measured from the closest weather center	15.8	70.2	41.4	1,215 circuits
Max Gust (mph)	Maximum gust speed experienced by a pole on the circuit measured from the closest weather center	20	88.6	58.4	1,083 circuits
Avg Manufactured Year	Average manufactured year by circuit	1963	2014	1987	1,235 circuits
Avg Height (ft.)	Average pole height by circuit measured in feet	16	52	39	1,269 circuits
Avg Last Inspection Year	Average pole last inspection year from consolidated inspection data	2007	2017	2013	1,249 circuits
Vegetation Management	Off cycle circuits given a value of 1. On cycle circuits given a value of 0.	0	1	0	1,248 circuits

SIMPLE LINEAR REGRESSION: MAX WIND

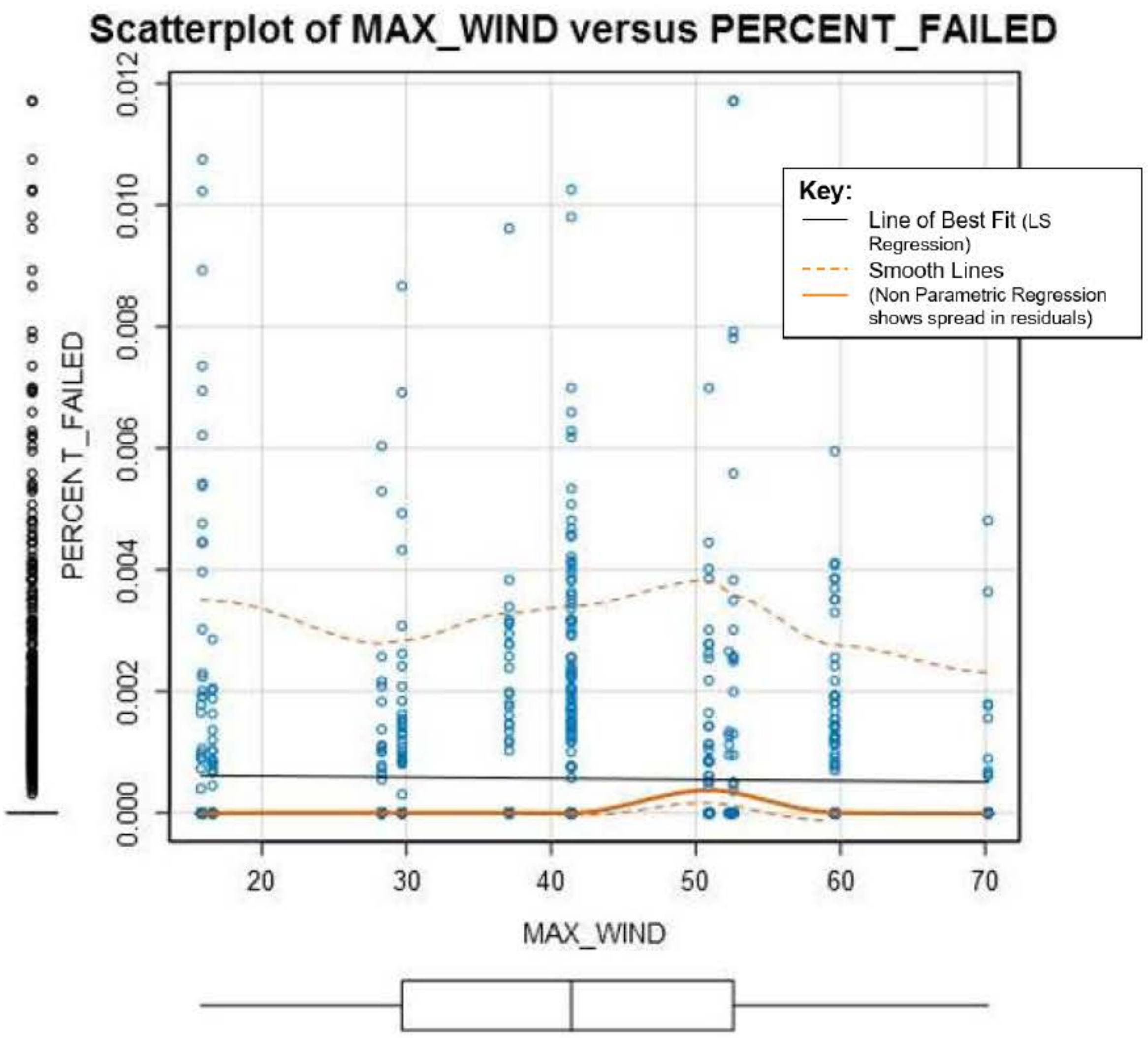
Data Summary

Variable	Min	Max	Median	Sample Size
Max Wind (x)	15.8 mph	70.2 mph	41.4 mph	1,215 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	6.498e-04	2.97e-08***
Max Wind	-2.038e-06	0.44725

- No statistically significant relationship between max wind experienced by a circuit and pole failure rate (P = 0.44725 >0.05)
- Data suggests other factors contributed to distribution pole failure



SIMPLE LINEAR REGRESSION: MAX GUST

Data Summary

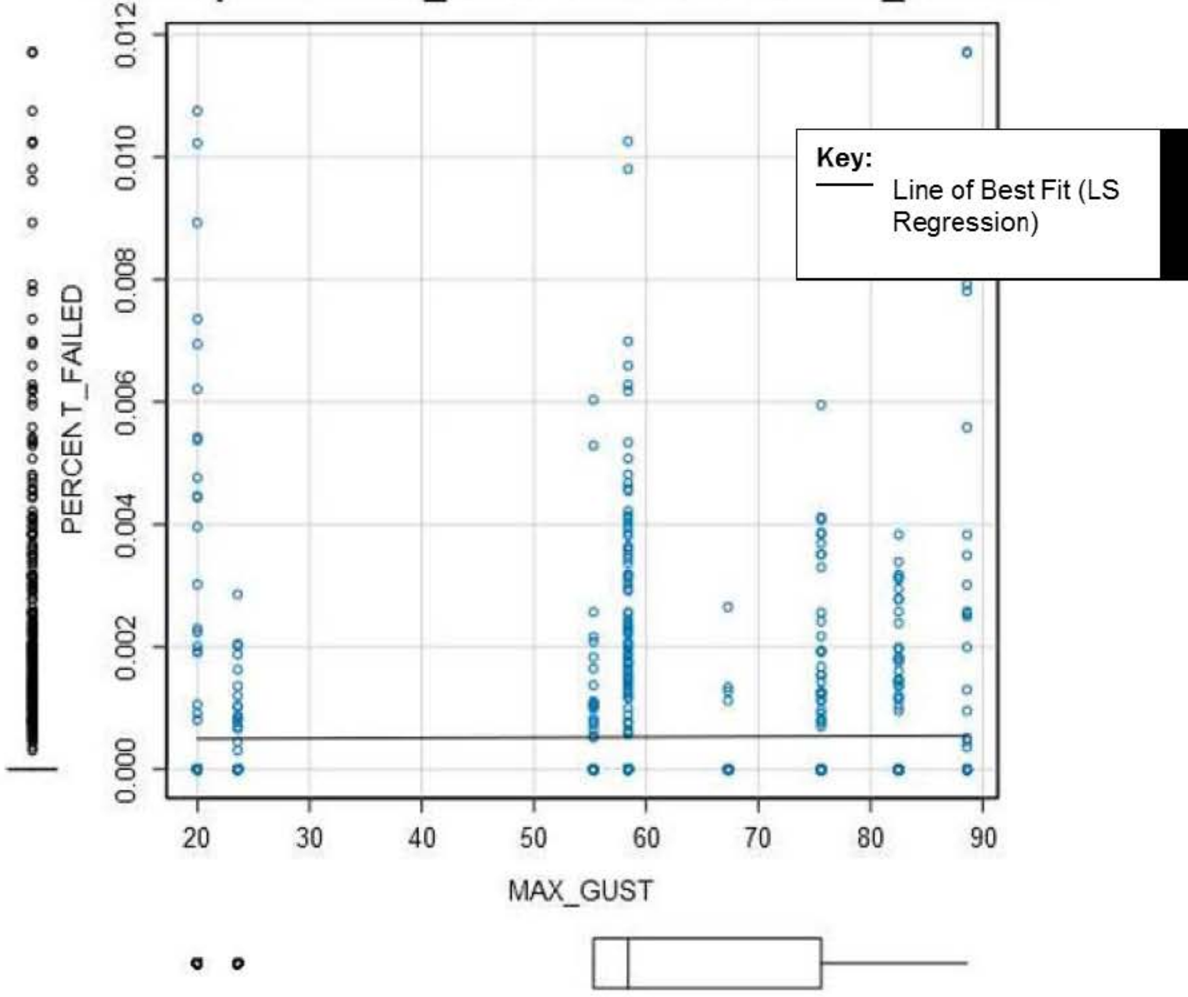
Variable	Min	Max	Median	Sample Size
Max Gust (x)	20 mph	88.6 mph	58.4 mph	1,083 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.836e-04	0.00016***
Max Gust	7.601e-07	0.71111

- No statistically significant relationship between max gust experienced by a circuit and percent pole failure (P = 0.71111 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of MAX_GUST versus PERCENT_FAILED



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SIMPLE LINEAR REGRESSION: AVG MANUFACTURED YEAR

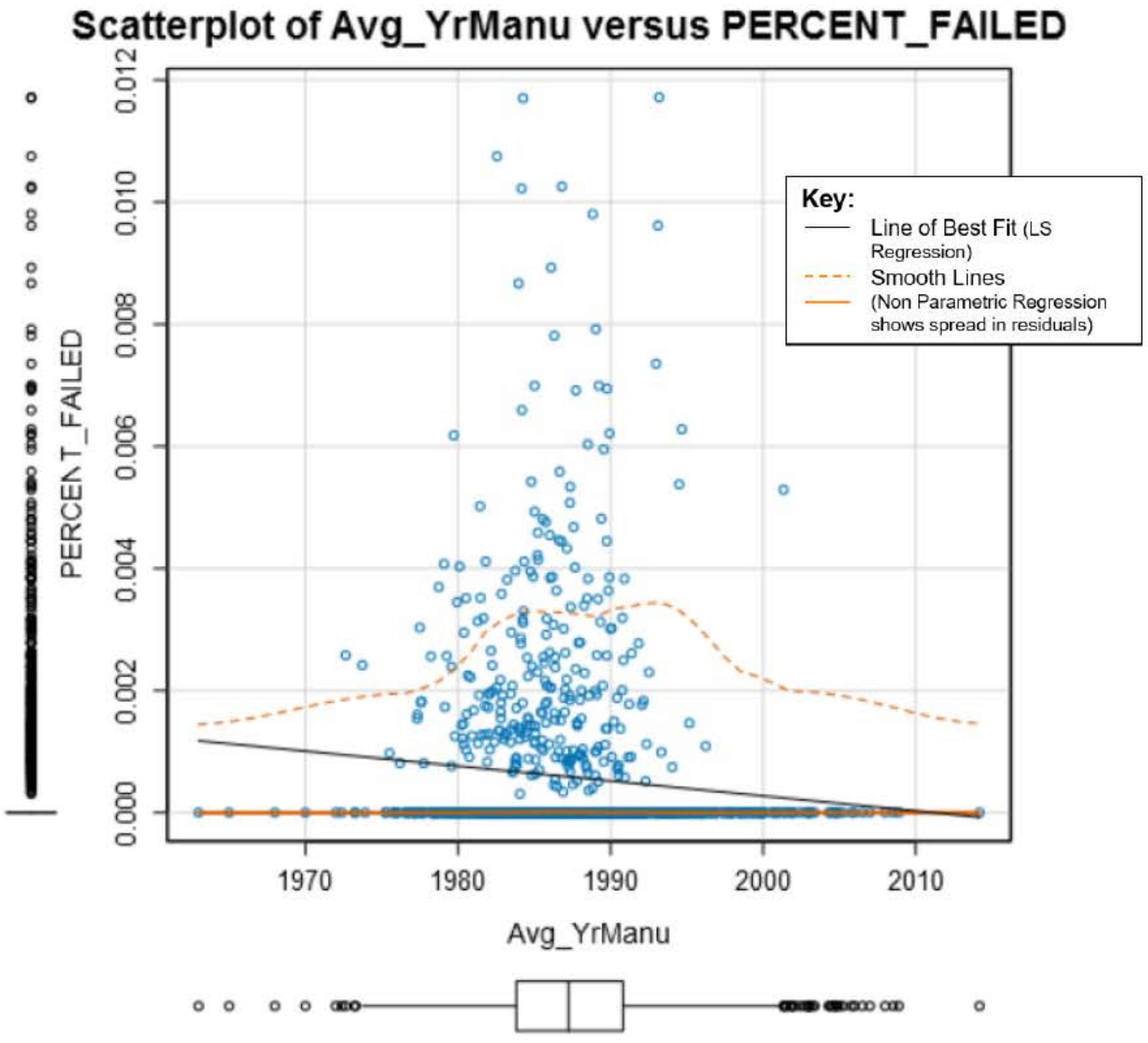
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Manufactured Year (x)	1963	2014	1987	1,235 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	4.925e-02	0.00043***
Avg Manufactured Year	-2.449e-05	5e-04***

- There is a statistically significant relationship between average manufactured year of a circuit and percent pole failure. (P = 0.0005 <0.05)
- Data suggests circuits with newer poles on average are associated with lower pole failure rates*.



*Note: This analysis does not consider reinforcement of older poles.

SIMPLE LINEAR REGRESSION: AVG POLE HEIGHT

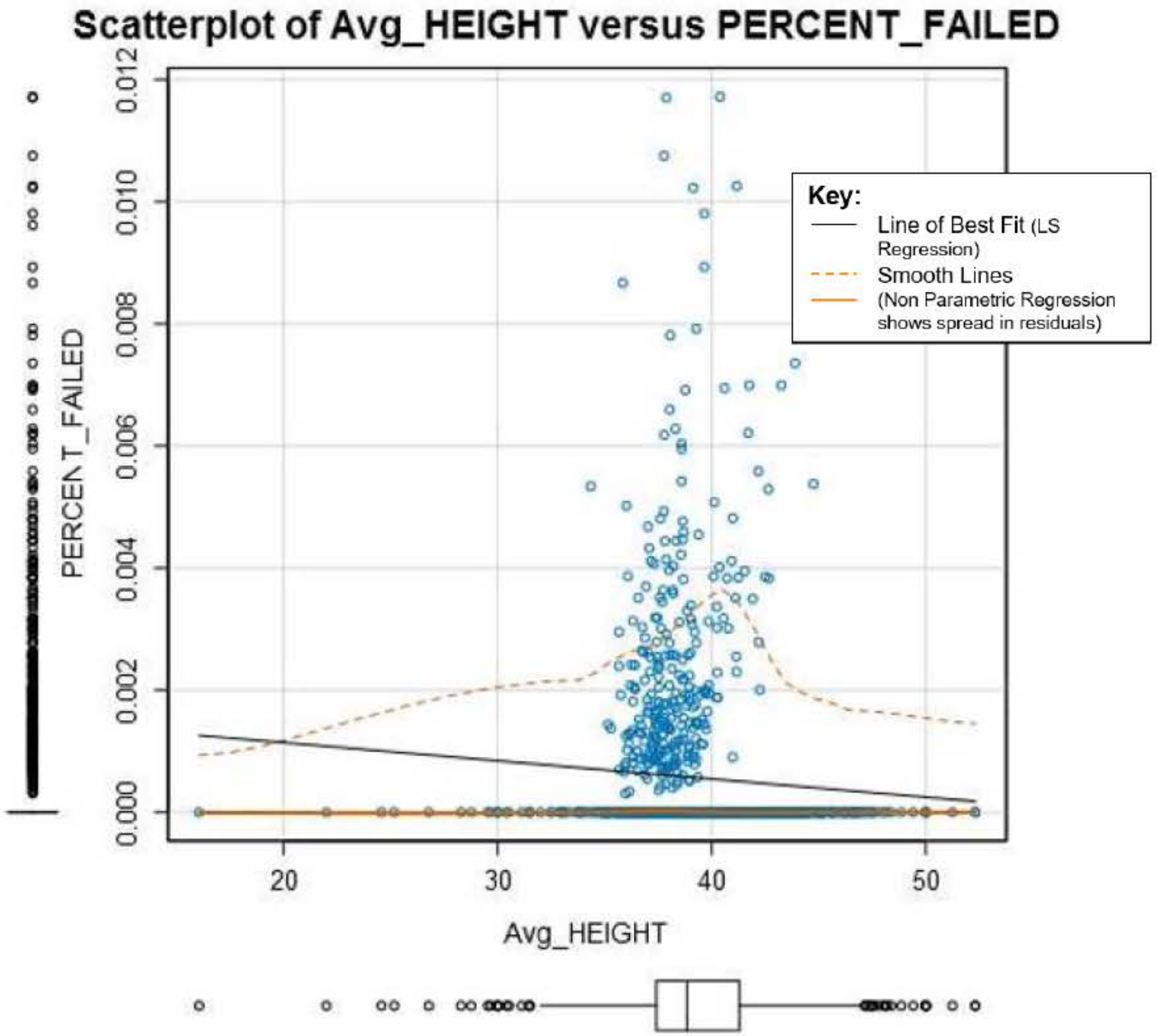
Data Summary

Variable	Min	Max	Median	Sample Size
Avg Pole Height (x)	16 ft.	52 ft.	39 ft.	1,269 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	1.734e-03	0.00025***
Avg Pole Height	-2.979e-05	0.01267*

- There is a statistically significant relationship between average pole height of a circuit and percent pole failure. (P = 0.01267 <0.05)
- Data suggests circuits with taller average pole heights are associated with lower pole failure rates.



SIMPLE LINEAR REGRESSION: AVG LAST INSPECTION YEAR

Data Summary

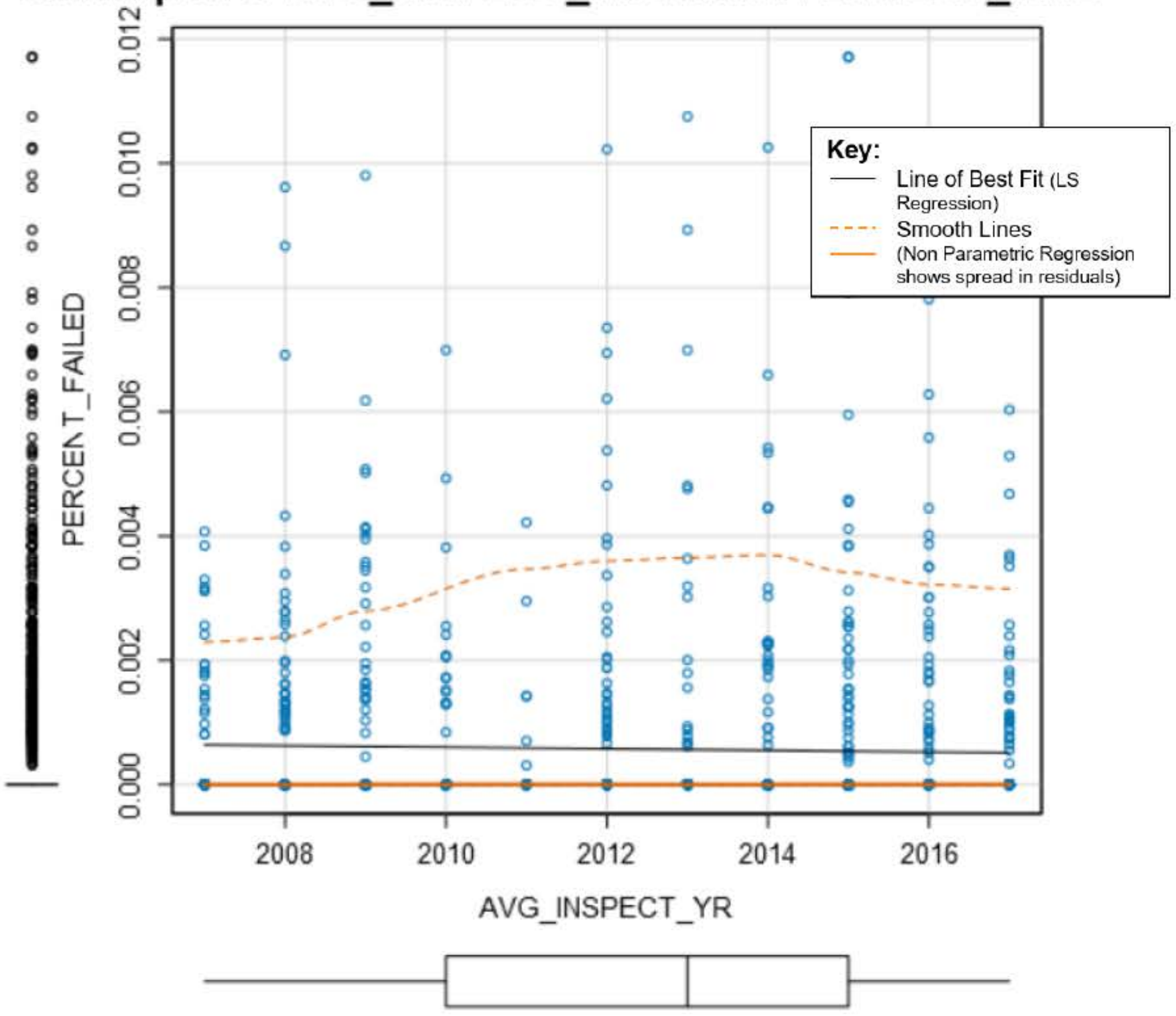
Variable	Min	Max	Median	Sample Size
Avg Inspection Year (x)	2007	2017	2013	1,249 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	2.629e-02	0.33208
Avg Inspection Year	-1.278e-05	0.34264

- No statistically significant relationship between average last inspection year of a circuit and percent pole failure (P = 0.34264 >0.05)
- Data suggests other factors contributed to distribution pole failure

Scatterplot of AVG_INSPECT_YR versus PERCENT_FAIL



DUKE ENERGY. FLORIDA

SIMPLE LINEAR REGRESSION: VEGETATION MANAGEMENT

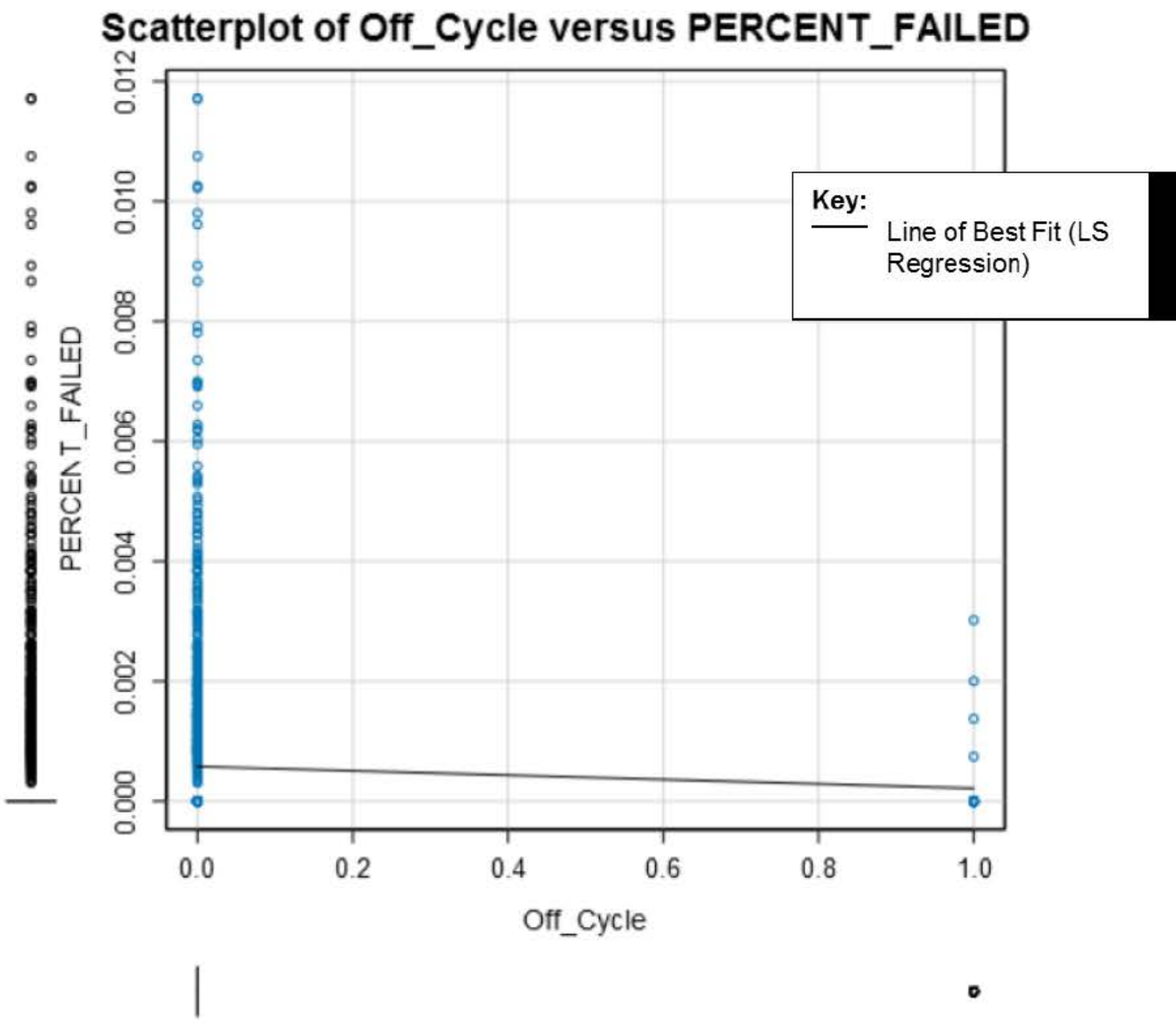
Data Summary

Variable	Min	Max	Median	Sample Size
Off Cycle* (x)	0	1	0	1,248 circuits
Percent Failed (y)	0.000	0.012	0.000	

Results

	Estimate	P Value
Intercept	0.0005788	<2.2e-16***
Off Cycle	-0.0003623	0.15662

- No statistically significant relationship between whether or not the vegetation maintenance of a circuit is on cycle or off cycle and the percent pole failure. (P = 0.157 >0.05)
- Data suggests other factors contributed to distribution pole failure.



*Note: This survey does not provide an assessment of degrees of off-cycle trimming, and other aspects of the VM program, (i.e., hot spot trimming and periodic inspections that are performed to ensure that reliability is not at risk).

MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Height + Last Inspection Yr.+ Max Off Cycle

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187 circuits	-1.731e-05	0.00254**
Max Gust	20 mph	88.6 mph	58.4 mph		7.011e-06	0.0794
Avg Manufactured Year	1963	2014	1987		-3.439e-05	0.00051***
Avg Height	22 ft.	55 ft.	39 ft.		-8.495e-06	0.59495
Avg Last Inspection Year	2007	2017	2013		3.038e-05	0.07384
Vegetation Management	0	1	0		-1.292e-04	0.6689

Results: While the correlations between max wind and average manufactured year versus pole failure rate are statistically significant, these factors are not the only contributors to pole failure.

- Higher average max winds are found to be associated with lower percent failure rates ($P=0.0025<0.05$). Circuits that have newer poles on average are also associated with a lower percent failure rates ($P=0.00051<0.05$).
- Gust, Height, Inspection Year and Vegetation Maintenance do not have statistically significant correlation coefficient estimates, suggesting that they are not highly correlated with pole failure rate by circuit.
- The Adjusted R^2 value of the model is 0.01619. Thus only 1.62% of the variation in observed pole failure rates by circuit is explained by our model. This indicates that other factors contributed to pole failure than those included in the model.
- Differing results from simple regression analysis can be explained by difference in samples as well as potential correlation between explanatory variables.

OPTIMIZED MULTIPLE LINEAR REGRESSION ON ALL POLE DATA

Percent Failure By Circuit ~ Wind + Gust + Manufactured Yr. + Inspection Yr.

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind	15.8 mph	70.2 mph	41.4 mph	1,187	-1.696e-05	0.00292**
Max Gust	20 mph	88.6 mph	58.4 mph		7.023e-06	0.07857
Avg Manufactured Year	1963	2014	1987		-3.737e-05	2e-05***
Avg Last Inspection Year	2007	2017	2013		3.165e-05	0.0603

Results: When optimizing the previous multiple linear regression model, the best predictors of pole failure are max wind and gust, along with the average manufactured year and inspection year.

- Again, higher average max winds are found to be associated with lower percent failure rates ($P=0.003<0.05$). Circuits that have newer poles on average are associated with a lower percent failure rates ($P=0.00002<0.05$).
- Adjusted R^2 value is 0.01767. Thus only 1.77% of variation in percent pole failure is explained by the model, still suggesting that there are other explanatory variables not captured.

MULTIPLE LOGISTIC REGRESSION ON BROKEN POLE DATA

Failure by Tree ~ Max Wind + Manufactured Year + Height + Last Inspection + Breakage Location + Attachment

Factor	Minimum	Maximum	Median	Sample Size	Estimate	P Value
Max Wind (mph)	15.8	70.2	37.1	384	-0.04031	9e-05***
Manufacture Year	1960	2017	1980		0.01710	0.17221
Height (ft.)	30	55	40		-0.1005	0.00029***
Last Inspection Year	2007	2017	2012		-0.10610	0.01527*
Breakage Location (T=3, M=2, B=1)	1	3	2		0.08490	0.65284
Attachment (Y=1, N=0)	0	1	0		1.55611	1e-05***

Results:

- When considering the above factors on the likelihood that a failed pole had a tree involved; max wind, height, last inspection year, and attachment are statistically significant factors.
- Poles with attachments were more likely to fail by mode of tree.

RESULTS SUMMARY: REGRESSION

Simple

- Max wind, max gust, average last inspection year and off cycle vegetation maintenance did not have a statistically significant correlation with pole failure rate by circuit.
- Circuits with a taller average pole height were more likely to have a lower pole failure rate.
- Circuits with newer poles were associated with lower pole failure rates.

Multiple

- Average pole manufactured year and max wind speed were the best indicators of pole failure rate by circuit.
- Circuits with older poles were associated with higher pole failure rates.
- Circuits that experienced lower wind speeds were associated with higher pole failure rates. This counterintuitive result could be due to the difficulties collecting wind data at all pole locations.
- Pole height, inspection year, and vegetation management level are likely not good indicators of pole failure.

Overall

- Simple regression and multiple regression models did not have high predictive power of pole failure rates, suggesting that there are unaccounted for explanatory factors captured in the error term of our models.
- **Model Improvements:**
  - Potential explanatory factors to consider further would be vegetation density, height and proximity of vegetation to distribution facilities, rainfall, reject status and wind direction, etc.
  - Improve wind data accuracy (gust, wind, GPS related data)
  - Consistent data across all poles for all fields/ Confirm randomized sampling

STORM HARDENING

accentureconsulting

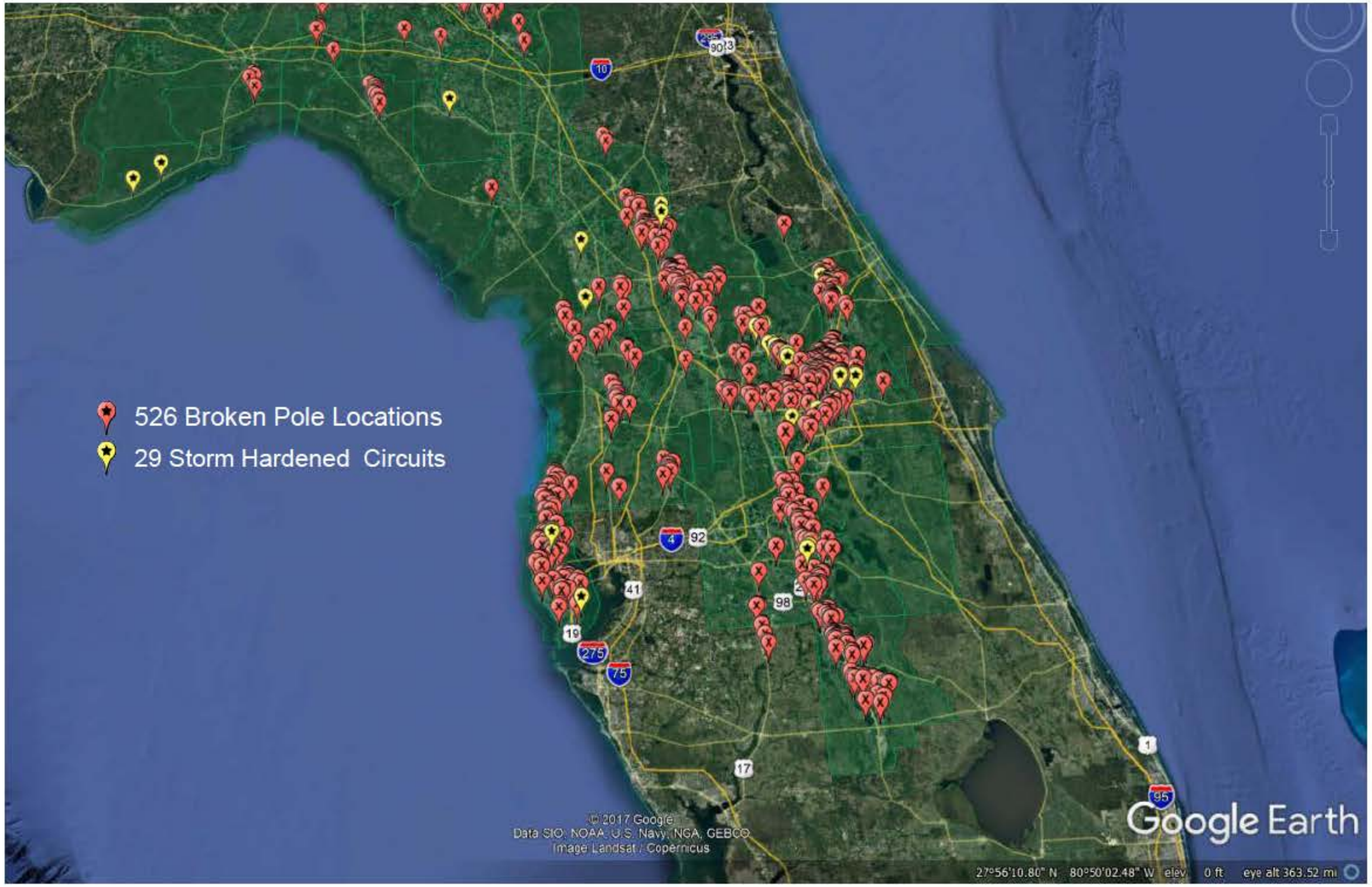
METHODOLOGY/APPROACH

- Duke FL performed storm hardening on a number of distribution line sections since 2006
- Determined if any poles that failed during Hurricane Irma were a part of the storm hardened circuits by:
  - Mapping broken poles that were reviewed by the forensics team
  - Overlaying storm hardened projects
  - Identifying if any broken poles were a part of the storm hardened projects

DATA COLLECTION

DUKE ENERGY. FLORIDA

- A sample set of broken pole data was collected by Duke FL's forensics team
- This information included:
  - EQUIP ID
  - POLE TAG
  - ADDRESS
  - DAMAGE COMMENTS
  - Birth Year
  - Last Inspect
  - Where did pole break? Top (T), Middle (M), Base (B)
  - Was Tree Involved?
  - ATTACHMENTS (Y/N)
  - EQUIPMENT(STA,RCL,SCT)
  - POLE BRACED?
  - OP CTR
- Matched broken pole data within GIS system to associate Latitude and Longitude coordinates
- Identified 29 storm hardening projects and mapped them with the broken pole data set



RESULTS SUMMARY: SYSTEM HARDENING ANALYSIS

- A forensic assessment of five hundred twenty-six (526) randomly selected poles was made across DEF's total broken pole population. None of these poles were a part of the 29 Storm Hardening projects.
- A separate assessment of twenty-nine (29) randomly selected Storm Hardening projects was made. No broken poles were identified.
- Initial findings led the team to believe there was one pole that failed in the North Central Zone, Mercers Fernery Rd storm hardening project, but further analysis showed it was not a part of the project

North Central - Mercers Fernery Rd

Exhibit C

DUKE ENERGY FLORIDA
Confidentiality Justification Matrix

DOCUMENT/RESPONSES	PAGE/LINE	JUSTIFICATION
DEF’s Response to OPC’s Second Request for Production of Documents, question no. 14	Bates No. 20170272-DEF-OPC-POD 2-14-00002, mid-page, cell number and Skype number following email address of Justin B. Wagaman; also mid-page, the email address of Larry Bonner following his name. Bates No. 20170272-DEF-OPC-POD 2-14-00003, top of page, numbers in the Invoiced and Due columns of the Open Receivables table; cell number and Skype number following email address of Justin B. Wagaman in top half of page; also mid-page, the first email address in the Cc: line. Bates No. 20170272-DEF-OPC-POD 2-14-00005, mid-page, cell number and Skype number following email address of Justin B. Wagaman; also mid-page, the email address of Larry Bonner following his name; phone number below Larry Bonner’s name near bottom of page. Bates No. 20170272-DEF-OPC-POD 2-14-00007, mid-page, cell number and Skype number following email address of Justin B. Wagaman; also mid-page, the email address of Larry Bonner following his name. Bates No. 20170272-DEF-	§366.093(3)(d), F.S. The document in question contains confidential information, the disclosure of which would impair DEF’s efforts to contract for goods or services on favorable terms. §366.093(3)(f), F.S. The document in question contains confidential employee personnel information unrelated to compensation, duties, qualifications, or responsibilities.

	OPC-POD 2-14-00008, top half of page, cell number and Skype number following email address of Justin B. Wagaman; also mid-page, the email address of Larry Bonner following his name; phone number below Larry Bonner’s name near bottom of page. Bates No. 20170272-DEF-OPC-POD 2-14-00010, top half of page, cell number and Skype number following email address of Justin B. Wagaman; also mid-page, the email address of Larry Bonner following his name; phone number below Larry Bonner’s name near bottom of page. Bates No. 20170272-DEF-OPC-POD 2-14-00012, mid-page, cell number and Skype number following email address of Justin B. Wagaman; also bottom half of page, the email address of Larry Bonner following his name; phone number below Larry Bonner’s name near bottom of page. Bates No. 20170272-DEF-OPC-POD 2-14-00013, mid-page, cell number and Skype number following email address of Justin B. Wagaman; also bottom half of page, the email address of Larry Bonner following his name; phone number below Larry Bonner’s name near bottom of page. Bates No. 20170272-DEF-OPC-POD 2-14-0000131, all values under the column titles 2017 and TOTAL in the table.	

	Bates No. 20170272-DEF-OPC-POD 2-14-0000132, all values in Table 1 below column titles: Discount % and Bill Rates; in Table 2, the number in 2nd column, row 2017 and the total discount amount in the last row; in Table 3, the number in 2nd column, row 2017; in Table 4, the number in 2nd column, row 2017. Bates No. 20170272-DEF-OPC-POD 2-14-0000133, in the first table, all values in rows 1 through 4 in columns 1, 2, 13, 14 & 15; in the second table, the numbers in row 3, columns 3 and 4; in the third table, the numbers in row 3, columns 3 and 4; in the fourth table, the numbers in row 3, columns 3 and 4. Bates No. 20170272-DEF-OPC-POD 2-14-0000134, all values in rows 2 through 5 in columns 11, 12, 13, & 14.	

Exhibit D

AFFIDAVIT OF JASON CUTLIFFE

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for limited proceeding for recovery of incremental storm restoration costs related to Hurricanes Irma and Nate by Duke Energy Florida, LLC

Docket No. 20170272-EI

Dated: July 12, 2018

AFFIDAVIT OF JASON CUTLIFFE IN SUPPORT OF DUKE ENERGY FLORIDA, LLC'S REQUEST FOR CONFIDENTIAL CLASSIFICATION

STATE OF FLORIDA

COUNTY OF PINELLAS

BEFORE ME, the undersigned authority duly authorized to administer oaths, personally appeared Jason Cutliffe, who being first duly sworn, on oath deposes and says that:

1. My name is Jason Cutliffe. I am over the age of 18 years old and I have been authorized by Duke Energy Florida (hereinafter "DEF" or the "Company") to give this affidavit in the above-styled proceeding on DEF's behalf and in support of DEF's Request for Confidential Classification (the "Request"). The facts attested to in my affidavit are based upon my personal knowledge.

2. I am the Director of Power Quality and Reliability ("PQR") in DEF's Distribution Engineering organization. I am also the Planning Section Chief in DEF's

Incident Command Structure ("ICS") which affords rapid scalability in response to a specific event.

3. DEF is seeking confidential classification for information provided in response to the Office of the Public Counsel's ("OPC") Second Request for Production of Documents (Nos. 11-15), specifically question 14, filed on June 27, 2018 in this docket. The confidential information at issue is contained in confidential Exhibit A to DEF's Request and is outlined in DEF's Justification Matrix that is attached to DEF's Request as Exhibit C. DEF is requesting confidential classification of this information because it contains proprietary confidential business information, the disclosure of which would impair the Company's ability to protect proprietary business information, and also because disclosure would impair the Company's ability to contract on favorable terms.

4. Strict procedures are established and followed to maintain the confidentiality of the Company's employee information, as well as sensitive contractual information, which includes restricting access to those persons who need the information to assist the Company, and restricting the number of, and access to the information. At no time since receiving the information in question has the Company publicly disclosed that information. The Company has treated and continues to treat the information at issue as confidential.

5. This concludes my affidavit.

Further affiant sayeth not.

Dated the 12 day of July, 2018.

Jason Cutliffe
(Signature)
Jason Cutliffe
Director of PQR
Distribution Engineering Organization
Duke Energy
2166 Palmetto St.
Clearwater, FL 33765

THE FOREGOING INSTRUMENT was sworn to and subscribed before me this 12th day of July, 2018 by Jason Cutliffe. He is personally known to me, or has produced his ____________________ driver's license, or his ____________________ as identification.

(Signature)

Karla Rodriguez
(Printed Name)

(AFFIX NOTARIAL SEAL)

NOTARY PUBLIC, STATE OF Florida

6/18/2021
(Commission Expiration Date)

GG 115647
(Serial Number, If Any)

NOTARY PUBLIC STATE OF FLORIDA
KARLA RODRIGUEZ
Commission # GG 115647
Expires June 18, 2021
Bonded Thru Budget Notary Services