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Filing Date - 2025-03-03 03:00:09 PM

Control Number - 57579

Item Number - 61

SOAH DOCKET NO 473-25-11558
DOCKET NO. 57579

APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR APPROVAL OF ITS 2026-2028 TRANSMISSION AND DISTRIBUTION SYSTEM RESILIENCY PLAN	§ § § §	**BEFORE THE STATE OFFICE** **OF** **ADMINISTRATIVE HEARINGS**

March 3, 2025

Contact: Stacey Murphree
CenterPoint Energy Service Company, LLC
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Houston, Texas 77002
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CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
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TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-01

QUESTION:

Please provide electronic files supporting the exhibits, tables and testimony workpapers for each CEHE witness, including underlying calculations and assumptions.

ANSWER:

CenterPoint Energy

The majority of the source data used to populate the figures within CenterPoint's Application, Testimony, and System Resiliency Plan can be found in TCUC 01-01 Attachment 1 - 2026-2028 Resiliency Plan MASTER.xls.

Please also see attached Exhibit JWG 04 - Illustrative Carrying Costs.xls

Guidehouse

Please see spreadsheet TCUC 01-01 Attachment 2 CONFIDENTIAL.xls which provides underlying calculations and assumptions supporting derivation of BCA and CMI values for each applicable measure. The Guidehouse spreadsheet is provided under protective order.

In addition to the above spreadsheet for BCA and CMI values, please refer to sources cited in Exhibit ELS-2 and Mr. Shlatz's direct testimony for charts and tables Guidehouse relied upon to support results, findings and conclusions.

Guidehouse developed a qualitative comparative benefit analysis approach for the technology and the situational awareness resiliency measures. Please refer to sources cited in Exhibit ELS-2 (section 1.4, section 5.1.4.1, and section 5.8.3.6) and Mr. Baugh's direct testimony (section IV) for details.

Guidehouse has provided the circuit-level analysis results in tabular format in TCUC-RFI01-01 Attachment 3.xls.

TCUC-RFI01-01 Attachment 3.xls is a voluminous attachment and will be provided in electronic format only.

SPONSOR:
Nathan Brownell, Eugene Shlatz, Joseph Baugh

RESPONSIVE DOCUMENTS:
TCUC-RFI01-01 Attachment 1 - 2026-2028 Resiliency Plan MASTER.xls
TCUC-RFI01-01 - Exhibit JG-04 - Illustrative Carrying Cost.xls
TCUC 01-01 Attachment 2 CONFIDENTIAL.xlsx
TCUC-RFI01-01 Attachment 3.xls

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
System Resiliency Plan
Sponsor: Jeff W. Garmon

Pre-tax WACC	Annual	Monthly
Long-term Debt	2.519%	0.207%
Common Equity	5.057%	0.412%
Total	7.575%	0.610%

TABLE 1 - Resiliency Carrying Costs Calculation

Line		[A] Illustrative Resiliency Net Capital Investment	[B] Illustrative Resiliency Deferrals	[C] Cumulative Illustrative Resiliency Deferrals	[D] Debt Carrying Costs	[E] = [F] - [D] Equity Carrying Costs	[F] Total Carrying Costs	[G] Debt Cumulative Carrying Costs	[H] Equity Cumulative Carrying Costs	[I] Total Cumulative Carrying Costs	[J] Overall Cumulative Balance
1	January-25	$ 12,000,000	$ -	$ -	$ 24,899	$ 48,346	$ 73,245	$ 24,899	$ 48,346	$ 73,245	$ 73,245
2	February-25	11,900,000	100,000	100,000	24,947	48,440	73,387	49,846	96,786	146,632	246,632
3	March-25	11,800,000	100,000	200,000	25,099	48,735	73,835	74,945	145,521	220,467	420,467
4	April-25	11,700,000	100,000	300,000	25,253	49,033	74,286	100,198	194,554	294,752	594,752
5	May-25	11,600,000	100,000	400,000	25,407	49,332	74,739	125,605	243,887	369,491	769,491
6	June-25	11,500,000	100,000	500,000	25,562	49,633	75,195	151,166	293,520	444,686	944,686
7	July-25	11,400,000	100,000	600,000	25,718	49,936	75,654	176,884	343,456	520,340	1,120,340
8	August-25	11,300,000	100,000	700,000	25,875	50,241	76,116	202,759	393,697	596,456	1,296,456
9	September-25	11,200,000	100,000	800,000	26,033	50,548	76,580	228,792	444,245	673,037	1,473,037
10	October-25	11,100,000	100,000	900,000	26,192	50,856	77,048	254,983	495,101	750,085	1,650,085
11	November-25	11,000,000	100,000	1,000,000	26,351	51,167	77,518	281,335	546,268	827,603	1,827,603
12	December-25	10,900,000	100,000	1,100,000	26,512	51,479	77,991	307,847	597,747	905,594	2,005,594
13											
14											
15		Total	$ 1,100,000		307,847	$ 597,747	$ 905,594				
16											
17											
18											

Resiliency Program Listing

RM #	Programs	Witness	2026	2027	2028	Total (2026-2028)	Dist %	Dist $ (2026-2028)	Capital	O&M	# Assets in 3 yrs	Type	% Complete	Comments
	Extreme Wind		**981.2**	**1,461.5**	**1,570.0**	**4,012.7**		**1,998.1**	**3,864.6**	**148.1**				
RM-1	Distribution Circuit Resiliency	Tumlinson	165.2	171.4	176.8	513.4	100%	513.4	513.4	-	25,000	poles	on-going	$18K per fiberglass pole, based on # wood poles w/ fall in risk, ongoing due to VM risk changing
RM-2	Strategic Undergrounding	Pryor	116.0	266.0	478.0	860.0	100%	860.0	860.0	-	111	miles	9.39%	$200M for 7 hospitals, $60M for 75 FW crossings ($20M/yr), $600M for high fall-in risk locations-ongoing due to VM risks, UG all 1st & 2nd sections
RM-3	Restoration IGSD	Tumlinson	34.9	35.9	37.0	107.8	100%	107.8	107.3	0.5	900	devices	54%	includes IT costs, ~$120K each, % complete based on # of 1675 OH circuits w/ at least 1 IGSD for cut & clear
RM-4	Distribution Pole Replacement/Bracing	Tumlinson	81.2	83.8	86.6	251.6	100%	251.6	251.6	-	30,000	poles	on-going	based on results of historical inspections, $18K fiberglass (3%), $10K wood (73%), $2K brace (23%)
RM-5	Vegetation Management	Pryor	54.5	45.2	46.4	146.1	100%	146.1	-	146.1	11,700	miles	on-going	incremental miles and spend only, does not include base VM which is 50% of 23,400 mi of OH, avg $/mi depends on voltage
RM-6	Transmission System Hardening	Mercado	285.4	649.5	533.2	1,468.0	5%	73.4	1,467.3	0.8	1715	structures	100%/19%	all energized transmission wood structures hardened by end of 2028. 100% Wood Completion, 19% legacy 345kV tangent double circuit transmission towers (242/1267)
RM-7	69kV Conversion Projects	Mercado	166.8	173.1	29.5	369.3	10%	36.9	369.3	-	462	structures	93%	completion may extend to 2029, includes Downtown GIS sub. 93% Completion (14/15 Remaining 69kV Circuits)
RM-8	S90 Tower Replacements	Mercado	74.8	31.6	12.0	118.4	0%	-	118.4	-	37	towers	100%	all S90 towers replaced by end of 2028, ~$3M/tower
RM-9	Coastal Resiliency Projects													
	Location #1	Mercado	1.5	2.5	165.1	169.1	5%	8.5	168.4	0.8	1	location	100%	Requires ERCOT RPG review
	Location #2	Mercado	1.0	2.5	5.5	9.0	5%	0.5	9.0	-	1	location	3%	3% Completion (9M/359M expected spend), Requires ERCOT RPG review
	Programs	**Witness**	**2026**	**2027**	**2028**	**Total (2026-2028)**	**Dist %**	**Dist $ (2026-2028)**	**Capital**	**O&M**				
	Extreme Water		**31.6**	**31.7**	**28.3**	**91.6**		**76.4**	**91.6**	**-**				
RM-10	Substation Flood Control	Mercado	14.6	14.6	14.6	43.8	70%	30.7	43.8	-	12	substations	on-going	includes IT costs, assumes 4/year, based on Neara data + Harvey flooded locations, risk changes so on-going
RM-11	Control Center Flood Control	Mercado	3.5	3.5	-	7.0	70%	4.9	7.0	-	1	locations	100%	Backup control center floodwall
RM-12	MUCAMS	Pryor	3.5	3.6	3.7	10.8	100%	10.8	10.8	-	318	sites	64%	Various dedicated UG areas. % completed based on current location counts.
RM-13	Mobile Substations	Mercado	10.0	10.0	10.0	30.0	100%	30.0	30.0	-	6	units	on-going	2/year for 3 years, ongoing due to load, $5M each
	Extreme Temp (Freeze)		**14.0**	**21.0**	**21.0**	**56.1**		**41.8**	**53.5**	**2.6**				
RM-14	Anti-Galloping Technologies	Mercado	5.0	5.0	5.0	15.0	5%	0.8	14.0	1.0	25	es	on-going	based on galloping events so on-going; $180K/circuit mile + 75 sensors @ $15K each
RM-15	Loadshed IGSD	Tumlinson	1.5	1.5	1.5	4.6	100%	4.6	4.5	0.1	36		Annual Review	estimated 12 per year but depends on results of annual review, ~$120K each including IT costs
PP-1	Microgrid Pilot Program	Tutunjian	7.5	14.5	14.5	36.5	100%	36.5	35.0	1.5	3-5	s	N/A	estimated 3-5 locations at $7M/location (Per location: impact study $100K (94% cap/6% O&M), engineering and design $1M (95%/5%), transfer trip $120K (100%/0%), switches $3M (100%/0%), control system upgrades $2.5M (100%/0%))
	Extreme Temp (Heat)		**368.5**	**430.0**	**446.0**	**1,244.4**		**1,214.4**	**1,207.2**	**37.2**				
RM-16	Distribution Capacity Enhancement/Substations	Mercado	183.2	191.2	205.2	579.6	100%	579.6	579.6	-	20	substations	on-going	DDP projects supporting resiliency, e.g. 12 kV islands, step up/down scenarios, ongoing due to load requests
RM-17	MUG Reconductor	Pryor	55.0	95.0	95.0	245.0	100%	245.0	245.0	-	21.72	miles	on-going	Assumes majority under City of Houston streets, 4 miles of feeder main per mile of duct-bank
RM-18	URD Cable Modernization	Pryor	41.1	42.8	44.5	128.4	100%	128.4	128.4	-	34,500	spans	100%	accelerate completion from 2030 to end of 2028, target all URD installed before 1985
RM-19	Contamination Mitigation	Tumlinson	50.0	50.0	50.0	150.0	80%	120.0	144.0	6.0	20	circuits	21%	includes distribution contamination circuits, EPRI sensors, and substation insulator replacement assuming 3-4 coastal substations per year to be completed. % Complete based on total number of southern zone circuits with fall in risk, 97 circuits
RM-20	Substation Fire Barriers	Mercado	3.0	3.0	3.0	9.0	100%	9.0	9.0	-	36	firewalls	38%	21 substations, 36 firewalls
RM-21	Digital Substation	Mercado	9.3	11.1	11.4	31.8	100%	31.8	31.8	-	13	substations	6%	4-5 per year
RM-22	Wildfire Advanced Analytics	Easton	0.3	0.3	0.3	0.9	100%	0.9	-	0.9	N/A	N/A	on-going	Technosylva O&M
RM-23	Wildfire Strategic Undergrounding	Pryor	10.0	20.0	20.0	50.0	100%	50.0	50.0	-	7.1	miles	on-going	assumes $7M per mile, UG all 1st & 2nd sections in HFRA but risk may change so on-going
RM-24	Wildfire Vegetation Management	Easton	10.0	10.0	10.0	30.0	100%	30.0	-	30.0	3,000	miles	on-going	O&M only, $10K per mile
RM-25	Wildfire IGSD	Easton	6.6	6.6	6.6	19.7	100%	19.7	19.4	0.3	150	devices	on-going	50 per year, 130 ckts currently but HFRA may change so on-going
	Programs	**Witness**	**2026**	**2027**	**2028**	**Total (2026-2028)**	**Dist %**	**Dist $ (2026-2028)**	**Capital**	**O&M**				
	Physical Attack		**12.5**	**12.5**	**12.5**	**37.5**		**9.1**	**37.4**	**0.1**				
RM-27	Substation Security Upgrades	Mercado	6.5	6.5	6.5	19.5	33%	6.4	19.4	0.1	30	substations	on-going	10 per year, refreshed every 5 yrs
RM-26	Substation Physical Security Fencing	Mercado	6.0	6.0	6.0	18.0	15%	2.7	18.0	-	21	substations	15%	7 per year
	Technology & Cybersecurity		**67.2**	**15.5**	**10.3**	**93.0**		**46.5**	**79.6**	**13.5**				
RM-28	Spectrum Acquisition	Bahr	42.0	-	-	42.0	50%	21.0	42.0	-	N/A	N/A	100%	Based on analysis and recommendation by West Monroe; assumes 1.6GHz lease/own
RM-29	Data Center Modernization	Bahr	6.6	3.8	3.5	13.9	50%	7.0	12.7	1.3	N/A	N/A	90%	CEHE Portion (42%); $5.5M M SCADA Link Redundancy, $2.5M - On-Premise Infrastructure, $1.7M - Data Protection Storage, $1.7M - SAN Fabric Redesign, $0.9M - Active-Active solution, $0.4M Disaster Recovery Toolset. O&M estimate 10%.
RM-30	Network Security & Vulnerability Management	Ford	4.9	2.3	2.3	9.5	50%	4.8	7.5	2.0	N/A	N/A	on-going	Estimate includes related hardware/software purchases ($7.3M), additional FTEs ($2.1M) and training/certification requirements ($60K)
RM-31	IT/OT Cybersecurity Monitoring	Ford	7.7	6.4	3.5	17.6	50%	8.8	13.4	4.2	N/A	N/A	on-going	Estimate includes related hardware/software purchases ($11.1M), additional FTEs ($6.0M) and training/certification requirements ($500K)
RM-32	Cloud Security, Product Security & Risk Management	Ford	6.0	3.0	1.0	10.0	50%	5.0	4.0	6.0	N/A	N/A	on-going	Estimate includes related hardware/software purchases ($4.2M), additional FTEs ($5.3M) and training/certification requirements ($500K)
	Situational Awareness		**88.4**	**57.1**	**73.3**	**218.8**		**202.0**	**209.5**	**9.2**				
RM-33	Advanced Aerial Imagery/Digital Twin	Easton	6.8	6.8	6.8	20.4	100%	20.4	18.4	2.0	N/A	N/A	on-going	Annual LiDAR and aerial imagery capture, Neara
RM-34	Weather Stations	Easton	0.1	0.1	0.1	0.3	100%	0.3	-	0.3	N/A	N/A	on-going	Capital spend in 2025, ongoing O&M
RM-35	Wildfire Cameras	Easton	0.3	0.3	0.3	0.9	100%	0.9	-	0.9	N/A	N/A	on-going	Capital spend in 2025, ongoing O&M
RM-37	Backhaul Microwave Communication	Bahr	5.7	3.5	3.5	12.7	50%	6.3	12.7	-	165	microwave radios	25%	Estimated capital based on estimated equipment costs and estimated labor that will be completed yearly. The estimate is developed by number of links which includes a radio/antenna on each side of the link. Each radio link is approx. $75k. We plan to implement 75 links in 2026, 45 links in 2027, and 45 links in 2028.
RM-36	Voice & Mobile Data Radio System	Bahr	9.5	7.1	4.3	20.9	50%	10.5	20.9	-	27	DMR Tier 3 Sites	100%	Estimated capital based on RFP response for equipment costs and estimated other labor and work required to implement based on experience with similar implementations. Includes the antennas, console system, handhelds/ portables, vehicle radios, base station radios. This will also include the coverage analysis and optimization.
RM-38	Emergency Operations Center	Brownell	52.0	2.0	2.0	56.0	100%	56.0	50.0	6.0	1	location	100%	Majority of spend will be in 2025
RM-39	Hardened Service Centers	Brownell	14.0	37.3	56.3	107.6	100%	107.6	107.6	-	4	service centers	78%	4 locations; approxiately $26M/each
	TOTAL PROGRAMS		**$ 1,563.4**	**$ 2,029.2**	**$ 2,161.4**	**$ 5,754.0**		**$ 3,588.3**	**$ 5,543.3**	**$ 210.7**				

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

PUBLIC UTILITY COMMISSION OF TEXAS
REQUEST NO.: TCUC-RFI01-02

QUESTION:

Please provide the following information regarding other utilities reviewed by Guidehouse or CEHE who are implementing or have implemented resiliency plans:

a. Utility

b. Date of resiliency plan

c. Copies of Guidehouse testimony and reports supporting the utility's proposed resiliency plan

d. Number of customers by class served by utility

e. Annual kWh sales by class served by the utility

f. Service area size of utility

g. Utility distribution line miles

h. Utility transmission line miles

i. Total cost of resiliency plan as proposed by utility

j. Total cost of each resiliency measure as proposed by utility

k. Total approved cost of each resiliency measure as approved by the applicable regulatory commission

l. Estimated reduction in customer minutes of interruption ("CMI") for each resiliency measure

m. Estimated Benefit-Cost ("BCA") ratio for each resiliency measure

n. Quantified BCA ratio of each resiliency measure proposed by utility

o. Assumed value of lost load ("VoLL") used for calculating BCA of proposed resiliency measures

p. State whether VoLL was included as a benefit in BCA analysis or as a qualitative benefit in analysis of each proposed resilience measure

q. Utility SAIDI including major storm events for last five years

r. Utility SAIDI excluding major storm events for last five years

s. Regulatory docket number and status of review of proposed resiliency plan

t. Regulatory Commission order addressing the utility's request for approval of proposed resiliency plan

ANSWER:

there are three groups of peer utilities that were discussed in Guidehouse's report:

1. *Utilities for whom Guidehouse has previously conducted similar analysis (listed in Section 3.1)*
2. *Utilities who participated in the peer survey (Appendix A)*
3. *Utilities whose resiliency plans were reviewed as part of the jurisdictional benchmarking research (Appendix B)*

However, the specific information requested, with limited exception, is not information that Guidehouse gathered during the course of its research and analysis associated with CEHE's SRP. The benchmarking efforts conducted by Guidehouse were intended to provide an indication of whether the measures being proposed by CEHE are consistent with industry precedents, among other objectives which are described further in the report. The related information contained within the report is reflective of the scope of information that was gathered during Guidehouse's benchmarking research, and the information being requested in this RFI generally was not collected, as it was not necessary to inform the research that was conducted.

Nonetheless, much of the requested information may be publicly available, either through regulatory proceedings associated with utility resiliency plans or otherwise through public information provided by the utility. To help facilitate the collection of the requested information, we have compiled information below about relevant proceedings where some of this information may be gathered.

The information below, organized by the three groups of utilities noted above, addresses requested information including:

(a) Utility
(b) Date of filing
(c) Regulatory docket number

For item (c), any available Guidehouse testimony or reports would be contained with the dockets listed below for group #1. Similar, for item (t), any available commission orders would be available within the dockets listed below for groups #1 and #3.

For items (d) through (r), this information was generally not collected as part of Guidehouse's research, except that some information in items (i) through (k) was collected only for a few utilities including for SRPs submitted by other Texas utilities (Oncor, Entergy Texas, AEP Texas, and TNMP) and for two utilities associated with wildfire mitigation plans (SCE and NV Energy).

1. *Utilities for whom Guidehouse has previously conducted similar analysis*

The following dockets are related to utility filings for which Guidehouse has conducted similar analysis previously (as listed in Section 3.1). Please see links to utility resiliency plans Guidehouse relied on to prepare testimony and exhibits. The resiliency plans may not contain all of the information requested in Items (a) through (t) above.

Duke Energy Florida – 2020 Storm Protection Plan:
https://www.psc.state.fl.us/library/filings/2020/01943-2020/01943-2020.pdf
Florida Power & Light – 2022 Storm Protection Plan:
https://www.floridapsc.com/library/filings/2022/02358-2022/02358-2022.pdf
New Jersey Board of Public Utilities – Jersey Central Power & Light Operation & Financial Audit
https://www.nj.gov/bpu/pdf/auditpdfs/2016%20JCPL%20Final%20Audit%20Report.pdf
Kentucky Power 2023 Rate Filing (Recovery of Storm Hardening Investments)
https://psc.ky.gov/pscecf/2023-00159/lmscott%40aep.com/11062023030229/10-KPCO_Shlatz_Rebuttal_Testimony.pdf
Illinois Commerce Commission – Commonwealth Edison
ICC Exhibit - See TCUC RFI 01-02 Attachment 1.pdf

2. *Utilities who participated in the peer survey*

For the peer survey, Guidehouse collected information from primary research, as reflected in Appendix A. Guidehouse did not review utility resiliency plans as part of this study. Any review of resiliency plans for participating utilities is reflected within Appendix B.

3. *Utilities whose resiliency plans were reviewed as part of the jurisdictional benchmarking research*

The list provides regulatory docket information for utilities whose resiliency plans were reviewed or otherwise referenced as part of the jurisdictional benchmarking research. While Guidehouse directly reviewed some of these resiliency plans, Guidehouse did not fully review all of them. Additionally, while other utilities may be mentioned in the benchmarking research, some of the information gathered is not directly related to a specific resiliency plan filing.

- ***California - Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E):*** *Rulemaking on Physical Security of Electrical Corporations Pursuant to Senate Bill 699 (Year 2015: Docket R.15-06-009), Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation (Year 2018: Docket R.18-04-019), Rulemaking to Implement Electric Utility Wildfire Mitigation Plans Pursuant to Senate Bill 901 (Year 2018: Docket R.18-10-007)*
- ***Connecticut – Eversource Energy and The United Illuminating Company:*** *Investigation into Distribution System Planning of the Electric Distribution Companies (Year 2018: Docket 17-12-03) and Resilience and Reliability Standards and Programs (Year 2018: Docket 17-12-03RE08)*
- ***Florida – Duke Energy Florida, Florida Power & Light, Florida Public Utilities Company, Gulf Power Company (FPL), and Tampa Electric Company (TECO):*** *Review of Florida's Electric Utility Hurricane Preparedness and Restoration Actions (Year 2017: Docket 2017-0215-EU)*
- ***Illinois – Ameren Illinois and Commonwealth Edison:*** *Order Requiring Ameren Illinois Company to file an initial Multi-Year Integrated Grid Plan (Year 2022: 22-0487) and Order Requiring Commonwealth Edison to file an initial Multi-Year Integrated Grid Plan (Year 2022: 22-0468)*
- ***Louisiana – Entergy Louisiana****: Application for Approval of the Entergy Future Ready Resilience Plan Phase 1 (Year 2022: LPSC Docket U-36625)*
- ***Nevada – NV Energy:*** *Application of NV Energy for Approval of Natural Disaster Protection Plan for the Period 2024 – 2026 (Year 2023: Docket 23-03003)*
- ***New Jersey – Public Service Enterprise Group:*** *Petition of PSEG for Approval of the Second Energy Strong New Jersey Program (Year 2018: Docket EO 18060629)*
- ***New York – Con Edison, Central Hudson, National Grid, New York State Electric and Gas, and Rochester Gas and Electric:*** *Proceeding on Motion of the Commission Concerning Electric Utility Climate Studies and Plans (Year 2022: Case 22-E-0222)*
- ***South Carolina: Dominion and Duke Energy South Carolina:*** *Regarding Measures to Be Taken to Mitigate Impact of Threats to Sage and Reliable Utility Service (Year 2021: Docket 2021-66-A)*
- ***Virginia: Dominion Energy:*** *Petition of Dominion Energy Virginia for Approval of a Plan for Electric Distribution Grid Transformation Projects (Year 2018: Case PUR2018-00100)*

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
TCUC RFI 01-02 Attachment 1.pdf

ComEd Ex. 13.0

NAVIGANT

Independent Investigation:

Material Condition Assessment and Benchmarking Study of the Commonwealth Edison Company Delivery System

Navigant Consulting, Inc.
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Burlington, Massachusetts 01803

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March 2012

NAVIGANT

Table of Contents

NAVIGANT

List of Figures and Tables

Figures:

Tables:

1. Introduction and Executive Summary

This report presents Navigant Consulting, Inc.'s (Navigant) independent assessment of the performance and impact of the summer 2011 storms. It includes a material condition assessment of Commonwealth Edison's (ComEd) electric distribution system, a benchmark review of distribution design and maintenance practices, and storm performance resiliency versus electric utilities of comparable size and system configuration. The Navigant Study team was led by Messrs. Eugene Shlatz and Hector Artze, Directors, and Ms. Maggie Duque, Assistant Director.

1.1 *Background*

Navigant was engaged to conduct an independent, comprehensive investigation of the summer 2011 storms that impacted ComEd's distribution system. Navigant's study includes a review and material condition assessment and benchmark study of lines and equipment in areas affected by these storms to those over ComEd's entire distribution system. The report includes a benchmark comparison of ComEd's reliability performance and design and maintenance practices to other electric utilities with comparable service territory attributes and demographics. Navigant also sought to determine the degree to which ComEd's design and maintenance practices comply with Illinois Administrative Codes, national design and safety standards, and prudent utility practices; focusing on the adequacy of the distribution system impacted by the six storms that occurred during the summer of 2011.

1.2 *Study Objectives*

Navigant's primary objective is to assess the adequacy of ComEd's distribution system with respect to its ability to withstand major storms such as those that impacted its northern and western service territories during the summer of 2011, and to thereby test the validity of criticisms that have been made about the condition of the system and its operation and maintenance. To address these issues, Navigant conducted a comprehensive review and assessment of ComEd's distribution system design, material condition, reliability programs, and equipment performance. Navigant's analysis included a rigorous assessment of the underlying outage causes and equipment impacted by the summer 2011 storms performance. The approach Navigant applied to ComEd's storm review is based on decades of experience of each of the lead consultants responsible for the review. The findings and conclusions presented in this report reflect the knowledge and perspective gained from this experience, which includes similar studies conducted for numerous electric utilities in North America and worldwide, and several regulatory jurisdictions.

Study activities and the tasks that Navigant undertook to perform its independent evaluation are summarized below:

1) Assess ComEd's physical assets based on a review of distribution design and performance data, and the results of field inspections for areas affected by and those unaffected by the six summer 2011 storms
2) Evaluate ComEd distribution system reliability, including performance benchmarks for normal and major to those experienced by other comparable utilities

3) Benchmark design and construction standards to common utilities practices, including compliance with state of Illinois Administrative Codes and national safety standards
4) Assess the adequacy of ComEd's tree trimming standards and programs, including compliance with Illinois Commerce Commission (ICC) standards, and compared to other comparable utilities
5) Assess the overall adequacy of ComEd's distribution system design, construction, protection, and storm resiliency
6) Provide an overall assessment of ComEd distribution system adequacy, including a determination as to whether any of the interruptions that occurred during the major storms of summer 2011 were avoidable

1.3 Methodology

For this study, Navigant conducted four key tasks: The first is a comprehensive review of the storms that impacted ComEd's distribution system in the summer of 2011; the second focused on the adequacy of ComEd's distribution engineering and design standards; the third is an independent material condition assessment of ComEd's distribution system and equipment; the fourth includes benchmark comparisons of ComEd reliability performance, improvement programs, design standards, maintenance activities, and costs to other comparable utilities. Each task is described in further detail below.

1.3.1 Storm Impact Analysis

The initial phase of review focused on identifying outage causes and equipment impacted by the summer 2011 storms. It includes a rigorous examination of the factors and conditions underlying the number and duration of interruptions to ComEd's customers during the summer 2011 storms.[1] A key objective of this task was to obtain outage data and conditions needed to make a determination of whether any of these interruptions were avoided. These results are then combined with our assessment of engineering design standards, material condition, and assessment of operation and maintenance (O&M) practices to support such a determination.

Our analysis is based on a comprehensive analysis of ComEd's system within and outside the areas impacted by the summer 2011 storms. Navigant independently selected a range of feeders for inspection, which included short and longer lines, difference voltage classes, rural and urban segment, primarily overhead versus underground, mostly residential or commercial, and lines in heavily treed versus those located in open areas. We also requested and received from ComEd all data requested needed to

[1] ComEd defines an interruption as the failure or operation of a single delivery system component, or the simultaneous failure or operation of physically and directly connected components, that results in electric service being lost to customers, subject to certain exceptions (e.g., disconnections for failure to pay bills, or at the request of law enforcement). Although exact wording varies, this definition is consistent with our understanding and use of the term to refer to a condition on the system that causes a loss of service to one or more customers and that resulting loss of service. This is also consistent with how all major benchmarks define and measure interruptions. We use interruption in this sense. We also use the term "customer interruption" to refer to the number of customers affected by an interruption. We use the plural term "total interruptions" or "total customer interruptions" when we refer to all of the interruptions that meet a given criterion, for example, that are caused by damage from a particular storm.

conduct a thorough and independent investigation, one supported by records and documentation of ComEd's distribution system condition, design and performance. Importantly, ComEd and its representatives did not recommend specific lines to inspect or avoid, nor did company personnel refuse to supply data to any of our numerous information requests.

1.3.2 Distribution Engineering Standards and Design Review

Navigant reviewed ComEd's transmission and distribution (T&D) design standards to assess the capability of its energy delivery system to withstand major storms. Our review includes a review of ComEd's distribution design and planning criteria, loading practices, equipment selection, system protection, and automation. Specific design practices we assessed included:

- Planning and design criteria of the primary distribution system, including consistency among regions served
- Design and physical loading criteria for overhead conductors and devices
- Pole and equipment selection for primary main line and secondary; particularly for multi-circuit lines located in areas susceptible to damage
- Fusing and protection practices, both to minimize the likelihood of interruptions and to reduce restoration times
- Use of automated devices and communication systems to improve restoration times. This included an assessment of auto-sectionalizing devices such as line reclosers to isolate faults and transfer line sections to minimize the number of sustained customer interruptions
- Use of insulated or bundled conductor to reduce the number of tree-related interruptions
- Effectiveness of trimming methods and compliance with ICC standards, including an assessment of the distribution system to withstand tree-related interruptions during major storms
- Consistency and compliance of ComEd distribution design and maintenance practices to Illinois Administrative Codes, National Electric Safety Code (NESC) requirements and industry practices
- Design and maintenance practices as applied to lower voltage secondary and service lines

1.3.3 Material Condition Assessment

Navigant reviewed and analyzed ComEd's overhead primary and secondary distribution system, focusing on areas affected by the summer 2011 storms. A review of underground systems and equipment was performed, although not to the same level of detail as overhead systems, as the number of interruption caused by underground failures was small. The material condition assessment also included an investigation of to the adequacy of ComEd's operating and maintenance practices, as the condition of ComEd's power delivery system is dependent on effective maintenance and operations, as well as on prudent design practices and investments. Additionally, Navigant also compared distribution system design, construction, operating and maintenance practices, and performance of lines and equipment impacted by the summer 2011 storms to other ComEd regions.

Specifically, Navigant reviewed and analyzed:

- Prior ComEd studies, reports, and investigations that focused on equipment and material condition, including findings and actions taken by ComEd to address deficiencies and gaps
- ComEd reliability records to identify areas of the system where equipment and material-related failure has caused distribution system interruptions, focusing on equipment failure or malfunction cause codes to identify trends and equipment most susceptible to failure
- Asset records to identify age and material standards to assess durability and conformance to current design standards. This task included a review of distribution engineering design practices and standards, focusing on equipment deemed most susceptible to failure based on storm interruption and reliability data
- Distribution inspection and maintenance records, including prior studies, pole inspections reports, cable condition reports, thermal inspections, and other operation and maintenance data that can be used to ascertain equipment condition and consistency with common utility practices
- Information obtained from interviews with ComEd engineering and operations management and supervisory staff to obtain data and information regarding equipment condition or design, and areas of greatest concern to ComEd or to Navigant investigators
- Targeted field inspections for a broad range of overhead and underground distribution facilities, with a representative cross-section of urban versus suburban, short and long feeders, heavily and sparsely treed, high and low load density, and other criterion deemed most suitable as a result of interviews and reliability review
- Vegetation management practices with regard to trimming cycles, clearing standards, contractor selection, field inspection, and program effectiveness
- Benchmark results of ComEd's design, maintenance, and storm recovery practices to those of other comparable utilities using readily available data and the experience of Navigant's experts gained through prior engagements and direct experience

1.3.4 Benchmark Studies

Navigant conducted a series of benchmarking analyses to compare ComEd's reliability performance and spending levels to those of other comparable utilities. Our analysis includes a high-level benchmark comparison of ComEd's system performance and impacts caused by the summer 2011 storms to other utilities subject to similar storms over the past decade. To determine if design, maintenance, and performance were consistently applied throughout ComEd's service territory, we conducted a series of internal benchmark analyses that compared the design, maintenance, and performance of the segments of ComEd's distribution system impacted by these storms to areas unaffected by the storms. We also compared ComEd's planning, design, construction, and protection practices to those of comparable utilities.

1.3.5 Field Inspections

To support its analysis of ComEd's distribution system practices and reliability performance, Navigant conducted a comprehensive inspection of distribution lines and equipment, both in the areas affected by the summer 2011 storms and of representative lines in the other three ComEd regions. Navigant selected the feeders for inspection, with an objective to include a representative cross-section of distribution lines. Selection criterion included short and long feeders, urban and suburban, low and high number of storm interruptions, single and multi-circuit construction, with and without line reclosers, and lines with a higher percentage of primary underground lines. The facilities inspected included a diverse mix of over 480 miles of feeders, including over 125 miles each of overhead lateral and mainline feeder segments, located in 19 municipalities and related unincorporated areas including both areas affected by storm outages and, for comparison purposes, areas not significantly affected. We also observed facilities in place along and near these lines including substations, primary transformers, secondary connections, other switchgear and communications equipment, disconnect and reclosing devices, and grounding and protection equipment. Appendix A (CONFIDENTIAL) presents more specific data for each feeder inspected in the affected and non-affected areas.

Prior to each inspection, Navigant obtained maps to compare field inspection results to one-line diagram details, and to ensure that a mix of three-phase main line, and single- or two-phase laterals were inspected. For all inspections, Navigant sought to inspect at least 50 percent of the total feeder. ComEd's personnel, mostly Reliability Engineers, accompanied Navigant on the inspections. Several hundred photographs were taken, with annotated entries highlighting the type and attributes of the equipment or lines inspected at each location. Detailed inspection reports are retained with our workpapers.

1.4 *Executive Summary*

Based on its independent investigation and analysis of ComEd's distribution system and the storms that impacted ComEd's customers during the summer of 2011, Navigant offers the following findings and conclusions.

(1) The interruptions that occurred as a result of the summer 2011 storms were unpreventable.

The results of Navigant's independent investigation confirm that the body of interruptions that occurred during the Summer 2011 Storms were unavoidable, and the damage that occurred was due to events outside of ComEd's direct or indirect control. In addition, in virtually all cases evidence was available to allow us to assess the interruptions individually. Notably, each of the distribution lines experiencing interruptions during these storms had been trimmed in accordance with ICC standards. Further, our review of ComEd's distribution design standards, confirmed by field observation, unequivocally indicates system design and construction is consistent with prudent and common utility standards. Notably, we did not observe any violations or inconsistency with Title 83 of Illinois Administrative Code 305 and NESC requirements referenced within the Code. In many areas, such as targeted reliability initiatives and distribution automation, ComEd has adopted industry best practices. Navigant's findings and conclusions are supported by over 75 years of collective experience evaluating electric utility distribution systems, including post-storm performance evaluation and recommendations.

The following provides specific evidence, analysis, and data supporting this statement:

- Over 80 percent of the interruptions were tree or weather related, many caused by trees that were uprooted due to high winds. The remaining 20 percent is mostly equipment that was damaged as a result of catastrophic storm impacts. Notably, less than one percent of total customer interruptions were caused by outages on secondary or service lines. Similarly, less than five percent of the number of interruptions was underground cable faults or padmount equipment failures, caused by lightning surges.
- Each of the feeders where tree-related interruptions occurred had previously been trimmed in the prior four years. This excludes trimming on secondary lines or services that are not generally ComEd's responsibility. However, Navigant strongly believes the number and duration of customer interruptions would not have materially increased if secondary lines and services were previously trimmed.
- The frequency and duration of tree-related interruptions during the summer 2011 storms was independent of the year that trees along the feeder were last trimmed. This finding provides strong evidence to confirm the conclusion that uprooted trees and breakage of limbs outside of trim zone envelopes caused most of the tree-related interruptions.
- ComEd's vegetation management program for overhead distribution lines is based on ICC cycle trimming targets, which call for electric utilities to have a program in place designed to trim vegetation affecting primary distribution lines, at minimum, every four calendar years. ComEd is not required to trim trees located on low voltage service lines that are on private property (not easements), most of which are service connections. ComEd performs interim spot trimming on feeders where vegetation management issues are identified from reliability records, scheduled maintenance inspections, or field observation. More than 99 percent of lines are successfully trimmed on this schedule (even taking real world disruptions into account), an excellent record of implementing a cyclical vegetation management program.
- Field inspection results confirm that ComEd meets the ICC's trimming standard. Moreover, at the time of actual observation, virtually all primary distribution lines inspected maintained adequate clearances when inspected. Although secondary lines that are the responsibility of customers are not included in ComEd's four-year clearing cycle, many of the secondaries are located directly below primary distribution lines that are regularly inspected and trimmed.
- The results of high-level benchmark studies for utilities impacted by comparable storms indicate the amount of equipment damaged and duration of interruptions is consistent with statistics of other utilities. Notably, national standards such as the NESC do not require utilities to design and construct distribution systems to withstand winds and conditions that ComEd experienced in the summer of 2011.

(2) ComEd's overhead distribution system is designed and constructed consistent with or above commonly accepted utility practice. Further, these practices are followed consistently throughout ComEd's service territory.

ComEd's distribution design standards are consistent with or exceed those of utilities with comparable service territory attributes and customers served. In all areas reviewed, confirmed by field inspections, ComEd's distribution system is designed and constructed in accordance with Title 83 of the Illinois Administrative Code, National Electric Safety Code, and common and prudent utility practice. We did not observe any clear violations of these codes and practices. The size and capability of key distribution equipment, including poles, wires, transformers and cable, are appropriately sized for the function they provide, and are properly maintained. Regular patrol and inspection of all lines ensure potential reliability problems are proactively addressed and emergent code violations immediately addressed. Protection practices meet or exceed industry practices, including extensive use of reclosers and employment of auto-sectionalizing loop schemes, minimize number of customers are impacted by interruptions, and restoration times are expedited.

Navigant's conclusions are based on and supported by the following findings and observations.

- The majority of ComEd's overhead three-phase, 12.47 kV and 4.16 kV distribution lines are wood-pole, cross-arm construction. Similarly, most single-phase lines also use wood poles, with pole-top insulators. Where trees or other barriers are near or within the right-of-way, or to maintain tangent construction, ComEd uses ally-arms for some three-phase lines. Many overhead primary distribution lines include double circuit 12.47 kV or 4.16 kV, or secondary lines; mostly underbuild construction. However, there were few instances where Navigant observed three or more primary distribution lines on the same pole. This likely reduced the number of interruptions that otherwise would have occurred for outages caused by large uprooted trees that fell onto overhead lines.
- In all towns inspected, field inspection results confirmed the presence of three-phase main line and lateral taps located on or along rear lots or back alleys. Many of these lines, particularly those in residential areas, are heavily treed with limbs that often form a canopy, within ICC clearance targets, to overhead distribution lines. Some of the most heavily treed areas, densest canopies, and largest species were located in towns closest to Lake Michigan. Lake Forest and Highland Park are notable for the extensive vegetation along many overhead line sections.
- The design and construction of lines and equipment in areas within and outside of the northern region appeared consistent. The use of mid-line and auto-sectionalizing reclosers on 34.5 kV subtransmission and 12.47 kV distribution lines was evident in all areas inspected, and further supported by ComEd's records.
- ComEd has aggressively implemented distribution automation over the past 10 to 15 years. Since the early 2000s many 34.5 kV subtransmission lines have been equipped with auto-sectionalizing devices and communications systems designed to automatically detect and isolate faults, and rapidly restoring unaffected line sections to adjacent feeders. Over the past seven years, ComEd has also installed over 200 auto-sectionalizing reclosers on primary distribution

lines. The company reports these devices reduced customer interruptions by over 1 million minutes in 2011.

- Navigant views ComEd's distribution automation program as an industry leading best practice. The use of reclosers for auto-sectionalizing is superior to SCADA-controlled, three-phase load break disconnect switches, as it does not rely on remote switching from dispatch control; a process that can be extremely cumbersome, and difficult to track and manage during major storms.
- There is minimal bundled conductor or tree wire used on ComEd's primary distribution system. Navigant does not believe use of bundled conductor or tree wire would have materially reduced either the number or duration of customer interruptions, as many outages were caused by trees permanently falling on wires. ComEd is expanding the use of bundled conductor on line sections with high tree-related outage exposure.

(3) The condition of ComEd's overhead distribution system is consistent with or above commonly accepted utility practice. This finding is supported by reliability performance that is superior to other utilities and which continues to improve. Proactive maintenance and targeted maintenance, implemented cost-effectively, are factors supporting this finding. In short, ComEd is effectively managing its distribution assets.

ComEd has effectively managed its distribution assets to ensure reliability is not degraded by lines or equipment that is improperly maintained or applied. The institution or regular maintenance inspections and targeted reliability programs are designed to proactively identify and address potential problems. Although some equipment is several decades old, its condition and ability to perform well under normal storms is assured by these proactive efforts. This finding is underscored by the continued reduction in the defective equipment cause code for overhead distribution and overall improvement in reliability performance measured by commonly accepted reporting metrics.

Our conclusions are supported by the following:

- Navigant did not identify any lateral primary distribution line segments fed directly from main line sections that were not equipped with fuses. There are some very short overhead line sections not directly connected to the main line section that are unfused. However, Navigant does not view this finding as significant, as interruptions on short, lateral tap lines not connected to the main line feeder do not materially increase either the number or duration of customer interruptions.
- Pole inspection records indicate that less than three percent of poles inspected annually are rejected. Of those that are rejected, all poles listed as priority replacements have been replaced or reinforced; typically shortly after the inspection. Where applicable, ComEd installs C-Trusses on poles, a cost-effective process that significantly extends the lives of poles. Of the remaining

poles are fumigated or otherwise treated with decay retardants. These practices are consistent with common utility practice.

- Although some equipment appeared to be older – several pole stamps indicated ages of 40 years or greater - Navigant did not observe any poles or transformers that were clearly deteriorated and in need of immediate replacement or repair based solely on visual observation; nor did its inspectors see any major lines or equipment that were clearly deteriorated and in need of repair or replacement.
- ComEd's VM policy for subtransmission lines does not allow for any overhang or canopies (it is allowed over lower voltage lines, subject to clearances). Notably, many 34.5 kV subtransmission lines contain one or more 12.47 kV or 4.16 kV distribution lines attached directly below the 34.5 kV lines. These lower voltage distribution lines will also share in any benefit from the greater clearance.
- ComEd has instituted a proactive maintenance inspection program designed to identify potential reliability problems. Every feeder is inspected at least every 4 years, covering a wide range of potential conditions that could degrade reliability if otherwise not detected and mitigated. Navigant confirmed that each of the distribution feeders experiencing interruptions during the storm of summer 2011 was inspected within the prior 4 years.
- The inspections include identifying issues that would otherwise exacerbate the number and duration of storm interruption if not proactively addressed by these inspections. These include devices in need of repair, damaged equipment, deteriorated poles and crossarms, low clearances, failed lightning arresters, missing fuses and other items prescribed for inspection. Navigant views ComEd's proactive maintenance inspection program as an industry best practice, and likely prevented some interruptions and reduced the duration of others during the summer 2011 storms. Further, ComEd's maintenance inspection personnel visually inspect all lines experiencing more than 100 customer interruptions following a storm, and all feeder lock-outs. Navigant also views this as an industry best practice.
- The company has instituted a series of processes designed to ensure quality assurance (QA) and ongoing improvement for distribution reliability and performance. These include key reliability and maintenance programs for vegetation management, reliability initiatives, maintenance inspections, and post-storm inspection and review.
- The QA processes Navigant reviewed appear to be properly managed, as we confirmed that compliance in each of these areas was very high. For example, over 99 percent of scheduled trimming was completed within the ICC-mandated four-year cycle. Similarly, over 99 percent of scheduled feeder maintenance inspections were completed within ComEd's internal four-year cycle.

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(4) A benchmark comparison of ComEd's reliability performance is consistently above industry averages. Industry data and statistics for major storms confirm the damage and interruptions ComEd experienced is comparable to other utilities.

Benchmark studies indicate ComEd's reliability performance is superior to those of comparable utilities. ComEd's reliability performance over the past three years is in the first or second quartile for SAIFI and SAIDI. Similarly, ComEd's reliability performance versus the IEEE survey benchmark is better than most of the utilities included in the survey. ComEd's reliability performance over the past three years meets or exceeds those of comparable utilities. When measured on the basis of frequency, duration, and customer minutes, ComEd reliability metrics, exclusive of storms, falls within the first or second quartile of over two dozen utilities included in the peer group. ComEd's reliability performance also exceeds those of other reporting utilities in the state of Illinois.

Supporting data and benchmark results are supported by the following facts:

- Benchmark studies indicate ComEd's reliability performance is superior to those of comparable utilities. ComEd's reliability performance over the past three years is in the first or second quartile for SAIFI and SAIDI. Similarly, ComEd's reliability performance versus the IEEE survey benchmark is better than the most of the utilities included in the survey.
- ComEd's reliability performance over the past three years meets or exceeds those of comparable utilities. When measured on the basis of frequency, duration, and customer minutes, ComEd reliability metrics, exclusive of storms, falls within the first or second quartile of over two dozen utilities included in the peer group. ComEd's reliability performance also exceeds those of other reporting utilities in the state of Illinois.
- Electric utility distribution lines, both for ComEd and utilities in general, are not designed to withstand damage caused by uprooted trees; nor does the NESC specify design standards to withstand major storms or winds of the magnitude that occurred during several of the summer 2011 storms. Storm surveys confirm code specifications.
- ComEd's spending for distribution O&M is comparable to the benchmark utility group. These findings are based on number of customers served or kWh sold. The data indicates the company is managing costs while achieving favorable reliability performance.
- The wind speeds during the summer 2011 storms approached 80 mph in some areas, well above applicable design standards, and in ranges where independent utility studies indicate a sharp increase in system damage.
- A benchmark comparison of utilities storm performance in the last two decades demonstrates ComEd's equipment failures and customers affected were similar or lower than other utilities impacted by storms with wind speeds comparable to those that repeatedly impacted northern Illinois in 2011. The many contributing factors that caused significant damage and numerous interruptions to ComEd customers that clearly were unpreventable.

2. Summer 2011 Storms – Impact Analysis

2.1 *Overview*

Navigant performed an independent review and analysis of ComEd's interruption data for the six major storms that impacted towns in the northern and western regions of its system during the months of June and July 2011. These storms produced winds speeds of up to 80 miles per hour (mph) and tens of thousands of lightning strokes. Due to their severity, the storms have been described as a one-in-ten-year event. Navigant's review and reliability analysis was performed using unaltered storm interruption data provided by ComEd; that is, to ensure independence, Navigant did not make any changes or adjustments to cause code or equipment entries. Table 1 summarizes the total number of interruptions, total customer interruptions, and total customer interruption minutes for each storm.

Table 1. Interruption Statistics

Storm Date	Total Number of Interruptions	Total Customer Interruptions (CI)	Total Customer Interruption Minutes (TCMI)
June 8-9, 2011	1,181	189,797	57,749,526
June 21, 2011	2,646	415,313	410,875,364
June 30, 2011	665	164,762	52,682,376
July 11, 2011	5,307	902,268	1,041,498,863
July 22, 2011	1,188	167,133	70,146,105
July 27, 2011	1,701	226,716	79,790,206
TOTAL	**12,688**	**2,065,989**	**1,712,742,441**

Table 2 summarizes the equipment ComEd replaced or repaired during the six storms. Notably, the number of poles replaced is about 0.1 percent of the total number of poles located on feeders that were impacted by the storms; approximately 800 feeders experienced sustained interruptions.

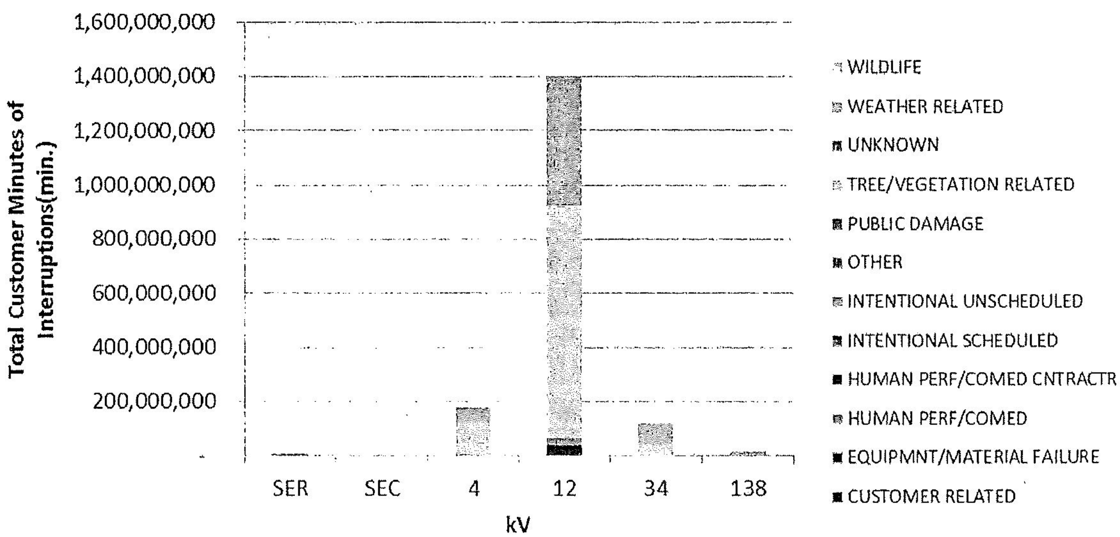
Table 2. Replacement and Repair Statistics

Equipment Category	Quantity	Unit
Poles	371	Number
Cross Arms	178	Number
Overhead Conductor	5190	Sections
Underground Cable	226	Sections
Overhead Transformers	683	Number
Other Devices	3907	Number

2.2 *Interruption Statistics*

Figure 1 illustrates the combined totals for total customer minutes of interruption (TCMI) for the six storms by voltage class. The majority of TCMIs occurred on 12.47 kV primary distribution feeders, with a much smaller amount on 4.16 kV feeders, and negligible amounts on secondary lines and services (typically, 120/240v or 277/480v). A relatively small percentage of the total TCMIs occurred on 34.5 kV subtransmission and 138 kV transmission.[2]

Figure 1. Total Customer Minutes of Interruption by Voltage



2.3 *Interruption Causes*

Table 3 indicates the large majority of total TCMI for the six storms was due to three primary causes: trees, weather, and overhead equipment. The data indicates that over 80 percent of the interruptions were tree or weather related, an expected result given the severity of rain, lightning, and wind accompanying these storms. For the weather cause code, the majority of TCMI was due to lighting and wind. The majority of tree-related TCMI was due to uprooted trees and broken limbs and tree trunks. Of these, the large majority of customer interruptions were on distribution lines operating at primary voltages (mostly 12 kV) – interruptions to secondary and service lines due to trees and limbs constitute less than one percent of tree-related interruptions. The other major outage cause code is overhead and underground equipment damage, mostly as a result of weather-related impacts, such as line transformers that fell to the ground during the storms or underground equipment damaged by high current lightning surges. The data from Table 3 is also depicted in Figure 2 below.

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[2] There was a single interruption on a double circuit 138 kV line that caused the complete interruption of approximately 26,000 customers served by the substation for about three hours on June 9th.

Table 3. Customer Interruptions by Cause Code

Cause Category	Cause Detail	Number of Interruptions	Customer Interrupted
Tree Related	Limb Broken – Primary	3,524	715,039
	Limb Broken - Service Drop	1,259	1,674
	Tree Contact – Primary	725	84,877
	Tree Contact - Service Drop	322	404
	Uprooted Tree – Primary	186	61,648
	Uprooted Tree – Secondary	1	1
	Uprooted Tree - Service Drop	49	49
	Limb Broken – Secondary	14	25
	Tree Contact – Secondary	2	3
	Tree Related Subtotal	**6,082**	**863,720**
Weather Related	Wind / Tornado	1,428	200,383
	Lightning	2,956	666,629
	Extreme Heat	56	2,553
	Flooding/Water Damage	38	11,272
	Weather Related Subtotal	**4,478**	**880,840**
Underground Equipment Related	Underground Failure	554	67,989
	Malfunction	189	36,662
	Underground Equipment Related Subtotal	**743**	**104,651**
Intentional	Emergency Repairs	466	120,144
	Protection of System Integrity	11	1,336
	Intentional Subtotal	**477**	**121,480**
Overhead Equipment Related	Malfunction	177	34,434
	Broken Fuse Link	58	2,788
	Contamination	38	3,037
	Overhead Equipment Related Subtotal	**273**	**40,259**
Unknown or Animal Related	Unknown	201	18,149
	Squirrels	105	2,769
	Birds	20	1,262
	Animal – Other	18	270
	Unknown or Animal Related Subtotal	**344**	**22,450**
Other	**Other**	**144**	**25,137**
Public	Vehicles	27	2,156
	Dig-in by Others	11	167
	Accident by Others	5	154
	Fire	7	80
	Vandalism	3	10
	Foreign Object	5	1,431
	Public Subtotal	**58**	**3,998**
ComEd/Contractor Personnel-Errors	Switching Error	0	0
	Dig-in by ComEd	2	89
	Accident by ComEd Contractor	2	50
	ComEd/Contractor Personnel-Errors Subtotal	4	139
Transmission and Substation Equipment Related	**Substation Equipment**	**39**	**2,242**
Customer Related	**All**	**46**	**1,073**
Total		**12,688**	**2,065,989**

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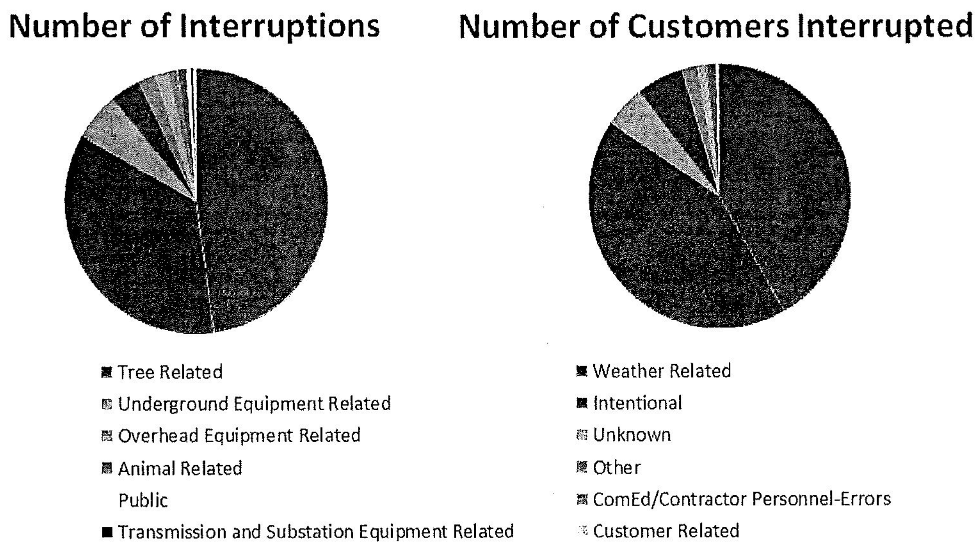
Figure 2. Number of Interruptions and Number of Customers Interrupted by Cause Code



Section 3 confirms that trees along each feeder where tree-related interruptions occurred were previously trimmed within the four years prior to the storms. ComEd's vegetation management schedules exclude trimming of trees along secondary lines or services which are located on private property over which ComEd has no access rights (secondary lines on rights of way are trimmed). However, storm statistics outlined above suggest that the number and duration of interruptions would not have materially increased even if trees along all secondary lines and services had been trimmed by ComEd - less than one percent of the customer interruption minutes were caused by tree-related interruptions on secondary lines or services.

2.4 *Equipment Damage*

Table 4 presents equipment that failed or was severely damaged during the summer 2011 storms, from ComEd's reliability data base. The number of poles that were completely severed or broken was approximately 400, less than 0.1 percent of the total number of poles in the affected areas. The number of broken cross arms recorded caused about two percent of the interruption. Primary wire failures dominated damage statistics, causing nearly 50 percent of the total interruption and over 70 percent of the number of interruption minutes.

Table 4. Equipment Damaged or Repaired During Summer 2011 Storms

Category	Total Number of Interruptions	Percent	Total Customer Interruption Minutes (TCMI)	Percent
Poles and Anchors	395	3.1%	98,520,145	5.8%
Cross Arms and Braces	237	1.9%	54,051,262	3.2%
Overhead Switching Devices	199	1.6%	16,840,730	1.0%
Overhead Transformers	760	6.0%	25,093,042	1.5%
Padmount Transformers and Devices	127	1.0%	5,861,843	0.3%
Substation Equipment	133	1.0%	19,347,194	1.1%
Recloser	124	1.0%	17,528,530	1.0%
Overhead Wire Secondary	130	1.0%	15,821,830	0.9%
Ariel Cable, Primary and Secondary	690	5.4%	26,538,394	1.5%
Phase Wire, Connectors & Insulators	6,125	48.3%	1,215,477,973	71.0%
Static Wire and Neutrals	74	0.6%	23,203,404	1.4%
Cables and Splices	663	5.2%	29,138,198	1.7%
Arresters	39	0.3%	2,842,889	0.2%
Fused Cutouts	2,955	23.3%	159,198,251	9.3%
Other	37	0.3%	3,278,755	0.2%
TOTAL	**12,688**	**100%**	**1,712,742,441**	**100%**

These results indicate several hundred poles were broken or severely damaged, but many of these likely were due to uprooted trees or large limbs that fell directly onto overhead lines, thereby causing poles to break upon impact. A typical example of the type of damage caused by uprooted trees is illustrated in Figure 3**Error! Reference source not found.**.

Figure 3. Example Storm Damage from Uprooted Tress

The modest number of damaged transformers was caused mostly by devices that fell to the ground, resulting in broken insulators, top removal and broken connections. Other pole-related damage includes numerous cross-arm brackets, broken wires, and blown arresters, all of which, in the experience of the engineers that conducted the inspections, commonly fail during major storms on electric utility overhead systems.[3]

2.5 *Tree-Related Interruptions*

Because of the share of interruptions that were tree-related among the total group of storm-related interruptions, it is important to critically examine the data and test the premise that tree-related interruptions should increase as the time since the date of the last trimming increases. If this premise cannot be confirmed, it is highly likely that many of the tree-related interruptions that occurred during the summer 2011 storms were caused by uprooted trees and large limbs falling onto lines that typically are beyond the ComEd's trimming clearance standards. To assess the relationship between tree-related interruptions and prior trimming cycles, Navigant compared the number of interruptions during the summer 2011 storms as a function of last date trimmed. Results are presented in Figure 4 for total customer interruptions and minutes.

[3] The three Navigant inspectors collectively have almost 50 years of experience working for electric utilities in engineering or operating functions. The years they have worked as industry consultants on comparable issues adds decades to this experience profile.

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Figure 4. Tree-Related Interruptions

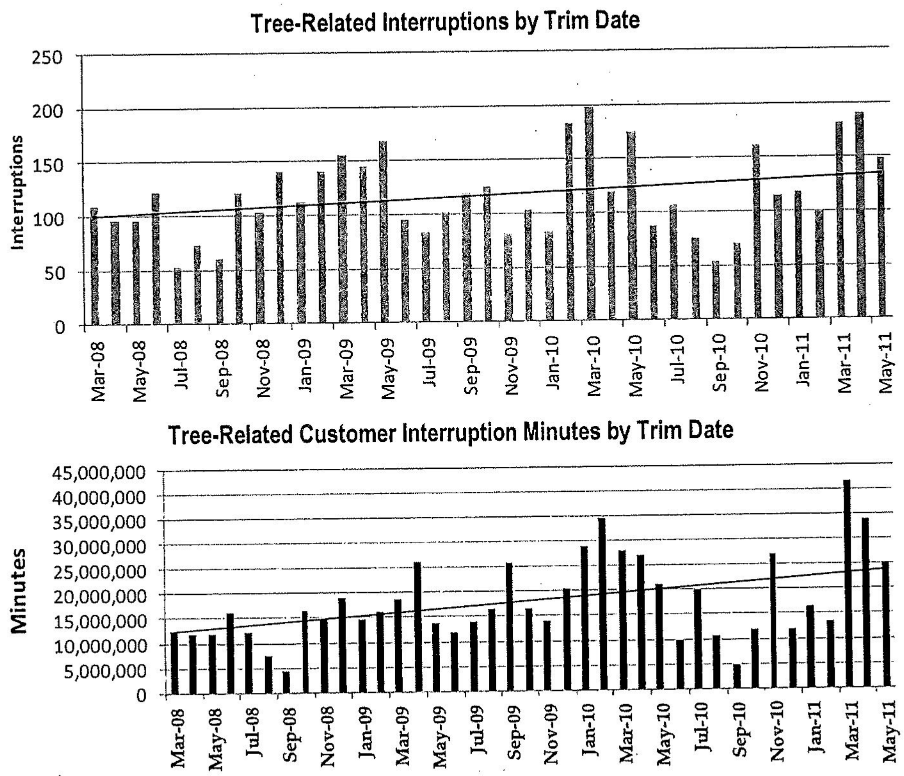
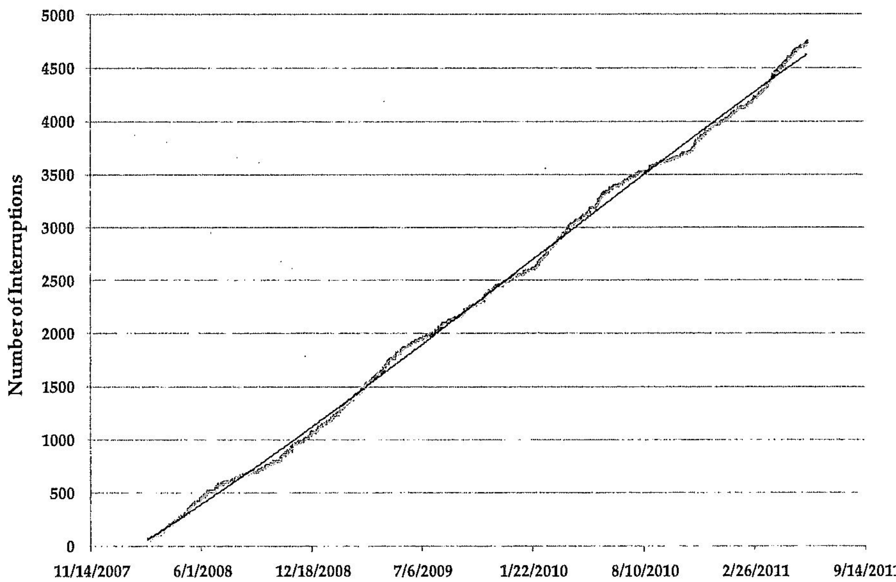


Figure 5 presents the above results on a cumulative basis. Using data provided by ComEd, trim dates for each circuit with a tree-related outage were determined. The data was then divided into monthly buckets based upon the trim date for each circuit. The number of interruptions for each month then was calculated and plotted in Figure 5. Results indicate a highly linear relationship, when a downward slope would be expected if tree-related interruptions during the storms were caused by limbs within the ICC trim zones. Results suggest tree-related interruptions were independent of whether or not the trees along the feeder were recently trimmed or had been trimmed several years earlier.

Figure 5. Cumulative Tree-Related Interruptions by Trim Date



A statistical analysis was performed using a P-Test to test the hypothesis that the trim date does not correlate to the number of interruptions on a circuit.[4] This indicated an absence of correlation between trim date and subsequent interruptions; that is, the trim date is not correlated to the number of interruptions that resulted during these outages.

2.6 *Summary*

Most of the damage to ComEd's distribution system and resulting interruptions was weather-related, much of it caused by uprooted trees and large limbs that fell onto 12.47 kV and 4.16 kV distribution lines. Additionally, severe, repeat lightning storms, many of which likely were direct strikes to distribution lines, caused many of the remaining interruptions. Lightning-related damage includes failures of terminations, padmount equipment, and underground cable caused by lightning surges. The large majority of these interruptions, measured in customers interrupted and customer interruption minutes, occurred on main-line segments and laterals operating at primary voltages. Relatively few customer interruption minutes occurred on lines operating at secondary or service voltages. The primary damage on ComEd's distribution system was broken poles, downed transformers, and broken overhead conductors; each symptomatic of damage that can occur when wind speeds reach 70 to 80 mph on rain-saturated trees and roots.

The amount of damage ComEd's distribution system experienced is not unusual or inconsistent with damage reported by other utilities during major storms, as the damage was a consequence of conditions outside of ComEd's control and common distribution design standards. Specifically, overhead

[4] A p-value was obtained through using the Data Analysis TookPak in Excel.

distribution design standards are not intended to withstand uprooted, large trees that may fall onto the lines. Further, statistical analyses confirm that tree-related interruptions did not correlate with the last trim date, adding further credence to visual evidence that trees and limbs outside of clearance zones established by ComEd were the most likely cause. Similarly, damage to cross arms, devices, and appurtenances appear to have been caused by debris tossed onto lines by high winds. As discussed in Section 3, NESC design standards include criterion for ice and wind loadings, but not for damage caused by severe events; for example, uprooted trees and windborne debris.

3. Distribution Design Standards

3.1 *Overview*

Navigant reviewed ComEd's distribution design practices and standards. We also interviewed ComEd's engineering and planning personnel to determine how these practices are implemented, and if these practices are consistent with state of Illinois Administrative Codes and national safety standards. Navigant also performed field inspections of numerous feeders to confirm the system is constructed consistent with documented practices and visually assess the condition of these assets; the latter is covered in greater detail in Section 4. Navigant also reviewed distribution loading practices to assess the degree to which equipment may be overloaded or stressed, thereby compromising reliability.

Most of our review focuses on overhead distribution, as the large majority of interruptions occurred on the overhead distribution lines. It also includes comparison of ComEd's design and construction practices to those of other similar utilities, identifying areas where ComEd's practices exceed or are below those of these utilities. It includes an assessment of design and equipment selection practices with regard to withstand capability during major storms, and the standards and criterion utilities typically apply to enhance resiliency to damage and storm-related interruptions.

3.2 *Overhead Distribution Design*

The majority of ComEd's overhead three-phase, 12.47 kV and 4.16 kV distribution lines are wood pole, cross-arm construction. Similarly, most single-phase lines are wood-pole construction, typically with pole-top insulators. ComEd often uses ally-arms for some three-phase lines where trees or other barriers are near or within the right-of-way, or to maintain tangent construction without supplemental guying. Many overhead primary distribution lines are double circuit, 12.47 kV or 4.16 kV, or secondary lines; mostly underbuild construction. However, there were a few instances where Navigant observed three or more primary distribution lines on the same pole. This is typically done where rights-of-way are limited and multiple circuits must follow the same route. This likely increased the number of interruptions caused by large uprooted trees that fell onto overhead lines.

In all towns inspected, field inspection results confirmed that many three-phase main line sections and lateral taps are located in rear lots or alleys. Many of these lines, particularly those in residential areas, are located in heavily treed areas, with mature species and limbs that often formed a canopy above overhead lines. Some of the most heavily vegetated areas with the largest trees and densest vegetation are located in towns closest to Lake Michigan. Figure 6 illustrates one example of this type of construction.

Figure 6. Three-Phase Rear Lot Overhead Distribution (Rolling Meadows)

There is minimal bundled conductor (ComEd also refers to this as "spacer cable") or tree wire used on the primary distribution system. Navigant does not believe use of bundled conductors or tree wire would have significantly reduced either the number or duration of customer interruptions, as many outages were caused by large trees and limbs toppling onto overhead conductors, often disconnecting wires from dead-end connections and terminations. In areas where smaller limbs fell onto lines, bundled conductors may have avoided some outages. Accordingly, ComEd reported that it is currently installing bundled conductors in areas most susceptible to damage by tree limbs. Several of these installations were observed during our inspections.

ComEd's current design standard for distribution lines is based on 83 Illinois Administrative Code 305 and the NESC; portions of Code 305 incorporate NESC requirements. The segment of ComEd's service territory affected by the summer 2011 storms fall within NESC's region for a heavy loading design standard.[5] Navigant did not conduct independent analyses to determine whether ComEd's distribution facilities are fully in compliance with these standards. Nonetheless, we did not detect any clear or obvious violations of these codes during field inspections; but caution that a determination of compliance should be based on a series of engineering calculation of line loadings based on equipment

[5] NESC heavy loading design standard is based on 0°F, a 4 lb. per square foot wind plus ½ inch of ice for structures or poles under 60 feet tall.

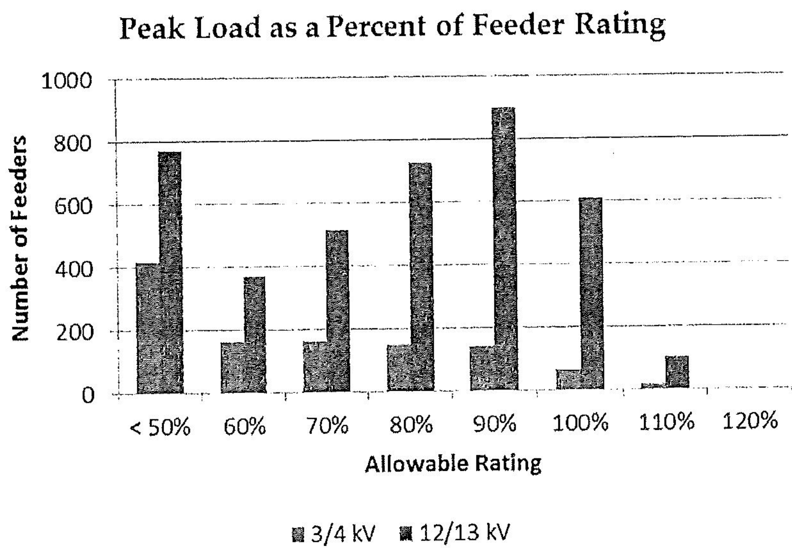
strength, wind velocity, pole attachments, and other factors that cannot be determined by field observation alone.[6] Further, distribution construction standards for equipment operating at utilization voltages - 12.47 kV and 4.16 kV dominate ComEd's system - do not apply to damage caused by storms and winds of the magnitude experienced during the summer 2011 storms. Poles greater than 60 feet in height are subject to NESC standards for extreme weather – poles of this size and class typically are used for transmission, which for ComEd, was relatively unaffected by the storms.

ComEd's distribution planning criteria specifies that the system should be designed with sufficient reserve capacity and ties to feeders fed from an adjacent substation to enable load transfer at peak, either for maintenance or when outages occur. ComEd's current overhead conductor standard specifies use of 477 AAC for three-phase lines; several older lines are equipped with 266 AAC, ComEd's prior design standard. Most single-phase overhead lines use 1/0 AAAC conductor; or #2 AAAC, #4CU, or #6CU on older lines. These wire sizes limit loading (and outage exposure for each feeder) to about 10 - 12 MW. Emergency rating is higher but reserved for back-up as ComEd planning criteria specifies that sufficient feeder capacity should be available to enable load transfer via feeder ties.

Figure 7 presents ComEd feeder peak loads as a percent of long-term allowable rating (as opposed to short –term emergency rating). The profile confirms ComEd is properly managing feeder loads, as the distribution is consistent with those Navigant has observed at other utilities. Each year, a small percentage – typically three to five percent – of feeders are upgrades or new feeders added due to load growth or other factors such as feeder reconfiguration.

[6] ComEd's Engineering Standard Practice (ESP) manual provides detailed specifications and calculations that are used to determine the size, rating, and application of equipment that should be selected given loading conditions, protection requirements, location, and other factors that engineers and designers consider in the design and construction of overhead and underground distribution systems. Navigant reviewed ESP Volume V – Distribution, dated July 29, 2011 as part of this review. Volume V contains over 1,300 pages addressing all components of overhead and underground primary and secondary distribution design, including 34.5 kV lines.

Figure 7. Distribution Feeder Loading Profile



Navigant confirmed the presence of multiple feeder tie points (designated as EMC's) on virtually all of the feeders inspected. Many of these feeder ties are auto-sectionalizing loop schemes, designed to transfer loads from unfaulted line segments to feeders fed from adjacent substations.[7] Other automatic reclosers are mid-feeder fault isolation devices. The tie points where auto-sectionalizing schemes are employed typically are equipped with reclosers. All other distribution ties are manually operated devices, usually single blade disconnects. Gang-operated, three-phase devices typically are used for 34.5 kV subtransmission lines or on 12.47 kV lines that are not readily accessible by ground crews or from bucket trucks.

3.3 *Underground Distribution Design*

The distribution feeders Navigant inspected typically included a mix of overhead and underground lines. In urban areas, the percentage of underground lines often was higher. At most substations, feeder exits are underground; in some areas, up to one mile or longer. Several feeders are mostly overhead main line construction, with underground laterals tapped off the main line via riser poles, particularly in newer subdivisions. Each of the riser poles serving laterals was equipped with arresters and fuses. However, some feeders with mostly underground construction (laterals) may have experienced a large number of customer interruptions if line faults occurred on main line sections during the summer 2011 storms. For example, in Lake Forest, many underground lateral taps are fed from three-phase main line sections. In some cases, the main lines contained a mix of overhead and underground construction, with one or more "dips" traversing the main line right-of-way. Padmount switchgear was evident on many feeders with three-phase underground construction, which improves switching flexibility and better

[7] During some of the summer 2011 storms, ComEd's Distribution System Operations personnel (DSO) remotely disabled some of the auto-sectionalizing schemes due to the widespread interruptions caused by severe weather.

isolation and restoration of service for underground faults. These design practices are consistent with those of other large utilities that Navigant has inspected.

3.4 *Protection Practices*

To identify and confirm distribution protection practices, Navigant interviewed ComEd's engineering staff, reviewed distribution one-line diagrams, and conducted field inspections. In regions impacted by the storm and system wide, ComEd's protection practices conform to those typically employed by utilities with similar feeder length and outage exposure. These include use of line fuses on lateral taps and auto-transfer schemes using mid- and end-of-line reclosers. Table 5 confirms that longer lines serving a large number of customers are protected by line reclosers; many of them are part of an auto-sectionalizing scheme. Field observations confirm the presence of many reclosers and auto-sectionalizing schemes (Figure 8 illustrates one example).

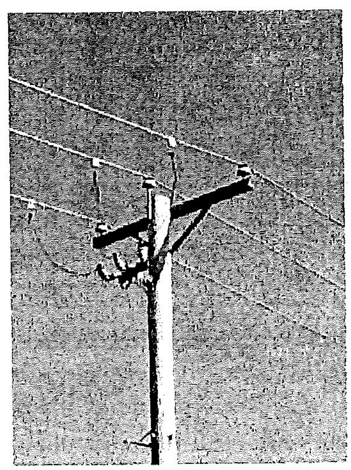
Figure 8. Intelli-Rupter on 12.47 kV Line (Rolling Meadows)

Navigant did not observe any unfused lateral taps fed from main line feeder sections in any of the regions inspected. There are some very short line sections not directly connected to the main line section that were unfused. However, Navigant does not view this finding as significant, as interruptions on these short line segments do not materially increase the number or duration of customer interruptions, as the line tap from the main line section is fused and the substation breaker does not trip.

ComEd reports that it implemented an aggressive program in the early to mid-2000's to install fuses on untapped laterals, focusing on those with greatest reliability exposure first; for example, lateral taps off main line sections. ComEd also includes unfused laterals in its maintenance inspection forms, discussed in greater detail in Section 4. Once detected, ComEd's engineering staff reviews the finding to determine if it is necessary or practicable to install the fuse.[8] Navigant believes institution of these programs and ongoing quality assurance are two of the primary reasons why it did not detect any missing fuses on laterals taps from main line sections.

For distribution lightning protection, ComEd's practices include installation of lighting arresters every 600 feet (at 4 kV and 12 kV), either via arresters on line transformers, devices, risers, or line terminations. Where none of these conditions or equipment exists, arresters are installed every 600 feet – 800 feet in lighting-prone areas – on distribution lines (Figure 9).[9] This is consistent with and in some cases, exceeds common utility practice. Most ComEd distribution lines rated 12.47 kV or below do not include shield wires, also consistent with common utility practice. However, many 34.5 kV subtransmission lines, which use taller poles, contain single overhead shield wires. The 34.5 kV lines with primary underbuild provide an added level of protection for distribution lines. Navigant's field inspections confirm the consistent application of lightning protection practices in the areas inspected.

Figure 9. Distribution Lightning Arresters (Rockford)



3.5 *Distribution Automation*

ComEd is recognized as an industry leader in distribution automation for subtransmission applications. In the mid to late 1990s, the company installed SCADA-Mate auto-sectionalizing reclosing circuit breakers on 34.5 kV lines throughout its service territories. More recently, the company has expanded the program to include mid-stream reclosers and auto-sectionalizing loop schemes on its 12.47 kV

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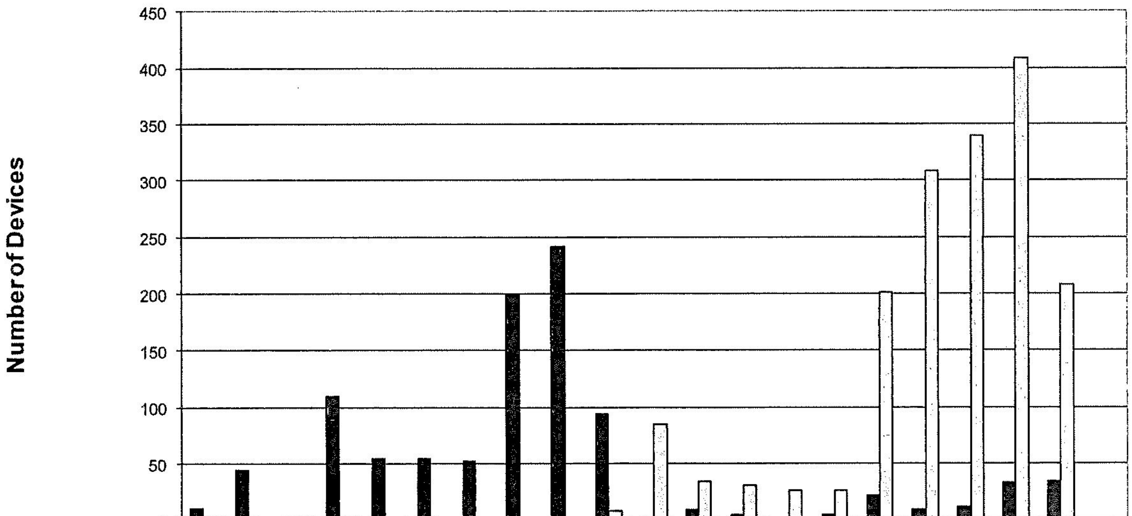
[8] The company may elect to not install a fuse if the lateral is very short with few customers potentially impacted by interruptions, or where the fuses cannot coordinate with upstream devices. These types of exclusions are consistent with common utility practice.

[9] The presence of lightning arresters on line segments typically protect lines from interruptions due to induced lightning strikes. Lightning arresters generally cannot avoid interruptions for most direct lightning strikes due to the large amounts of energy that must be dissipated. However, equipment damage is minimized via use of arresters that may fail, but nonetheless absorb much of the energy caused by direct lightning strikes.

distribution system. Figure 10 presents the number of 34.5 kV and 12.47 kV devices installed over the past two decades.

Figure 10. ComEd Distribution Automation Devices Installed



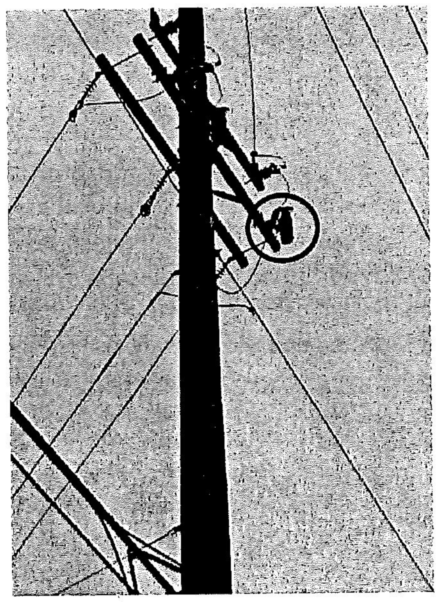
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
ALRS's Installed	11	44	2	110	55	55	52	200	242	94	2	10	5	0	5	22	10	12	33	34
Reclosers Installed	0	0	0	0	0	0	0	0	0	9	85	34	31	26	27	201	308	340	409	208

Year

Over the past seven years, ComEd has installed over 200 auto-sectionalizing loop schemes on primary distribution lines, with well over 1000 reclosers installed system wide. ComEd reports the installation distribution class auto-sectionalizing has reduced customer interruption minutes by over one million in 2011. It proposes to aggressively continue installation of reclosers and auto-loop schemes, targeting feeders based on outage exposure, number of customers within sectionalizing zones, and estimated savings in customer minutes.

Over the past few years, ComEd has begun to install single-phase fuse saving devices (also referred to as "Trip Savers") as part of a pilot program evaluation, including installations on feeders impacted by the summer 2011 storms. These devices replace conventional fuses, with the advantage of providing automatic single-shot reclosing for temporary faults. Figure 11 illustrates these devices on a three-phase lateral tap and on a single phase lateral tab. ComEd's reliability engineers report the initial installations have performed well and the program is expected to continue.

Figure 11. Fuse-Saver Sectionalizers



3.6 *Non-Affected Areas*

ComEd's distribution design practices are comparable to those we have evaluated or observed at other North American utilities serving a mix of urban and suburban load. Although some of the lines and equipment are in the newer subdivisions in outlying areas, we did not observe any distinct difference in the design or construction of lines in areas affected by the summer 2011 storms to other parts of the system. Asset records, field observation, and statistics confirm main line and lateral line sections are comparable in length, and equipped with reclosers and fuses in a consistent manner, with few observable inconsistent applications of these practices.

3.7 *Summary Assessment*

ComEd's distribution design standards are consistent with or exceed those of utilities with comparable service territory attributes and customers served. In all areas reviewed, confirmed by field inspections, ComEd's distribution system is designed and constructed in accordance with Title 83 of the Illinois Administrative Code, NESC, and common and prudent utility practice. We did not observe any clear violations of these codes and practices. The size and capability of key distribution equipment, including poles, wires, transformers, and cable, are appropriately sized for the function they provide, and are properly maintained. Regular patrol and inspection of all lines ensure potential reliability problems are proactively addressed and emergent code violations immediately addressed. Protection practices meet or exceed industry practices, including extensive use of reclosers and employment of auto-sectionalizing loop schemes, ensuring that the minimum number of customers is impacted by interruptions and restoration times are expedited.

4. Material Condition Assessment

4.1 *Overview*

Navigant's condition assessment of ComEd's distribution system included a rigorous and independent review of key data, field observations and design factors, all of which are essential to formulating consistent and defendable findings and conclusions. Sources include asset registry data, performance history, design standards, maintenance records, ICC reports, and other relevant system records and documentation; supplemented by information obtained in interviews with those responsible for managing and implementing these processes and field inspection observations. Navigant focused on areas impacted by the summer 2011 storms[10], and compared these data and statistics to areas unaffected by these storms.

[10] Impacted as defined in Mr. Owens on page 7 of his direct testimony on behalf of The Office of the Attorney General State of Illinois dated January 26, 2012 - Arlington Heights, Elmhurst, Evanston, Glenview, Highland Park, Lake Forest, Morton Grove, Niles, Park Ridge, Rockford, Rolling Meadows, Schaumburg.

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4.2 *Distribution System Assessment*

Table 5 compares key distribution statistics for distribution feeders in areas affected by the summer 2011 storms to those located in ComEd's entire service territory. The table confirms the distribution feeders impacted by the summer 2011 are comparable to those located in unaffected areas.

Table 5. Distribution System Statistics

Distribution Lines and Equipment	Total ComEd Distribution System	Areas Affected by Summer 2011 Storms	Areas Affected Versus Total System (Percent)
Total Number of Feeders	5,022	604	12%
Total Number of Customers	3,799,887	450,956	12%
Total Main Line Miles	27,334	3,189	12%
Overhead	14,510	1,545	11%
Underground	12,824	1,645	13%
Total Lateral Line Miles	33,524	2,966	9%
Overhead	17,206	1,329	8%
Underground	16,318	1,636	10%
Total Line Miles	60,858	6,155	10%
Overhead	31,716	2,874	9%
Underground	29,142	3,281	11%
Average Circuit Length Main Line	5.44	5.28	97%
Average Number of Customers Main Line Mile	139	141	101%
Average Circuit Length Laterals	6.68	4.91	74%
Number of Reclosers	1,828	264	14%
Main Line Circuits with Reclosers	1,087	164	15%

Note: Values based on circuit miles for primary voltage lines (4kV and 12kV).

Statistics for areas impacted by the storms are consistently near 12 percent of ComEd's system totals for virtually all categories, including the number of feeders, customers served, and miles of line. Similarly, the average length of main line feeder sections is virtually identical to the composite system average. One statistic where differences exist: laterals are 25 percent shorter, on average, than lines in regions unaffected by the summer 2011 storms. Notably, the number of line reclosers per circuit mile is higher in areas affected the storms than the system as a whole. The average age of ComEd's overhead distribution transformers, system wide, is about 25 to 30 years. The average age of transformers in the northern region is just under 20 years. Overhead and padmount transformers are inspected every four years as part of the company's maintenance inspection program. This is consistent with or above common utility practice.

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Figure 12. Age Distribution: Transformers

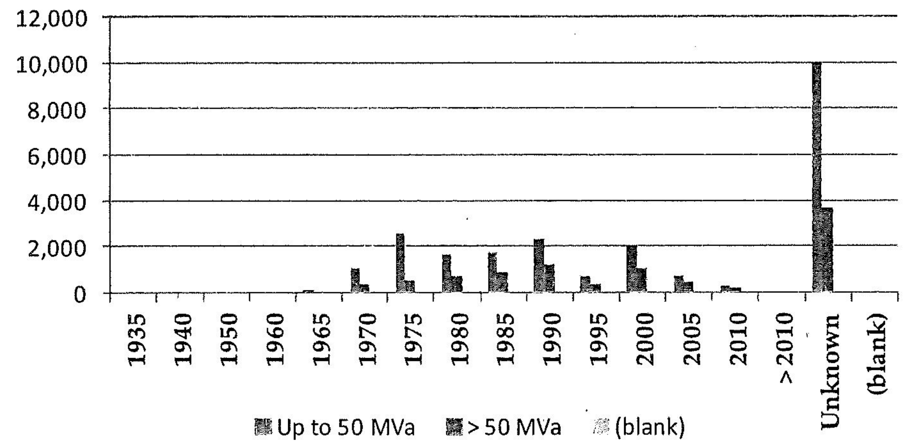
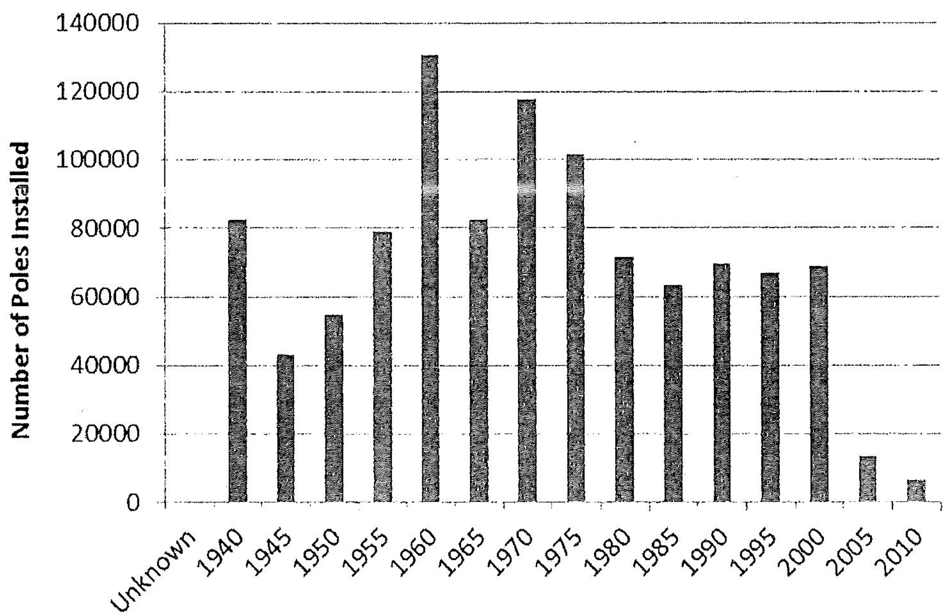


Figure 13 presents the age of ComEd's distribution poles for the entire system. The average age of ComEd's distribution poles, system wide, is about 42 years. Pole inspection records indicate that about three percent of poles inspected annually are rejected. Of those that are rejected, all poles listed as priority replacements have been replaced or reinforced. This is consistent with common utility practice.

Figure 13. Pole Age Distribution



4.3 *Reliability Improvements & Performance Review*

4.3.1 Reliability Improvement Programs

ComEd has instituted a series of programs and measures designed to enhance reliability performance. Some of these programs have been in place for several years; some are relatively new, such as those crafted based on smart technologies. Most of these programs, described below, provide reliability benefits for both normal conditions and storms.

4.3.2 Targeted Reliability Improvements

ComEd's reliability improvement program is designed to maximize reliability improvements at the lowest cost. It includes capital and O&M programs targeted to feeders with the greatest opportunity for reliability improvement. Specific initiatives include:

- Worst 1% Feeder Program
- Cable Diagnostic Testing
- Circuit Capacity Improvement
- Customer Targeted Program
- Distribution Automation Program
- Underground Cable Program
- Miscellaneous Reliability Improvements

Collectively, these programs, along with pro-active maintenance, appear to have directly contributed to an improvement in reliability metrics over the past five to ten years. They likely contributed to a reduction in both the number and duration of interruptions that otherwise would have occurred during the summer 2011 storms. For example, reinforcing poles, installing auto-sectionalizing loop schemes, replacing damaged equipment and targeted lightning protection each are important factors for enhancing storm durability. However, substantial amounts of damage caused by uprooted trees and large fallen limbs will damage even the most durable distribution equipment.

Some utilities have sought to employ storm hardening to its distribution system, such as installing higher-class poles, larger cross arms, bundled conductor and relocating lines underground. Navigant's experience is that these measures are difficult to justify economically, particularly for existing equipment where replacement can be very expensive if applied system wide. Other options such undergrounding overhead lines can be exceedingly expensive, particularly for three-phase primary distribution lines, where each fault interrupts the greatest number of customers.[11] The undergrounding of single-phase lateral tap lines is less expensive, but results in far less reliability benefit due to the lower number of customers served on these line segments. Storm hardening typically is most cost effective when applied to new construction or scheduled replacements.

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[11] Prior Navigant studies indicate the cost of overhead to underground relocation, applied system-wide to large urban utilities similar to ComEd can cost in the billions of dollars.

4.4 *Maintenance Practices & Procedures*

4.4.1 Vegetation Management

ComEd's Vegetation Management (VM) program for overhead distribution lines is based on ICC requirements, which requires electric utilities to trim every primary distribution line, at minimum, every four years. ComEd is not required to trim trees located near low voltage service lines. Further, ComEd performs interim spot trimming on feeders where vegetation management issues are identified from reliability records, scheduled maintenance inspections, or field observation. ComEd's compliance with the ICC's targets exceeds 99 percent that all circuits get trimmed in four years, and has processes in place to ensure feeders meet this standard. Ongoing construction and other non-ComEd activities that limit access typically account for the remaining one percent.

Further, ComEd's VM policy for subtransmission lines does not allow for any overhang. Notably, many 34.5 kV subtransmission lines include one or more 12.47 kV or 4.16 kV distribution lines attached directly below the 34.5 kV lines. These lower voltage distribution lines would share in any benefit from this practice.

4.4.2 Pole Inspection Program

Since 1996, ComEd has inspected well over 1 million of the 1.4 million distribution poles on its system. The remaining 400,000 typically are newer poles installed for new loads or line extensions and are therefore given a lower inspection priority. The company has a goal to achieve a ten-year inspection cycle that it will maintain prospectively once reached. A ten-year inspection cycle is consistent for utilities located in decay zones comparable to northern Illinois.[12] ComEd employs Osmose® to perform and treat poles, a firm well recognized and employed within the utility industry and other industries using wood products.

Table 6 summarizes the composite results of these inspections, which indicate that less than 1 percent of the poles are deemed as priority replacement, indicating the pole must be replaced (less than 1,000 annually). This replacement rate is at or below those of other utilities Navigant has evaluated. Of the non-priority poles rejected, which includes those that should be addressed within one year, many of these are reinforced with C-Trusses, a low-cost alternative to complete pole replacement (Figure 14). Most of the remaining 96 percent of poles inspected are treated with decay retardants or pole wraps to extend asset lives.

[12] The North American Wood Pole Council has a rating system that establishes deterioration or decay zones on a scale of 1 to 5, with 1 as the lowest decay zones, 5 the highest. ComEd's service territory is mostly within zone 2, which is designated as a moderate deterioration zone. Pole inspection intervals typically correlate with zone designations; those in deterioration zone 1 or 2 typically have ten-year inspection cycles or longer. http://www.woodpoles.org/documents/TechBulletin_EstimatedServiceLifeofWoodPole_12-08.pdf

Table 6. Distribution Pole Inspections

	Year Last Inspected	Poles Inspected	Reject[13]		Non-Reject
			Priority	Non-Priority	
Affected Area	1996 - 2007	106,300	0.94%	2.70%	96.36%
System Area	1996 - 2007	1,223,948	0.89%	3.04%	96.07%
Difference		**8.69%**	**0.05%**	**-0.34%**	**0.29%**

Navigant views ComEd's practices of inspecting and treating poles to extend their service lives, and replacing poles only when tests indicate replacement is the only cost-effective option, as consistent with utility asset management practices and pole inspection processes. ComEd's actual practices are in contrast to recommendations in some states that ostensibly suggest poles should be replaced when they reach an age threshold – 40 to 50 years. This would markedly increase the pole replace rate, at significant cost, applying criterion unsupported by inspection results, internal strength measurements, and remaining pole life based on commonly accepted engineering principles and prudent utility practices.

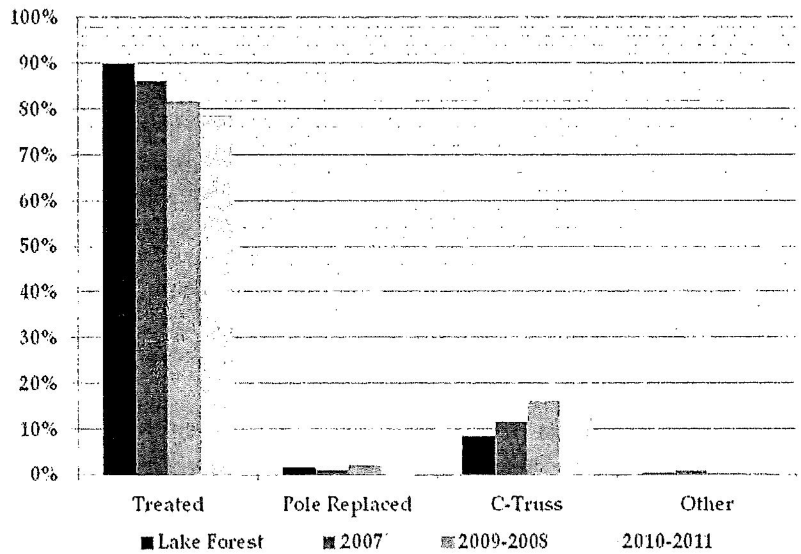
Figure 14. C-Truss Pole Reinforcement (Rockford)

Pole inspections performed in 2007 for Lake Forest confirms the condition of poles in an area heavily impacted by the summer 2011 storm are comparable to other areas in ComEd's system. Figure 15 presents pole inspection and treatment data for Lake Forrest in 2007 to other areas inspected between 2007 and 2011. Notably, the number of poles replaced or C-Trussed in Lake Forrest was below the

[13] Priority replacement is assigned when less than one-third of the original pole shell strength remains; non-Priority when less than two-third, but more than one-third of the original shell strength remains.

system average. Up to 90 percent of poles in Lake Forrest only required internal treatment, versus 80 percent of less in other towns.

Figure 15. Pole Inspections – Total System versus Lake Forrest



4.4.3 Maintenance Inspections

ComEd has instituted a proactive maintenance inspection program designed to identify potential reliability, performance, or safety issues. Every feeder is inspected at least every four years. Navigant confirmed that each of the distribution feeders experiencing interruptions during the summer 2011 storms was inspected within the prior four years.

The inspections include identifying issues that would otherwise exacerbate the number and duration of storm interruptions if not proactively addressed by these inspections. These include devices in need of repair, damaged equipment, deteriorated poles and crossarms, low clearances, failed lightning arresters, missing fuses, grounding (including cut ground wires) and other items prescribed for inspection. Table 7 lists the 25 items that appear on inspection sheets. Inspections are provided a second set of severity codes for each of these codes, ranging from 10 for items in need of immediate repair or replacement, to 40 for inclusion as a corrective maintenance work order. Code 10 designations must be addressed within 24 hours, Code 20 within 14 to 30 days and Code 30 within 30 to 60 days, respectively. Appendix B presents a more detailed array of these codes and severity levels.[14]

[14] Maintenance Inspectors are provided a document titled "Overhead Distribution Circuit Inspection Criteria," which has photographs and illustrations of typical conditions and codes that should be assigned for each of these conditions.

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Table 7. Overhead Maintenance Inspections

Maintenance Inspection Items				
Poles	Slack Span (Primary)	Tie Wire	Non-Oil Term	Guy Wire
Pole-Top Extension	Arms (Crossarm / Alley)	Connector	Wildlife Protection	Highway / Railroad Crossings
Conductors (Primary)	Arm Brace	Arresters Needed (Number)	Fault Indicators	Labeling
Conductors (Secondary)	Insulators / Deadends	Fuse / Cutout	Grounding	Clearance
Conductors (Neutral / Static)	Pin	Equipment (Trf/Reg/Pot/Recl/Cap)	U-Guard	Vegetation

Navigant views ComEd's proactive maintenance inspection program as an industry best practice and it likely prevented some interruptions and reduced the duration of others during the summer 2011 storms. Several, if not most, of the items on the list are susceptible to storm-related failure or faults, including vegetation. Notably, ComEd's maintenance inspection personnel visually inspect all lines experiencing more than 100 customer interruptions following a storm, and all feeder lock-outs.

Table 8 presents maintenance inspection data performed for each of the feeders scheduled in ComEd's northern region in 2010 (approximately 300) for inspection codes 30 and 40, which require repairs within 30 and 60 days, respectively. Many of the categories where mitigation was required include equipment susceptible to storm damage or weather-related impacts, such as arresters, terminations, cross arms, poles braces and brackets. The absence of vegetation management entries confirmed that danger trees or other tree-related issues were not detected during scheduled inspections one year prior to the storms.

Table 8. 2010 Maintenance Inspections (Northern Region)

Asset Category	Code 20	Code 30	Total	Percent
Arresters	0	297	297	27%
Clearance - Primary	6	2	8	1%
Clearance - Secondary	22	0	22	2%
Clearance - Service	56	1	57	5%
Connector	1	1	2	0%
Crossarm Brace	40	1	41	4%
Crossarm Broken	15	0	15	1%
Equipment	1	2	3	0%
Fuse Cutout	1	75	76	7%
Insulator / Deadends	1	144	145	13%
Neutral Wire or Static Wire	9	17	26	2%
Pin	31	9	40	4%
Pole	16	0	16	1%
Primary Wire	29	73	102	9%
Slack Span	0	168	168	15%
Tie Wire	0	71	71	7%
Total	**228**	**862**	**1090**	**100%**

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ComEd also employs several reliability engineers, whose sole responsibility is to identify and devise solutions for potential reliability issues based on feeder reliability data, field observations, customer complaints, performance history, and other sources. Many of these engineers accompanied Navigant's field inspectors. Feedback received from these engineers confirmed they are always on the "lookout' for reliability problems.

4.4.4 Thermography

In addition to the two- and four-year inspection cycles outlined in Table 7, ComEd performs a similar set of thermography inspections to detect hot spots and other areas of higher-than-normal heating, such as those associated with loose connections, hidden corrosion, and pending internal devices failures. Many utilities perform thermography, particularly for transmission and subtransmission. Navigant views ComEd's program as an industry best practice as it is performed regularly for all distribution feeders; not just on a targeted basis or to address isolated reliability or performance problems.

4.4.5 Quality Assurance

Navigant determined that the manner in which the reliability programs and initiatives have been established and implemented have contributed significantly to the quality assurance and continuous improvement of the overall reliability performance. This is evidenced by the overall improvement of key reliability indicators (SAIFI, CAIDI) to 1st and 2nd quartile in the benchmarking studies presented in Section 5.

In order to significantly improve the outcome of a process, there are two key components to assess: (1) The overall population of outcomes (reflected in the process average); and (2) the variation of the process (seen in the outliers or population tails) - ComEd's reliability programs focuses on both. The Maintenance Inspections, Distribution Automation, and Cable Diagnostic Testing are examples of reliability programs to improve the process average. The Worst 1 % Feeder Program, Worst Chronic Feeder Programs, and Customer Targeted Program are examples of initiatives to narrow the variation. Focusing on worst performing feeders and customers/equipment with higher number of failures is a best practice, contributing to the overall performance improvement. Com Ed consistent emphasis on the worst performing feeders have resulted in considerable improvement in this area, where now the worst feeders being addressed are experiencing on average 4.5 to 5.5 failures per year. It must be noted that to significantly impact an outcome indicator based on so many different input variables requires strong attention to details and focused on consistent plans and execution.

Continually re-evaluating plans, monitoring and controlling the execution, and acting on the non-performing parts of the process are critical components of continuous improvement. Navigant observed, through interviews and review of documented procedures, these important steps are functioning well, constituting a strong management process and quality control. ComEd has carefully detailed annual plans which include targets and monthly indicators that are tracked by management as part of the monthly indicator review meetings. Additionally, they conduct daily conference calls to review the previous day's findings as well as customer concerns.

During Navigant's field inspections, the Navigant team was accompanied by reliability engineers, and it was evident that ComEd's personnel are very familiar with the feeders and system infrastructure. A sense of "ownership" of their respective areas was apparent. On the infrequent occasion when an issue was identified, ComEd's personnel were proactive in documenting it and taking action.

4.5 *Summary Assessment*

ComEd's distribution system is comparable to many of those we have evaluated or observed at other North American electric utilities serving a mix of urban and suburban load. In certain areas, many segments of distribution lines observed during our inspections were located along heavily treed rights-of-way in back lots or back alleyways, particularly in areas affected by the summer 2011 storms. However, effective vegetation management programs, pro-active maintenance, and targeted reliability improvements, coupled with ongoing quality assurance has caused reliability to improve over the last decade.

ComEd has effectively managed its distribution assets to ensure reliability is not degraded by lines or equipment that is improperly maintained or applied. The institution of regular maintenance inspections and targeted reliability programs are designed to pro-actively identify and address potential problems. Although some equipment is several decades old, its condition and ability to perform well under normal storms is assured by these pro-active efforts. This finding is underscored by the continued reduction in the defective equipment cause code for overhead distribution. Although underground cable failures have increased, they were not a material factor during the summer 2011 storms. ComEd has implemented an underground cable and infrastructure upgrade program, targeted to circuits and cable sections with high failure history or known to be susceptible to failure.

The results of the above and the review of ComEd's distribution design in Section 3 and interruption statistics provides evidence that the large majority of interruptions – well over 95 percent based on reliability data - that occurred during the summer 2011 storms were unpreventable, as the damage that occurred was due to events outside of ComEd's direct or indirect control. Further, one would not expect to find evidence that every interruption is unpreventable, which is the case for all electric utilities crews and staff during major storms. Notably, each of the distribution lines experiencing interruptions during these storms had been trimmed in accordance with ICC standards. Further, our review of ComEd's distribution design standards, confirmed by field observation, unequivocally indicates system design and construction is consistent with prudent and common utility standards. Notably, we did not observe any violations or inconsistency with Illinois Administrative Code 305 or NESC requirements. In many areas, such as targeted reliability initiatives and distribution automation, ComEd has adopted industry best practices. Navigant's findings are supported by over 75 years of collective experience evaluating electric utility distribution systems and post-storm performance.

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5. Benchmark Analysis

5.1 *Objectives*

Navigant examined two benchmarking sources in order to determine ComEd's performance relative to industry peers across the U.S. and among all Illinois utilities. Navigant's examination of the benchmark results were focused on commonly used reliability indices including: SAIDI, SAIFI, and CAIDI; as well as O&M costs. Further, Navigant benchmarked equipment damage based on publically available data for tropical cyclones over the last two decades.

5.2 *27-Company Peer Group Reliability Benchmark*

As part of its quality program, ComEd participates in an annual benchmark with a group of similar utilities from across the U.S. The graphs below present the 2007 through 2010 results for SAIFI, CAIDI, and SAIDI relative to the peer companies. The results for ComEd are highlighted in red and performance quartile bands are indicated with various shades of gray.

Figure 16. Reliability Benchmark – System Average Interruption Frequency Index

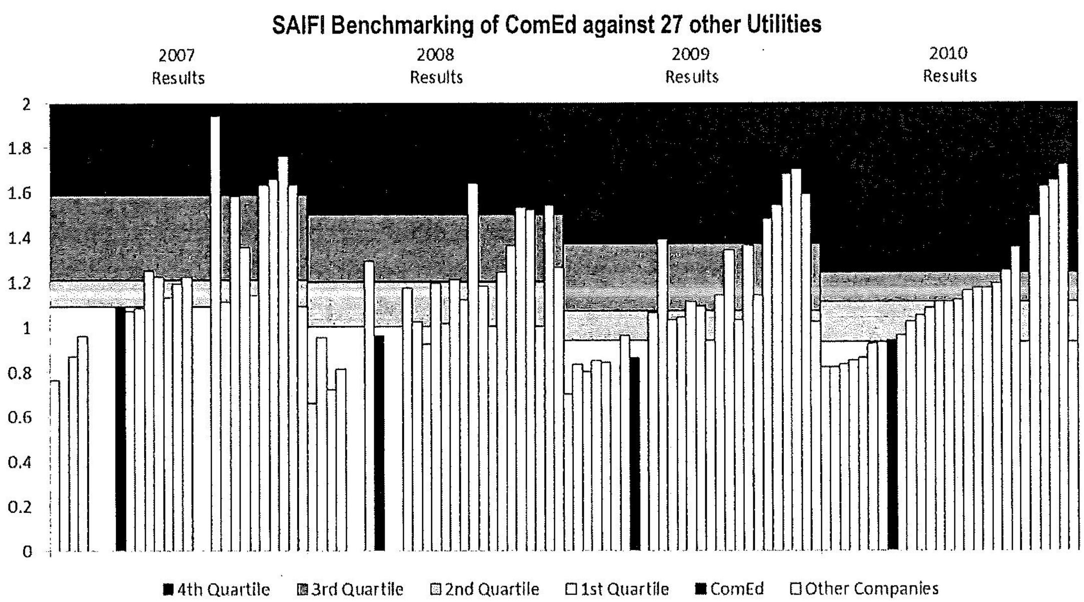


Figure 17. Reliability Benchmark – Customer Average Interruption Duration Index

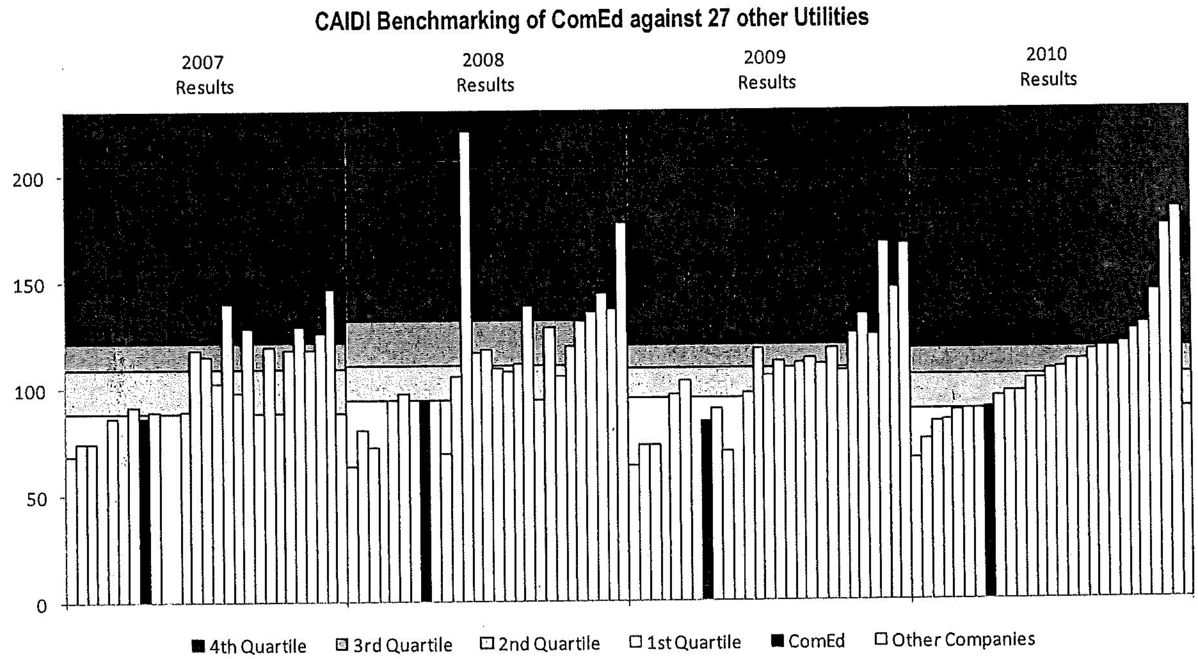
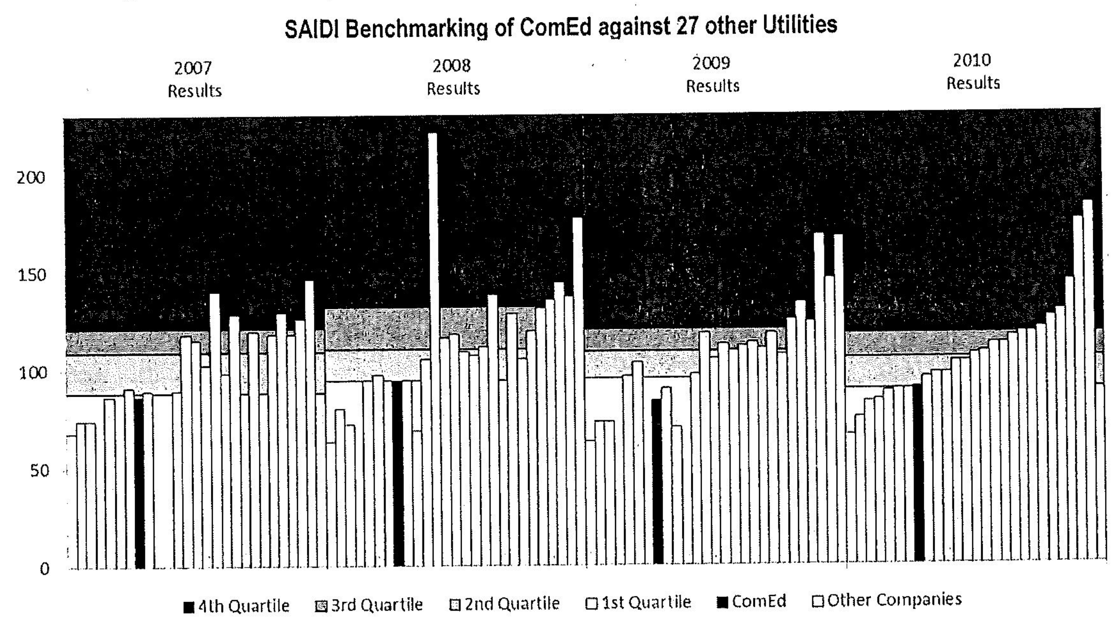


Figure 18. Reliability Benchmark – System Average Interruption Duration Index



The indices in this benchmark were calculated using the IEEE Std. 1366-2003 2.5 Beta Method which excludes major events and planned interruptions. Not all the companies in the benchmark reported their results every year and some did not measure a particular metric.

The results of the benchmark show a steady performance by ComEd over the period from 2007 to 2010. ComEd results for SAIFI and CAIDI placed them among the companies in the first quartile from 2007 to 2009 and at the top of the second quartile in 2010. ComEd's results for SAIDI placed them among the companies in the first quartile throughout the entire reporting period. These results suggest a sustained and well above average reliability performance consistent with a well maintained system.

5.2.1 Benchmark Companies

ComEd benchmarks performance versus a 27-company peer group comprised of anonymous utilities comparable in size or system attributes.[15] Instead, the companies have been identified by a number. Only ComEd is identified by name. The characteristics considered in the selection of the peer group panel members include:

Primary

- Approximately 1 million or more customers
- Availability of operating and financial data
- T&D operations

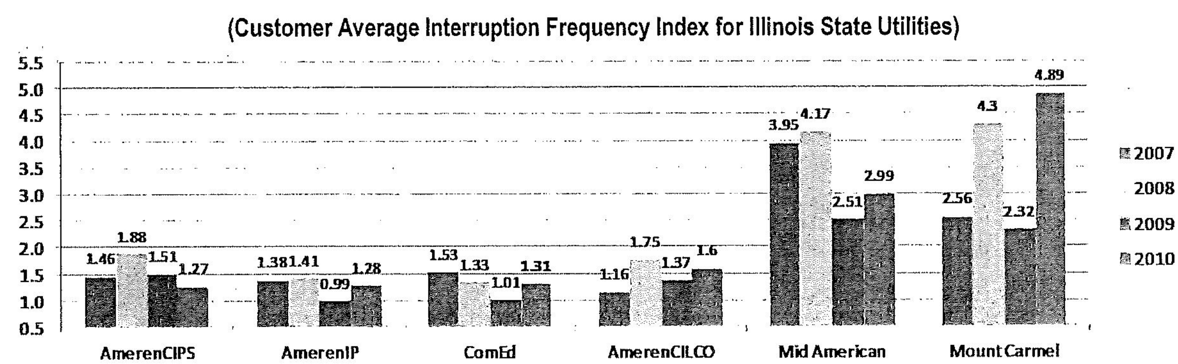
Secondary

- Publicly held utility
- Integrated utility (gas and electric)
- Operations in multiple states

5.3 *Illinois Commerce Commission (ICC) Reliability Benchmarks*

As part of ComEd's reporting requirements, ComEd participates in an annual reliability benchmark that includes all the utilities serving customers in Illinois. This benchmark includes SAIFI and CAIDI reliability metrics (including storm data). Figure 19 and Figure 20 present the results from 2007 to 2010.

Figure 19. Reliability Benchmark – Outage Frequency



[15] Data provided by the 27 utilities in the peer group is confidential; as participating utilities do so on the condition that company-specific data is not disseminated to third parties.

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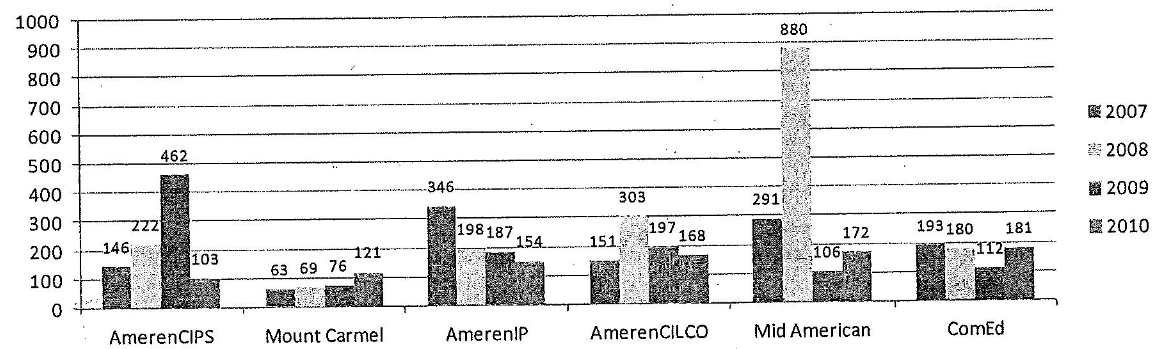
Figure 20. Illinois Utility Reliability Benchmark – Outage Duration

(Customer Average Interruption Duration Index for Illinois State Utilities)



The metrics in this Benchmark were calculated using Commission rules which includes outages lasting more than one minute, and excludes certain outages specified in 83 Illinois Administrative Code Chapter 1 Section 411 (i.e. Customer Related Outages).

The results of the Benchmark show a steady performance by ComEd over the period from 2007 to 2010. ComEd SAIFI and CAIDI results placed them in first and second place among major utilities (those with 80,000 or more) in 2008 and 2009 respectively. ComEd SAIFI results placed them in third place in 2010. CAIDI results 2010 placed them in fifth place as a result of the June 18, 2010 Storm which struck Northern Illinois and impacted over 540,000 customers increased CAIDI by 54 minutes. These results also suggest a sustained and well above average reliability performance consistent with a well maintained system.

5.3.1 Benchmark Companies – ICC Reliability Benchmark

The Benchmark includes utilities that have electric customers in Illinois including: AmerenCIPS, Mount Carmel, AmerenIP, AmerenCILCO, Mid American, and ComEd.

5.4 *Benchmark Costs- 27 Company Peer Group*

ComEd's spending for distribution O&M is comparable to the O&M spending of the 27-company peer group in ComEd's benchmark (please see description of peer group provided in section 5.2.1). Figure 21 compares ComEd's O&M annual spending to the 27 benchmarked utilities based on dollars per customer.

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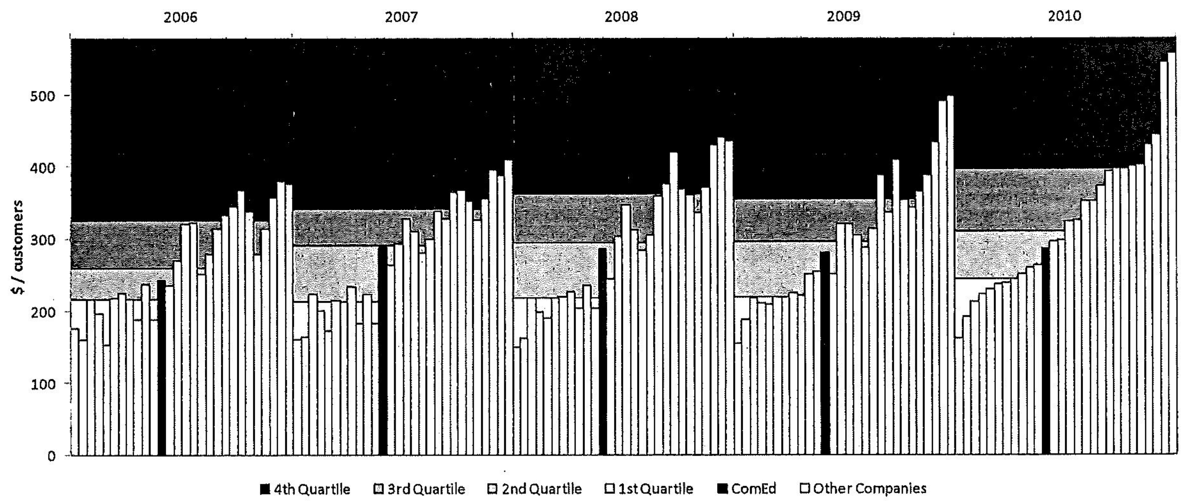
Figure 21. O&M Benchmark versus 27 Other Utilities



The cost benchmark results indicate ComEd's spending for O&M is slightly below the average. Navigant views these results as very favorable. ComEd has implemented a comprehensive O&M program, described in detail in prior sections. The ability to implement comprehensive O&M programs, several of which Navigant deems as best practices, suggests that spending is carefully managed and targeted to areas that provide the greatest reliability and performance benefits per dollar spent. Notably, major spend components like vegetation management as well as maintenance inspections are performed in a cycle that is at, or shorter than, those of other comparable utilities outside of Illinois.

5.5 *Major Storm Benchmark*

A comparison of ComEd's performance during major storms is difficult to benchmark since no two storms are exactly the same. Electric utility distribution lines, both for ComEd and utilities in general, are not designed to withstand damage caused by uprooted trees and the number of fallen trees with their devastating impact are not tracked during storms; nor does the NESC specify distribution design standards to withstand major storms or winds of the magnitude that occurred during several of the summer 2011 storms. Nonetheless, Navigant's experience indicates that favorable restoration trends for normal events often are a good indicator of how the system will perform during major storms. Further, it is possible to establish a reasonable perspective based on available data and understanding of storms' effect on utility infrastructure.

Storms and their effect on a utility's infrastructure are difficult to predict precisely since there are many factors to consider and many are not easily measured or consistently tracked by the industry. However, it is possible to establish a reasonable perspective based on available data and understanding of storms' effect on utility infrastructure. In a report that Brad Johnson, Independent Energy Advisor, prepared for Edison Electric Institute (EEI) in January 2004, he compiles and examines utility data from major storms that occurred between 1989 and 2003 by from. Mr. Johnson examined data from 44 storms; 21 from summer wind storms, lightning, tornadoes, or hurricanes; and nine from unnamed summer storms. The report suggests major equipment damage, such as damaged poles, is a reliable and consistent way to compare the severity of storm.

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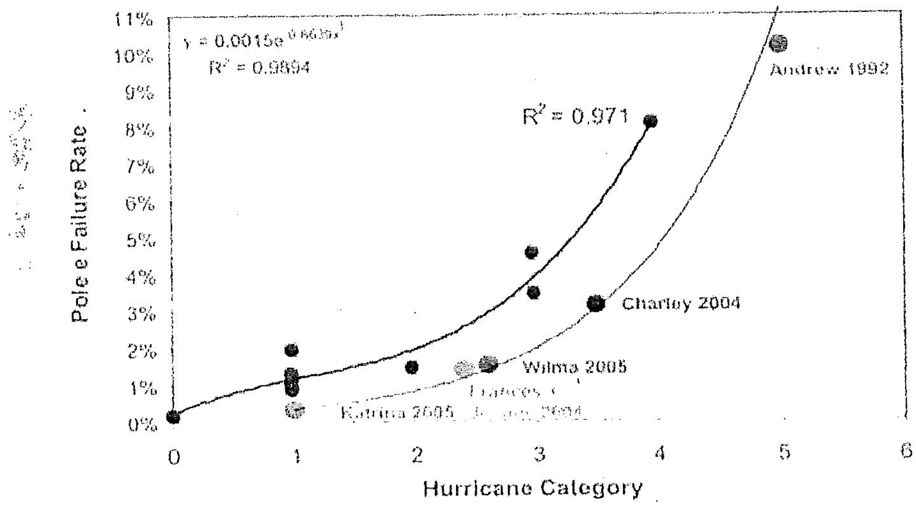
A predictive model illustrated in Figure 22 depicts number of damaged poles according to wind velocity. This model is based on historical performance of poles and wind speed maps for storms and was presented to the Public Utility Research Center by Florida Power & Light (FPL). The model uses the number of poles damaged by the storms as a proxy for overall system damage.

Figure 22. Pole Failure Rate for Major Storm Category



The model predicts that over one percent of poles in the affected area will need to be replaced for a Category 1 hurricane (highest recorded winds between 74 and 95 mph).

Meteorological records confirm wind speeds during the summer 2011 storms approached or exceeded 80 mph in some areas, particularly, on July 11th. These winds likely exceeded the design standards for many of the poles. Section 2 of this report presented data indicating ComEd replaced about 0.1 percent of poles during in the summer 2011 storms. We can therefore conclude that ComEd system performed significantly better than expected given the severity of the summer 2011 storms.

Navigant reviewed utility data available from major storms occurring between 1989 and 2003, compiled and examined by Brad Johnson, Independent Energy Advisor for a report for Edison Electric Institute (EEI) in January 2004. Of the 44 storms data, 21 were due to summer wind storms, lightning, tornadoes, or hurricanes including nine from unnamed summer storms. The report defines equipment damage as "the direct impact of the storm on a utility's physical infrastructure. It is a reliable and consistent way to compare the severity of one storm versus another storm."

For the survey, three major equipment categories were selected as proxy for overall system damage: total number of poles replaced, total number of transformers replaced, and total miles of primary conductors replaced. The number of data points by storm data makes it difficult to reach specific conclusions, but provides insight as to the vulnerability of electric systems to weather events. Table 9 lists equipment damaged and replaced by storm event as well as peak customers out and restoration period. Based on restoration performance or days to restore and number of customers out, the data confirms ComEd's statistics are comparable. Note that the report highlights peak customers out or maximum number of customers out at a given point in time as a better indicator of the severity of the storm.

Table 9. EEI Major Storm Restoration Survey Results, 1989-2003[16]

				Damage Estimates		
Storm Event	Date	Peak # of Customers Out	Outage Durations (Days)	Poles Replaced	Tx Replaced	Wire Replaced (Miles)
Tornados	May-89	228,000	8			
Hurricane Hugo	Sep-89	696,000	18	8,800	6,308	700
Hurricane Hugo	Sep-89	180,000	12		2,300	286
Hurricane Bertha	Aug-96	225,000	4			
Hurricane Fran	Sep-96	790,000	10	5,500	2,800	3,000
Hurricane Fran	Sep-96	450,000	9	1,400	921	217
April-97 Wind Storm	Apr-97	80,000	2	790	340	80
May-98 Lightning and Wind Storm	Jun-98	442,000	8	1,540	1,210	470
July-98 Lightning and Wind Storm	Jul-98	106,000	2	570	820	90
Hurricane Bonnie	Sep-98	244,500	4			
Hurricane Georges	Sep-98	260,000	3	644	328	118
May-99 Lightning and Wind Storm	May-99	99,000	2	680	570	110
Hurricane Floyd	Sep-99	537,000	6	1,160	586	680
Tropical Storm Floyd	Sep-99	322,494	8	350	210	85
Thunderstorms	May-00	155,000	4			
Hurricane Isidore	Sep-02	95,000	2	310	520	85
Hurricane Lili	Oct-12	243,000	2	1,800	920	202
Thunderstorms	May-03	142,000	1.5			
Tornadoes	May-03	218,000	6	1,100	200	
Thunderstorms, high winds	Jun-03	350,000	3			
Hurricane Isabel	Sep-03	320,000	2	212	307	70
Tropical Storm Isabel	Sep-03	480,883	8	444	306	103

In order to assess ComEd's restoration performance, Navigant compiled data from storm events from 2003 to 2011 (including ComEd's summer 2011 storms) with the number of customers affected and the number of days it took to restore those customers. Table 10 presents the data by year, storm name, utility name, number of affected customers, and days it took to restore. This more recent sample of storm data points includes name and unnamed storms for example Tropical Storm Irene, which had wind speeds of 65 mph winds when the storm reached New Jersey. Although most data available are for named storms,

[16] Data extracted from Figure 2, page 7, Brad Johnson "Utility Storm Restoration Response" Edison Electric Institute, January 2004.

a significant part of the damage was caused by tropical storm force winds. For example, the hurricane wind forces hitting the FPL territory were, for the most part, Category 1 and 2. FPL, in their presentations to EEI and the commission, described the hurricane wind forces as 75+ mph without claiming higher recorded wind gusts based on weather data.

Table 10. Benchmark Storm Restoration Performance

Year	Storm/Event	Utility	Affected Customers	Days to Restore
2003	Hurricane Isabel	Pepco	545,000	11
	Hurricane Isabel	BGE	790,450	8
	Hurricane Isabel	Dominion VA	1,800,000	16
2004	Hurricane Charley	FPL	874,000	13
	Hurricane Frances	FPL	2,786,300	12
	Hurricane Jeanne	FPL	1,737,400	8
	Katrina	FPL	1,453,000	8
	Rita	FPL	140,000	2
	Wilma	FPL	3,241,437	18
	July 27 Storm	Pepco	64,943	3
2006	Alberto Storm	FPL	21,000	2
2010	Ernesto Storm	FPL	114,000	1
	July 25 Storm	Pepco	323,662	5
2011	June 8, 9 Storm	ComEd	190,000	2
	June 21 Storm	ComEd	440,000	4
	June 30 Storm	ComEd	165,000	2
	July 11 - tornadoes	ComEd	902,000	6
	July 22 Storm	ComEd	167,000	3
	July 27 Storm	ComEd	227,000	3
	Irene Trop Storm	PSEG	805,000	7

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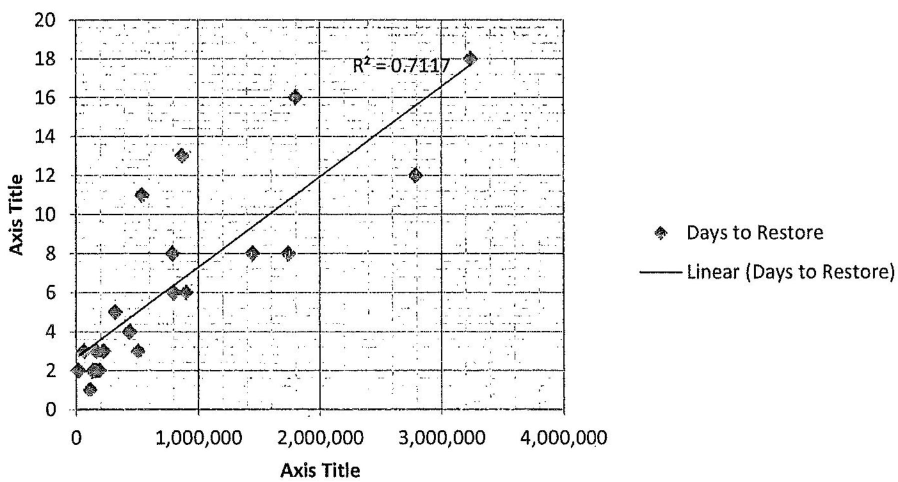
The "days to restore" data for ComEd included in Table 10 is based on initial outage time out and last customer connected. Other utilities exclude outliers such as smaller number of customers requiring additional significant work. For example, during Tropical Storm Irene, PSE&G's maximum restoration time was reported at 6.5 days, even though small pockets of 1,150 customers were still without power due to flooding and damage requiring safety inspections. The data from Table 10 was plotted a scatter diagram (Figure 23 below). Table 10 demonstrates a linear relationship between the number of customers out and the number of days to restore. Based on this analysis, we can conclude that ComEd's restoration performance is in line with that of other utilities across the U.S.

Figure 23. Days to Restore from Table 10, 2003-2011 Major Storms



It is far more difficult to correlate storm wind speeds and equipment damage due to available weather data without considering bandwidth of the storm, inches of rain, number of lightning strikes, tornadoes, and how storm wind speeds are determined. Table 11 lists the tropical cyclones classifications based on the Saffir-Simpson Hurricane Wind Scale.

Table 11. Saffir-Simpson Hurricane Wind Scale (SSHWS)

Tropical Cyclone	Winds	Summary
Tropical Depression	0 - 38 mph	
Tropical Storm	39 - 73	
Category 1	74-95 mph	Very dangerous winds will produce some damage
Category 2	96-110 mph	Extremely dangerous winds will cause extensive damage
Category 3	111-129 mph	Devastating damage will occur
Category 4	130-156 mph	Catastrophic damage will occur
Category 5	157 mph or higher	Catastrophic damage will occur

The Oceanographic and Meteorological Laboratory, Hurricane Research Division defines the wind speeds mentioned above as the measured or estimated as the top speed sustained for one minute at 10 meters above the surface, with peak gusts on the order of 10 to 25 percent higher (often not recorded). Therefore, a 70 mph tropical storm could potentially have winds exceeding 90 mph. In areas where the number and magnitude of peak gusts are higher may exacerbate the damage. Winds in a tropical cyclone that equal or exceed 75 mph are defined as hurricane strength (in the Atlantic and eastern and central Pacific Oceans). The National Weather Service, Weather Forecast Office for Chicago, IL noted the July 11th storm produced "strong mid and upper-level winds were able to mix down to the surface and produce a wide swath of 60-80 mph measurements – plus the associated damage."

Scientific analysis and instrument precision to record sustained wind speeds have improved, but it is not an exact science. For example, on August 2002, a submission to the National Hurricane Center (NHC) determined that Hurricane Andrew, established in August 1991 as a Category 4, should be reclassified as a Category 5 hurricane based on more recent data analysis.

Navigant offers the following additional observations, obtained through experience and utility operating personnel reporting on major storm damage:

1) No two storms are alike, and each individual outage can be the result of very different circumstances. For example, equipment can be damaged during a storm not only by the speed of the winds, but also its direction, and loose objects and debris in the proximity.

2) Tree branches – not those just directly above the line but traveling from a distance - can create considerable damage during a storm. Those who have directly experienced tropical storms or hurricanes report significant damage is caused by airborne debris traveling at high speeds.

3) There is a compounding effect when several storms hit the same area within a short time frame (season or year). Root structures are weakened, making it more likely a less severe storm will topple a tree; previously cracked tree branches will break easier toppling onto primary conductors or projectiles traversing the service territory.

Navigant's conclusions and findings include the following:

- The damage and outage duration of the ComEd's summer 2011 storms are consistent with other utilities' storm performance as a result of summer weather events.
- The number of poles damaged and replaced as a result of Com Ed's summer 2011 storms is less than pole failure rate from FPL's model.
- No two storms are alike, increasing the difficulty of evaluating the equipment damage between events and utilities. Areas with high vegetation density are most vulnerable since uprooted trees and flying branches have significant consequences that cannot be avoided. Such is the case in most of the areas impacted by the summer 2011 storms.

6. Vegetation Management

ComEd's four-year trimming cycle and clearance standards for distribution lines, which is in accord with ICC targets, are comparable to practices employed by other utilities.[17] Importantly, ComEd has implemented a vegetation management quality assurance program, actively managed, that ensures feeders are trimmed on cycle; post-trimming inspections are performed to ensure trimming cut-back standards are met. Spot trimming is performed when reliability data indicates need for supplemental trimming. Navigant field inspections confirmed that trees appeared properly trimmed, as we found minimal evidence of trees or limbs in direct or near contact with primary distribution lines.

ComEd's program is managed by personnel with horticultural backgrounds, and the company reports that it continually investigates methods for improving trimming methods. For example, the degree of cut back without damage to tree health often is dependent on tree species. Field observations confirm significant cut back on durable species. ComEd also has pro-actively worked with cities and towns that it serves to adopt practices that serve their common respective interests. For example, ComEd has successfully promoted use of low profile species in town rights-of-way below lines that improve overall appearance, but avoid growth into the overhead conductor.

[17] 34.5 kV subtransmission lines are part of the 4 year cyclic Preventive Maintenance Program. In addition, the 34.5kV circuits are included in the Mid-Cycle Program and inspected in the 34kV Feeder Program in the 3rd year of the cycle (the year prior to its Preventive Maintenance cycle trim). Spot trimming is performed within the Mid-Cycle as needed prior to full cycle trim.

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Appendix A. Feeders Inspected

TOWN NAME	Total Miles	OH Lat Miles	OH ML Miles	OH Tot Miles	UG Lat Miles	UG ML Miles	UG Tot Miles	Cust's	Comm Cust's	No. of Recl's	Voltage
Morton Grove	10	2	3	5	2	3	5	947	158	0	4/12 kV
Morton Grove	9	3	4	7	0	2	2	933	24	0	4/12 kV
Morton Grove	6	2	2	4	1	1	2	296	5	0	4/12 kV
Glenview	12	3	4	8	2	2	5	899	164	1	4/12 kV
Evanston	3	1	1	2	0	1	1	483	11	0	4/12 kV
Evanston	8	2	2	4	1	4	5	2377	112	2	4/12 kV
Arlington Hts	10	1	3	5	1	4	5	1672	177	2	4/12 kV
Arlington Hts	10	2	4	6	1	3	4	1099	129	2	4/12 kV
Arlington Hts	19	1	5	6	10	3	13	2617	152	3	4/12 kV
Rolling Meadows	12	5	5	9	1	2	3	1304	52	0	4/12 kV
Rolling Meadows	19	2	6	8	7	4	11	1075	266	2	4/12 kV
Park Ridge	13	3	5	9	1	3	4	1342	136	0	4/12 kV
Park Ridge	2	1	1	2	0	0	0	350	350	0	4/12 kV
Park Ridge	13	4	5	9	2	2	4	1313	929	1	4/12 kV
Lake Forrest	19	5	5	9	7	2	9	1218	43	1	4/12 kV
Highland Park	15	4	5	9	1	5	6	741	98	0	4/12 kV
Highland Park	3	1	1	2	0	1	1	162	6	0	4/12 kV
Niles	11	6	4	10	0	1	1	1272	44	0	4/12 kV
Niles	5	0	2	2	1	2	3	201	69	0	4/12 kV
Elmhurst	3	1	1	2	0	2	2	319	24	0	4/12 kV
Elmhurst	18	4	6	10	2	6	8	787	152	0	4/12 kV
Elmhurst	14	7	4	11	1	2	3	1423	30	3	4/12 kV
Schaumburg	11	1	1	2	2	7	9	199	36	0	4/12 kV
Subtotal	**245**	**61**	**79**	**141**	**43**	**62**	**106**	**23029**	**3167**	**17**	
Romeoville	9	1	1	2	1	6	7	54	53	0	4/12 kV
Homer Glen	43	9	11	19	21	2	23	775	64	0	4/12 kV
Palos Park	34	7	7	14	17	3	20	911	40	0	4/12 kV
Mokena	24	5	7	12	7	5	12	1530	236	2	4/12 kV
Joliet	9	3	5	8	0	1	1	1103	154	2	4/12 kV
Joliet	13	4	3	7	6	0	6	1339	104	1	4/12 kV
Joliet	16	7	6	13	1	1	3	1706	98	2	4/12 kV
Rockford	13	6	3	10	3	0	3	977	17	2	4/12 kV
Rockford	23	11	10	20	1	2	3	1403	78	1	4/12 kV
Rockford	32	8	6	14	15	3	18	1642	53	1	4/12 kV
Chicago	7	2	4	6	0	1	1	2735	200	2	4/12 kV
Chicago	9	3	3	5	2	1	3	2291	130	0	4/12 kV
Oak Park	9	2	5	7	0	2	2	2094	135	3	4/12 kV
LaGrange	4	1	1	2	1	1	2	493	16	0	4/12 kV
Subtotal	**243**	**69**	**71**	**140**	**74**	**30**	**103**	**19053**			
TOTAL	**488**	**130**	**150**	**281**	**117**	**92**	**209**	**42082**			

NAVIGANT

Appendix B. Overhead Inspection Checklist

DM-CE-P321-R0001 Rev. 5

OVERHEAD DISTRIBUTION CIRCUIT INSPECTION CHECKLIST

Circuit #: ____________ Town ____________ Inspection Date: ____________ Inspected by: ____________ Cycle: ____________

Page ______ of ______ DMC Office: ____________ QS-Pole# ____________ Geographical Location: ____________

	A	B	C	D	E	F	G
01-Pole	Excess Lean (40)	Pole Step Removed	Pole Steps (20)	Replace (20)	Replace (40)	Top Split (20)	Top Split (40)
02-Pole Top Extension	Broken (30)						
03-Conductors (Primary)	> 2 Splices/Span Bare Cond	> 2 Splices/Span Covd Cond	Aerial Cable Damage (30)	Aerial Cable Jacket Damage (40)	Aerial Cable Lashing Damage (40)	Bracket/Spacer Damage (30)	Damaged (30)
04-Conductors (Secondary)	Damaged (40)	Floating (40)	Lashing Damaged (40)	Spreader Damaged (40)			
05-Conductors (Neutral / Static)	> 2 Splices/Span Bare Cond	> 2 Splices/Span Covd Cond	Damaged (30)	Debris Non-tracking on Static (40)	Floating (20)	Floating (30)	
06-Slack Span (Primary)	Auto's in Slack (30)	Excessive (30)					
07-Arms (Crossarm / Alley)	Broken (20)	Damaged (40)					
08-Arm Brace	A-Arm Replace 1 (20)	A-Arm Replace 2 (20)	X-Arm Replace 1 (40)	X-Arm Replace 2 (20)	X-Arm Replace 3 (20)	X-Arm Replace 4 (20)	
09-Insulators / Deadends	Broken (30)	Broken (Deadend) (30)	Tracking (30)	Tracking (Deadend) (30)	34kV Polyethylene (40)		
10-Pin	Replace Arm Pins (20)	Replace Arm Pins (40)	Replace Ridge Pin (20)	Replace Ridge Pin (40)			
11-Tie Wire	Broken (30)	Covered Cond Radio [illegible] (Black Top) (40)	Covered Cond Clamp Top (40)	Covered Cond. [illegible] (40)	Improperly Installed (40)		
12-Connector	Eyebolt Stirrup 34kV Only (40)	Splice < 1Ft Tie/Rod (40)	34kV Connect-O-Switch (40)				
13-Arresters Needed (Number)	Need New #_____ (40)	Replace Non-MOV @ Term Pole #________ (40)	Replace #______ (30)				
14 Fuse / Cutout	AB Chance W/SS Hood#______	Blown at Cap Bank (40)	Damaged (30)	DBU Fuse - Clear Label Blue Cap (40)	GE Durabutte - Non porcelain (40)	Unfused Tap	
15-Equipment (Trf/Reg/Pot/Recl/Cap)	Damaged Bushing (40)	Damaged Case (40)	Leaking (20)	Leaking (40)	LTD Damaged (40)	Switch Damaged (40)	Unused
16-Non-Oil Term	Damaged Non-lead Term (40)	Tag Damaged Lead Term (20)	Tag Lead Sleeve Slip (20)				
17-Wildlife Protection	Broken/Damaged (40)	Improperly Installed (40)	Needed/Missing or Bird Guard Only (40)				
18-Fault Indicators	Improper Install Location (40)	Improper Type (40)	Not Facing Ground (40)	Not On Bare Conductor (40)	Replace #__ (40)	Too Close to Other (40)	
19-Grounding	Broken (40)	Equip GND Needed (40)	Molding Damaged (40)	Molding Replaced	Need New Nonexistent (40)	Not Conn To Sys Neut (40)	Rod Exposed (40)
20-U-Guard	Ground / Bond (40)	Primary Needed (40)	Secondary Needed (40)				
21-Guy Wire	Broken (40)	Insulator Needed (40)	Insultr GF (Grandfathered)	[illegible] Location Improper (40)	Marker Needed (40)	Marker Replaced #______	Slack (40)
22-Highway / RR Crossings	[illegible] Needed (40)						
23-Labeling	Replaced						
24-Clearance	Check Primary (20)	Check Primary (30)	Check Primary (40)	Check Secondary or Neutral (20)	Check Secondary or Neutral (40)	Check Service (20)	Check Service (40)
25-Vegetation **	Primary (Contact)	Primary (Dead Limb Over)	Primary (Near)	Secondary (In Between Tri/quadraplex Conds)	Secondary (Into Open Wire)	Vine Growth	Vine Snipped

	A	B	C				
26-Truck Access	Yes	No					
27-Mainline / Tap	On Mainline	On Fused Tap					
28-Dogs or Bees	Bees	Both	Dogs				
29-Osmose Red Tag	Yes						
30-Arm Size							
31-Latitude							
32-Longitude							
33-Cable Term Metal Rack	Yes						
34-Direction	Horizontal	Vertical					
35-Meter Window	Replaced						
36-P10 Call In	Yes						

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-03

QUESTION:

Please provide the Guidehouse BCA analysis and underlying calculations and assumptions supporting each resiliency measure proposed in this proceeding as discussed in witness Shlatz's direct testimony.

ANSWER:

Please see the response to TCUC RFI 01-01.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:

None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-04

QUESTION:

Please clarify whether the VoLL was included as a quantitative benefit in Guidehouse's BCA analysis or as a qualitative benefit for each proposed resilience measure.

ANSWER:

VoLL was used solely to derive quantitative benefits for each resiliency measure listed in Table 1-1 and Table 5-1 of the Guidehouse Independent Analysis and Review of CenterPoint Energy Houston Electric, LLC's System Resiliency Plan in Exhibit ELS-2. VoLL was not used to derive qualitative benefits for any resiliency measure.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-05

QUESTION:

Reference page 21 of witness Shlatz's direct testimony, please identify the information relied upon by Guidehouse and/or CEHE to conclude that each proposed resilience measure is engaged in or approved by a significant portion of the electric utility industry during the relevant period and therefore is consistent with good utility practice.

ANSWER:

Please refer to the Benchmarking section within each event category from Section 5.3 through Section 5.9 in Exhibit ELS-2, which lists information Guidehouse relied upon to support its conclusions for similar resiliency measures that other electric utilities have implemented and that Guidehouse deemed to be consistent with good utility practice.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-06

QUESTION:

Please provided Guidehouse's analysis and underlying calculations and assumptions supporting the forecasted CMI reduction for each resiliency measure proposed in this proceeding as discussed in witness Shlatz's direct testimony.

ANSWER:

Please see the response to TCUC RFI 01-01. Additionally, the methodology Guidehouse applied to derive CMI savings for each resiliency measure where BCA ratios were derived is described in Section 5.1 of Exhibit ELS-2 and Section IV of the direct testimony of Mr. Shlatz testimony. The assumptions applied to determine CMI savings for each resiliency measure where BCA ratios were derived appear in Section 5.3 of Exhibit ELS-2.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-07

QUESTION:

Please provided Guidehouse's BCA analysis and underlying calculations and assumptions, including but not limited to assumed VoLL and CMI Reduction, supporting each resiliency measure proposed in this proceeding as discussed in witness Shlatz's direct testimony.

ANSWER:

Please see the response for TCUC RFI 01-01 for the underlying calculations and assumptions Guidehouse used to derive BCA ratios and CMI reductions for each resiliency measure for which BCA ratios were derived. The methodology Guidehouse applied to derive BCA ratios and CMI reductions is described in Section 4 of Mr. Shlatz's testimony and Section 5.1 of Exhibit ELS-2. Additional details on the methodology applied to derive BCA ratios and CMI reductions for each resiliency measure where BCA ratios were derived appear in Section 5.3 of Exhibit ELS-2. A VoLL of $35,000 was applied to all resiliency measures for which BCA ratios were derived. Additionally, please see the response to TCUC 01-30 for additional information regarding the VOLL approval.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-08

QUESTION:

Please provide the Guidehouse BCA analysis and underlying calculations and assumptions, including but not limited to assumed VoLL and CMI Reduction, supporting each resiliency measure proposed in PUC Docket No. 56548.

ANSWER:

Please see TCUC-RFI01-08 Attachement 1 - (confidential).xls for the Guidehouse BCA analysis from Docket 56548.

TCUC-RFI01-08 Attachement 1 - (confidential).xls is the benefit-cost analysis model used by Guidehouse to derive:

- benefit-cost ratios;
- operations and maintenance cost savings;
- customer minutes of interruption (CMI) savings; and
- system average interruption duration index (SAIDI) savings.

The model is being provided as write-protected, meaning that the user cannot modify inputs or formulas, to protect the integrity of the model. However, all underlying cost and benefit assumptions are included and formulas can be viewed by clicking on a relevant cell in the model.

The model is being provided under Protective Order because it is proprietary to Guidehouse and, if publicly released, would give advantage to Guidehouse competitors in the professional consulting space.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
TCUC-RFI01-08 Attachement 1 - (confidential).xls

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-09

QUESTION:

Please explain in detail the specific reasons for increases in proposed spending for each proposed resiliency measure in this case when compared to spending proposed for the same or comparable resiliency measures in PUC Docket No. 56548.

ANSWER:

The changes in proposed spending for each proposed resliency measure in this proceeding (57579) when compared to the spending proposed for the same or comparable resiliency measures in PUC Docket No. 56548 are set forth in Exhibit NB-6 to the Direct Testimony of Nathan Brownell (Bates pages 592-593). The question posed in TCUC-RFI01-09 incorrectly assumes that such differences result from simple adjustments to proposed spending on a measure-by-measure basis. On the contrary, the proposed spending on each resiliency measure in this proceeding is the result of a different overall method of preparing the entire system resiliency plan. The plan presented in Docket No. 56548 was based primarily on a county-level analysis using historical trends. The plan presented in Docket No. 57579 is based on a much more granular (polygon) analysis using both historical trends and foward-looking modeling. The plan presented in Docket No. 57579 also benefits from more advanced analytical tools as well as feedback and analysis obtained following Hurricane Beryl and the May 2024 storms. The method used to prepare the 2026-2028 plan is discussed in the Direct Testimony of Nathan Brownell at PDF page 379:8-386:20 and the Direct Testimony of Eric Easton at PDF page 705:15-721:6. Specific differences between the development of the 2026-2028 plan and the 2025-2027 plan are discussed in the Direct Testimony of Nathan Brownell at PDF page 387:1-390:7 and the Direct Testimony of Eric Easton at PDF page 720:4-721:6. Mr. Easton also discusses the new analyitical tools used to develop the 2026-2028 plan in his direct testimony at PDF page 721:7-723:8.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-10

QUESTION:

Please provide the year-end customers and annual kWh usage for each CEHE customer class for each year since 2017.

ANSWER:

Please see TCUC01-10 Attachment 1.xls for year end customer counts and annual kWh usage for each CEHE customer class since 2017.

TCUC-RFI01-10 Attachment 1.xls is a voluminous attachment and will be provided in electronic format only.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
TCUC01-10 Attachment 1.xls

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-11

QUESTION:

Please provide CEHE's annual Distribution system SAIDI, SAIFI and CMI including extreme weather events for each year since 2017.

ANSWER:

See attachment TCUC 1-11.xlsx for the Distribution system SAIDI, SAIFI, and CMI including extreme weather events.

SPONSOR:
Deryl Tumlinson

RESPONSIVE DOCUMENTS:
TCUC 1-11 CEHE Annual Distribution System SAIDI SAIFI and CMI Including Extreme Weather Events.xlsx

TCUC RFI 1-11: CEHE's Annual Distribution System SAIDI, SAIFI and CMI Including Extreme Weather Events

SAIFI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Major Event	0.449	0.033	0.082	0.265	3.159	0.015	0.374	2.049
Forced Interruptions	1.038	1.163	1.263	1.144	1.207	1.414	1.376	1.476
Scheduled Interruptions	0.288	0.338	0.373	0.304	0.319	0.446	0.38	0.364
Outside Causes	0.086	0.142	0.107	0.113	0.094	0.111	0.099	0.079

SAIDI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Major Event	312.17	4.85	26.73	63.24	2,189.01	2.69	177.57	4,143.98
Forced Interruptions	102.73	116.46	152.68	122.03	135.94	164.65	140.16	138.53
Scheduled Interruptions	36.84	50.05	45.31	37.47	37.46	59.65	32.16	30.94
Outside Causes	2.62	7.23	3.08	3.84	3.46	4.79	4.15	3.07
CMI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Major Event	770,486,997	12,203,208	68,528,756	165,088,512	5,838,852,536	7,320,959	490,418,220	11,801,265,064
Forced Interruptions	253,559,379	293,154,830	391,495,997	318,564,024	362,598,293	448,185,125	387,107,632	394,495,481
Scheduled Interruptions	90,925,354	125,994,919	116,185,635	97,810,773	99,909,742	162,373,734	88,828,657	88,121,291
Outside Causes	6,475,986	18,201,066	7,905,990	10,028,762	9,240,980	13,028,029	11,471,972	8,752,587

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-12

QUESTION:

Please provide CEHE's annual Distribution system SAIDI, SAIFI and CMI excluding extreme weather events for each year since 2017.

ANSWER:

See attachment TCUC 1-12.xlsx for the distribution system SAIDI, SAIFI, and CMI excluding extreme weather events.

SPONSOR:
Deryl Tumlinson

RESPONSIVE DOCUMENTS:
TCUC 1-12 Distribution System SAIDI SAIFI and CMI Excluding Extreme Weather Events.xlsx

TCUC RFI 1-12: Distribution System SAIDI, SAIFI, and CMI Excluding Extreme Weather Events

SAIFI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Forced Interruptions	1.038	1.163	1.263	1.144	1.207	1.414	1.376	1.476
Scheduled Interruptions	0.288	0.338	0.373	0.304	0.319	0.446	0.38	0.364
Outside Causes	0.086	0.142	0.107	0.113	0.094	0.111	0.099	0.079

SAIDI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Forced Interruptions	102.73	116.46	152.68	122.03	135.94	164.65	140.16	138.53
Scheduled Interruptions	36.84	50.05	45.31	37.47	37.46	59.65	32.16	30.94
Outside Causes	2.62	7.23	3.08	3.84	3.46	4.79	4.15	3.07

CMI	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Forced Interruptions	253,559,379	293,154,830	391,495,997	318,564,024	362,598,293	448,185,125	387,107,632	394,495,481
Scheduled Interruptions	90,925,354	125,994,919	116,185,635	97,810,773	99,909,742	162,373,734	88,828,657	88,121,291
Outside Causes	6,475,986	18,201,066	7,905,990	10,028,762	9,240,980	13,028,029	11,471,972	8,752,587

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-13

QUESTION:

Please provide CEHE's Transmission system SAIDI, SAIFI and CMI including extreme weather events for each year since 2017.

ANSWER:

CenterPoint Houston's focus during an extreme weather event is on the rapid restoration of power to our customers. The Company does track the cause of a particular outage; However, crews focusing on the rapid restoration of power are not always precise in their cause selection. Therefore, the Company does not believe this source of information is reliable for answering the question posed. However, in the interest of transparency, CenterPoint is providing the data. See attachment TCUC01-13.xlsx for annual Transmission system SAIDI, SAIFI, and CMI including extreme weather events.

SPONSOR:
David Mercado

RESPONSIVE DOCUMENTS:
TCUC01-13 - CEHE Transmission SAIDI, SAIFI, and CMI Including Extreme Weather Events.xlsx

SOAH DOCKET NO. 473-25-11558
PUC Docket No. 57579
TCUC01-13 - CEHE Transmission SAIDI, SAIFI, and CMI Including Extreme Weather Events.xlsx
Page 1 of 1

SAIFI	2017	2018	2019	2020	2021	2022
Outside Causes - Transmission (Major Event)	0.000	0.012	0.003	0.000	0.012	0.000
Outside Causes - Transmission (Non-Major Event)	0.002	0.011	0.003	0.000	0.000	0.000
Outside Causes - Total	0.002	0.023	0.006	0.000	0.012	0.000

SAIDI	2017	2018	2019	2020	2021	2022
Outside Causes - Transmission (Major Event)	0.27	0.84	0.16	0.00	4.40	0.00
Outside Causes - Transmission (Non-Major Event)	0.42	2.98	0.04	0.00	0.28	0.00
Outside Causes - Total	0.69	3.82	0.20	0.00	4.68	0.00

CMI	2017	2018	2019	2020	2021	2022
Outside Causes - Transmission (Major Event)	672,355	2,103,171	399,367	0	11,736,661	0
Outside Causes - Transmission (Non-Major Event)	1,035,167	7,494,982	100,575	588	742,612	0
Outside Causes - Total	1,707,522	9,598,154	499,942	588	12,479,273	0

Note: CenterPoint Houston's focus during an extreme weather event is on the rapid restoration of power to our customers. The Company does trac
However, crews focusing on the rapid restoration of power are not always precise in their cause selection. Therefore, the Company does not believe
for answering the question posed. However, in the interest of transparency, CenterPoint is providing the data. See attachment TCUC01-13.xlsx for a
SAIFI, and CMI including extreme weather events.

2023	2024
0.029	0.000
0.002	0.000
0.031	0.000

2023	2024
37.06	0.50
0.21	0.00
37.27	0.50

2023	2024
102,358,534	1,428,381
574,691	0
102,933,224	1,428,381

k the cause of a particular outage;
e this source of information is reliable
nnual Transmission system SAIDI,

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
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TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-14

QUESTION:

Please provide CEHE's Transmission system SAIDI, SAIFI and CMI excluding extreme weather events for each year since 2017.

ANSWER:

See attachment TCUC01-14.xlsx for the transmission system SAIDI, SAIFI, and CMI excluding extreme weather events.

SPONSOR:
David Mercado

RESPONSIVE DOCUMENTS:
TCUC01-14 - CEHE Transmission SAIDI, SAIFI, and CMI Excluding Extreme Weather Events.xlsx

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PUC Docket No. 57579
TCUC01-14 - CEHE Transmission SAIDI, SAIFI, and CMI Excluding Extreme Weather Events.xlsx
Page 1 of 1

SAIFI

	2017	2018	2019	2020	2021	2022	2023	2024
Outside Causes - Transmission (Non-Major Event)	0.002	0.011	0.003	0	0	0	0.002	0

SAIDI

	2017	2018	2019	2020	2021	2022	2023	2024
Outside Causes - Transmission (Non-Major Event)	0.42	2.98	0.04	0	0.28	0	0.21	0

CMI

	2017	2018	2019	2020	2021	2022	2023	2024
Outside Causes - Transmission (Non-Major Event)	1,035,167	7,494,982	100,575	588	742,612	0	574,691	0

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TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-15

QUESTION:

Please provide CEHE's annual capital additions and O&M expenses for the following resilience measures for each year since 2017:

a. Distribution circuit resiliency

b. Strategic undergrounding

c. Distribution pole replacement and bracing

d. Transmission system hardening

e. Vegetation management

f. 69kV conversion projects

g. S90 tower replacements

h. Distribution capacity enhancements/substations

i. Substation flood control

ANSWER:

Please see attachment TCUC RFI 1-15.xls for the annual capital additions and O&M expenses since 2017 for the requested resiliency measures.

SPONSOR:
David Mercado

RESPONSIVE DOCUMENTS:
TCUC RFI 1-15.xls

TCUC RFI 1-15: CEHE's annual capital additions and O&M expenses for the following resilience measures for each year since 2017

Annual Capital ($ in millions)	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
a. Distribution circuit resiliency						40	40	17
b. Strategic undergrounding					1	8	11	14
c. Distribution pole replacement and bracing	18	17	19	29	30	61	52	78
d. Transmission system hardening	1	4	10	12	159	274	166	65
e. Vegetation management	none							
f. 69kV conversion projects				16	3	49	90	22
g. S90 tower replacements			1	3	20	24	10	10
h. Distribution capacity enhancements/substations	13	9	13	22	14	20	81	57
i. Substation flood control		1	5	18	13	20	20	4

Annual O&M ($ in millions)	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
a. Distribution circuit resiliency	none							
b. Strategic undergrounding	none							
c. Distribution pole replacement and bracing	none							
d. Transmission system hardening	0.9	1.4	0.8	1.3	1.4	1.3	1.9	0.3
e. Vegetation management*	28.5	35.7	32.6	29.6	31.4	34.6	45.8	147.1
f. 69kV conversion projects	none							
g. S90 tower replacements	none							
h. Distribution capacity enhancements/substations			0.0				0.0	0.0
i. Substation flood control	none							

* This data can also be found in Project 41381 - ANNUAL VEGETATION MANAGEMENT PLANS AND REPORTS PURSUANT TO PUC SUBST. R. §25.96.

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CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-16

QUESTION:

Please provide CEHE's total distribution system capital additions and O&M expenses for each year since 2017.

ANSWER:

Please see TCUC 01-16 and 01-17 Attachment 1.xls. All data included sourced from DCRF, TCOS, EMR and Base Rate Case dockets since 2017.

SPONSOR:
Deryl Tumlinson

RESPONSIVE DOCUMENTS:
TCUC 01-16 and 01-17 Attachment 1.xls

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-17

QUESTION:

Please provide CEHE's total transmission system capital additions and O&M expenses for each year since 2017.

ANSWER:

Please see the response to TCUC 01-16.

SPONSOR:
Deryl Tumlinson

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-18

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE's Application, please indicate whether CEHE is willing to guarantee the level of assumed CMI savings for each proposed resiliency measure as presented in this figure. If not, explain why not.

ANSWER:

The CMI savings stated in Figure APP-15 are estimates of CMI savings and thus actual CMI savings may differ, depending on the specific types of resiliency events that occur and the impact of such events on specific portions of CEHE's transmission and distribution system. For example, if there are no extreme water events (e.g. flooding), then the actual CMI savings for Substation Flood Control (RM-10) would differ from the estimated CMI savings of 3.9 million CMI. Similarly, if there are no substation fire events, then the actual CMI savings for Substation Fire Barriers (RM-20) would differ from the estimated CMI savings of 1.5 million CMI. Thus, CEHE is unable to guarantee the level of CMI savings that are estimated for each proposed resiliency measure.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-19

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE's Application, please provide the total CMI for each year since 2017 related to:

a. Distribution circuit resiliency

b. Strategic undergrounding

c. Distribution pole replacement and bracing

d. Transmission system hardening

e. Vegetation management

f. 69kV conversion projects

g. S90 tower replacements

h. Distribution capacity enhancements/substations

i. Substation flood control

ANSWER:

A historical analysis of CMI savings by resiliency measures since 2017 has not been completed. Please refer to responses in TCUC RFI 1-11 through 1-15 for historical CMI impact from various resiliency events.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-20

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE's Application, please identify and provide the category (e.g., extreme wind, extreme temperature) and total CMI associated with each extreme weather event that has been experienced by the CEHE system for each year since 2010.

ANSWER:

Please see attachment TCUC RFI 1-20.xlsx for total CMI associated with each extreme weather event referenced in Figure APP-12. Detailed records of extreme weather events prior to 2020 are incomplete for analysis purposes due to the Company's 5-year data retention policy for outage data.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
TCUC RFI 1-20.xls

TCUC RFI 1-20: Total CMI and resiliency category associated with each extreme weather event referenced in Figure APP-12 for 2020-2024

2020-2024 Extreme Weather-Related Resiliency Events

Year	Date	CMI	Resiliency Event Category
2020	April 29th	42,465,658	Extreme Wind
	May 15th-16th	18,164,937	Extreme Wind
	May 27th-29th	119,956,031	Extreme Wind
2021	February 14th-19th	5,286,599,764	Extreme Temp (Freeze)
	September 17th-18th	499,963,122	Extreme Water
	October 28th-29th	56,342,377	Extreme Wind
2022	January 8th-9th	13,717,407	Extreme Wind
	March 22nd	3,905,736	Extreme Wind
2023	January 24th-26th	77,613,139	Extreme Wind
	May 14th	7,960,783	Extreme Wind
	June 8th-10th	119,729,888	Extreme Wind
	June 21st-25th	320,541,355	Extreme Wind
2024	January 5th	2,632,486	Extreme Wind
	April 10th-11th	44,439,664	Extreme Wind
	May 2nd-3rd	41,148,200	Extreme Wind
	May 5th	681,972	Extreme Wind
	May 16th-24th	2,526,257,811	Extreme Wind
	May 28th-May 30th	117,893,422	Extreme Wind
	July 8th-July 19th	8,957,549,477	Extreme Wind
	Dec 28th	4,112,335	Extreme Wind

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-21

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE's Application, for each resiliency measure for which there is no estimated CMI savings, please provide the customer benefits that justify the proposed costs of each such measure.

ANSWER:

For all Resiliency Measures, with and without estimated CMI savings, anticipated customer benefits can be found Exhibit 1 in the last column in Figure SRP-ES-3. Additionally, benefits are outlined in the figures contained within the "Relevant Details" section of each Resiliency Measure description (beginning at PDF page 105). Finally, within the Guidehouse Independent Analysis and Review (Exhibit ELS-2 beginning at PDF page 1236), each Resiliency Measure review contains a section called "Benefit Analysis" that provides a quantitative and qualitative benefit analysis.

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-22

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE's Application, please provide the forecasted annual revenue requirement for each proposed resiliency measure for each of the first ten years of operations.

ANSWER:

The requested analysis has not been performed.

SPONSOR:
Jeff Garmon

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-23

QUESTION:

Reference Figure APP-15 on pages 16-18 of CEHE’s Application, please provide the forecasted annual revenue requirement for each proposed resiliency measure for each year included in Guidehouse’s BCA.

ANSWER:

The requested analysis has not been performed.

SPONSOR:
Jeff Garmon

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

TEXAS COAST UTILITIES COALITION
REQUEST NO.: TCUC-RFI01-24

QUESTION:

Please provide information transmitted by CEHE to customers regarding the forecasted reliability benefits and cost of each proposed resiliency measure.

ANSWER:

All publicly available information available to customers related to the System Resiliency Plan can be found at the website below.
www.centerpointenergy.com/systemwideresiliencyplan
Additionally, please see:
TCUC 01-24 Attachment 1 - CenterPoint_SRP_Overview
TCUC 01-24 Attachment 2 - CenterPoint _Resiliency_Plan_Fact_Sheet
TCUC 01-24 Attachment 3 - CNP Resiliency Plan Release_01.31.25
TCUC 01-24 Attachment 4 - SRP Customer Email_1.31.25

SPONSOR:
Nathan Brownell

RESPONSIVE DOCUMENTS:
TCUC 01-24 Attachment 1 - CenterPoint_SRP_Overview.pdf
TCUC 01-24 Attachment 2 - CenterPoint _Resiliency_Plan_Fact_Sheet.pdf
TCUC 01-24 Attachment 3 - CNP Resiliency Plan Release_01.31.25.pdf
TCUC 01-24 Attachment 4 - SRP Customer Email_1.31.25.pdf

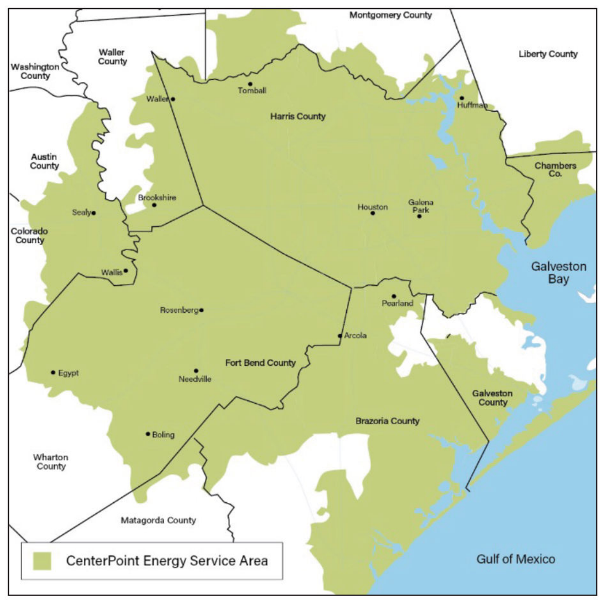
CenterPoint Energy

Systemwide Resiliency Plan Overview

Our Path to Becoming the Most Resilient Coastal Grid in the Country

CenterPoint Energy is pleased to present the following 2026-2028 Systemwide Resiliency Plan, detailing our efforts to build the most resilient coastal grid in the country.

CenterPoint's daily responsibility is to provide reliable and resilient energy to more than 2.8 million residential, commercial and industrial customers across the 12-county Greater Houston area, including over 5,000 square miles and the largest city in Texas, the fourth-largest city in the country, and the world's energy capital. We help deliver energy to one of the fastest growing population centers in the nation, as well as some of the largest medical and petrochemical complexes in the world, two international airports and one of the nation's largest container ports. All these factors demand an electric system that is stronger, self-healing and more resilient against the challenges of the future.



A map of CenterPoint Energy's 12-county Greater Houston service area.

CenterPoint Energy Houston Electric's 2026-2028 Systemwide Resiliency Plan is designed to help the Greater Houston area to prepare for and mitigate the impacts of extreme weather such as more powerful storms, hurricanes, wind events, like derechos, flooding, extreme temperatures, tornadoes, wildfires and winter storms. Because each of these weather hazards can affect our customers, our infrastructure and our economy in different ways, our Resiliency Plan includes a wide range of specific actions to address the variety of threats and impacts facing the electric grid and the communities it serves.

As the population, economy and energy needs of our region change and grow, so do the challenges we face from a range of extreme weather threats of the future. For example, data from the National Oceanic and Atmospheric Administration and the Federal Emergency Management Agency (FEMA) show that the Greater Houston area faces the highest weather and climate hazard risk of any major metro area in the country. In addition, there are more FEMA-designated "disaster resilience zones" across Harris County than any other county in the United States.

These realities represent the driving force behind our proposed 2026-2028 Systemwide Resiliency Plan. To effectively prepare for these evolving weather risks and mitigate future impacts on our customers and communities, it is clearer than ever before that it is vital to act now to strengthen and enhance the overall resiliency of the electric system and reduce the impacts of outages for our customers.

Building a Stronger, More Resilient, Self-Healing Grid of the Future

As the energy capital of the world, our customers deserve an energy system that is safe, reliable, cost-effective and resilient when they need it most. Our enhanced Systemwide Resiliency Plan will build upon the progress made through the Greater Houston Resiliency Initiative (GHRI).

Launched in August 2024, GHRI comprises a series of resiliency actions across three critical phases:

PHASE ONE	PHASE TWO	PHASE THREE
Completed more than 40 initial actions (see full list at CenterPointEnergy.com/TakingAction) over three months, including a suite of immediate resiliency improvements that were completed within the first 30 days of this effort.	Launched in September 2024 and set to be completed before June 1, 2025, this work builds on the progress of Phase One and includes another series of core resiliency actions to prepare for the 2025 hurricane season.	(June 1 – December 31, 2025) A transition period to continue important GHRI work throughout the 2025 hurricane season, while setting the groundwork to move forward with the Systemwide Resiliency Plan in January 2026.

As of January 2025, CenterPoint's ongoing GHRI initiative has:

- Installed more than 10,600 stronger, more storm-resilient poles designed to withstand extreme winds;
- Cleared more than 3,400 miles of hazardous vegetation near power lines to improve reliability;
- Installed more than 370 self-healing automation devices to minimize the duration and impact of outages and help improve overall restoration times; and
- Undergrounded nearly 200 miles of power lines.

These targeted efforts have already made our company, the grid and our communities better prepared for winter storms and the next hurricane season. Our entire CenterPoint team will continue working every day to provide the service our customers expect and deserve when extreme weather strikes.

About Our Enhanced Systemwide Resiliency Plan

Building upon the first three phases of GHRI, CenterPoint's long-term **Systemwide Resiliency Plan (SRP)** includes a series of long-term actions to be completed between 2026-2028 to address the growing and evolving series of extreme weather and other threats facing the Greater Houston area. The plan is designed to build the resilient electrical grid of the future that can better withstand more powerful storms, high wind events and extreme weather. To meet the extreme weather challenges of the future, the proposed $5.75 billion SRP represents the largest single grid resiliency investment in CenterPoint's history. Once completed, **the wide range of resiliency measures outlined in the SRP are expected to provide a series of important customer benefits**, including:

Reducing Outage Impacts

Reducing power outages following storms or extreme weather by **1.3 billion minutes into 2029**

Strengthening Overall Resiliency: Improving systemwide resiliency by 30% for all our customers

Meeting Future Energy Demand: Expanding the capacity of our system to meet our region's population growth and rising energy demand

Reducing Costs: Saving on storm-related costs of approximately $50 million per year

Improving Major Storm Resiliency: Avoiding outages for more than 500,000 customers in the event of another Beryl-like storm

Given the threat posed by future extreme weather across the Greater Houston area, the 2026-2028 Systemwide Resiliency Plan is designed to help prepare for and mitigate the grid impacts of a broad series of extreme weather events, including more powerful storms, hurricanes, wind events, like derechos, flooding, extreme temperatures, tornadoes, wildfires and winter storms.

The bold actions outlined in CenterPoint's SRP are designed to benefit customers across the entire service area, with a specific focus on customers in higher-risk areas. When complete, this suite of resiliency actions, combined with CenterPoint's normal operations, are expected to achieve the following improvements:

- **Automation Devices:** **100% of lines** that provide power to most of our customers will include devices capable of self-healing to reduce the impact of outages
- **Secure Substations:** **99% of substations** will be elevated above the 500-year flood plain
- **Stronger Distribution Poles:** **130,000 stronger, more storm-resilient poles** (rated to 110 mph and 132 mph) will be installed new, or replaced or braced to withstand stronger storms
- **Undergrounding:** **More than 50% of the system** will be undergrounded to improve resiliency
- **Vegetation Management:** Deploying an industry-leading, three-year vegetation management cycle, with **100% of power lines cleared of hazardous vegetation** every three years
- **Stronger Transmission Towers:** **2,200+ transmission structures** will be rebuilt or upgraded to be able to better withstand extreme weather while improving overall reliability
- **Modernized Cables:** **34,500 spans of underground cables** will be modernized to re frequency and impact of outages

Key Resiliency Actions and Improvements

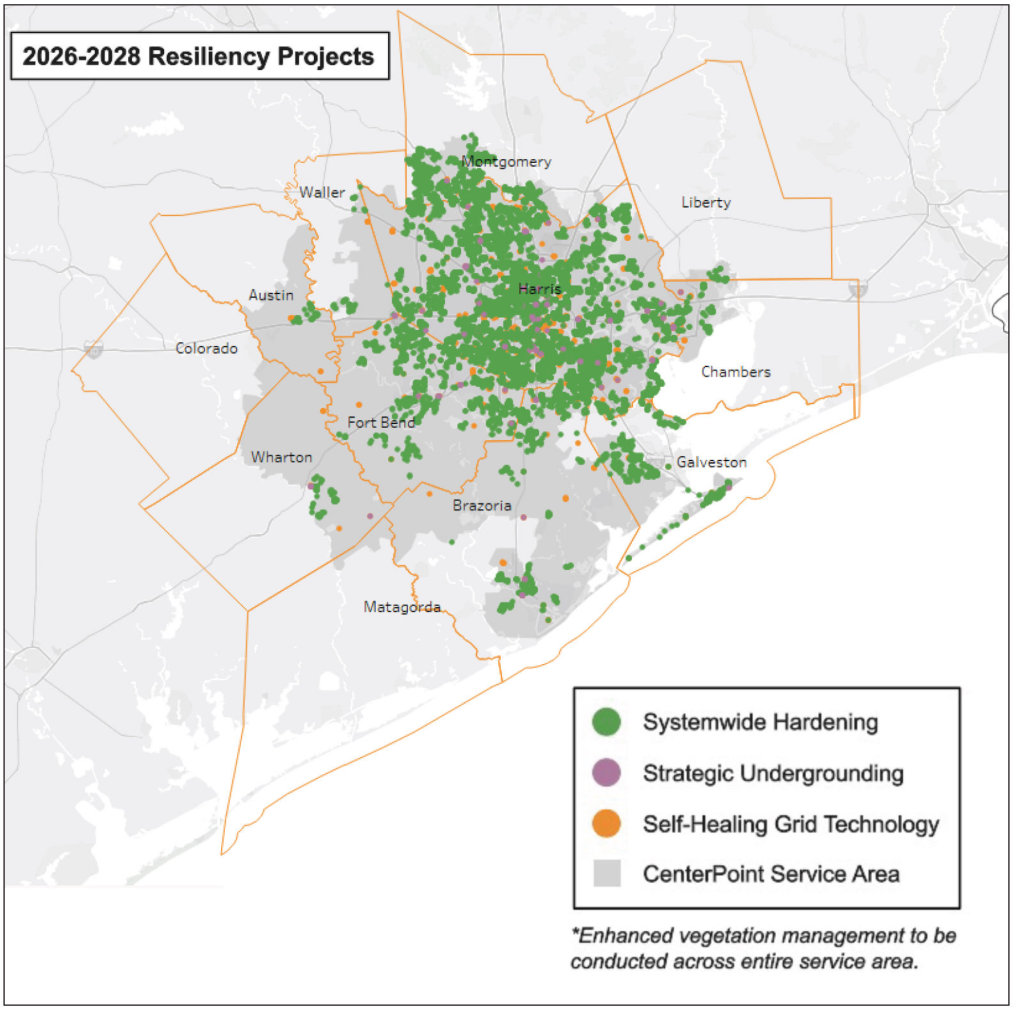
Some of the additional key actions and resiliency measures CenterPoint is proposing to harden the electric system, modernize the grid and make other critical improvements to the resiliency of the system for our customers are detailed below. From inner city to rural, suburban and all corners in between, each of these resiliency actions outlined in the SRP are expected to have clear and specific benefits for our 2.8 million customers and will help build the more resilient transmission and distribution system that will prove vital to meeting the extreme weather challenges of the future.

Category	Resiliency Action	Improvements and Benefits
Systemwide Hardening	Rebuild and upgrade approximately 25,000 poles and crossarms	▪ Improve structural integrity and wind-loading capability ▪ Reduce the frequency, customer impact and duration of outages
	Replace or brace approximately 30,000 wooden distribution poles	▪ Improve structural integrity and wind-loading capability ▪ Reduce the frequency, customer impact and duration of outages
	Replace or upgrade 1,715 wooden transmission structures with steel or concrete structures	▪ Improve structural integrity and wind-loading capability ▪ Reduce the frequency, customer impact and duration of outages
	Rebuild 462 transmission structures to handle an increase in electricity	▪ Create additional capacity during extreme weather
	Build additional transmission circuits and underwater cables in coastal areas	▪ Mitigate loss of transmission during extreme weather
	Elevate 12 substations	▪ Mitigate flood risk
	Install additional substations and distribution capacity	▪ Improve restoration times ▪ Reduce the customer impact and duration of outages
Strategic Undergrounding	Install 111 miles of underground lines to replace overhead lines at freeway crossings and in hard-to-access areas	▪ Improve structural integrity ▪ Reduce frequency, customer impact and duration of outages
Self-Healing Grid Technology	Install approximately 900 devices that utilize automation to respond to outages faster	▪ Improve restoration times ▪ Reduce customer impact of outages
Vegetation Management	Transition from five-year to three-year trim cycle across 11,700 miles of distribution circuits	▪ Reduce frequency, customer impact and duration of outages ▪ Reduce system restoration costs
Systemwide Modernization	Modernize 34,500 spans of underground cables	▪ Reduce frequency, customer impact and duration of outages
	Enhance existing IT systems and move customer-facing websites from on-premise to cloud-based hosting	▪ Maintain communications during restoration efforts ▪ Improve capabilities for high customer service call volumes

Where Customers Will See These Projects

The resiliency actions outlined in CenterPoint's SRP are designed to benefit customers across the Greater Houston service area, with a specific focus on customers in higher-risk areas.

The following map details the scope of proposed resiliency actions including systemwide hardening of transmission and distribution lines, strategic undergrounding and installation of automation devices capable of self-healing:



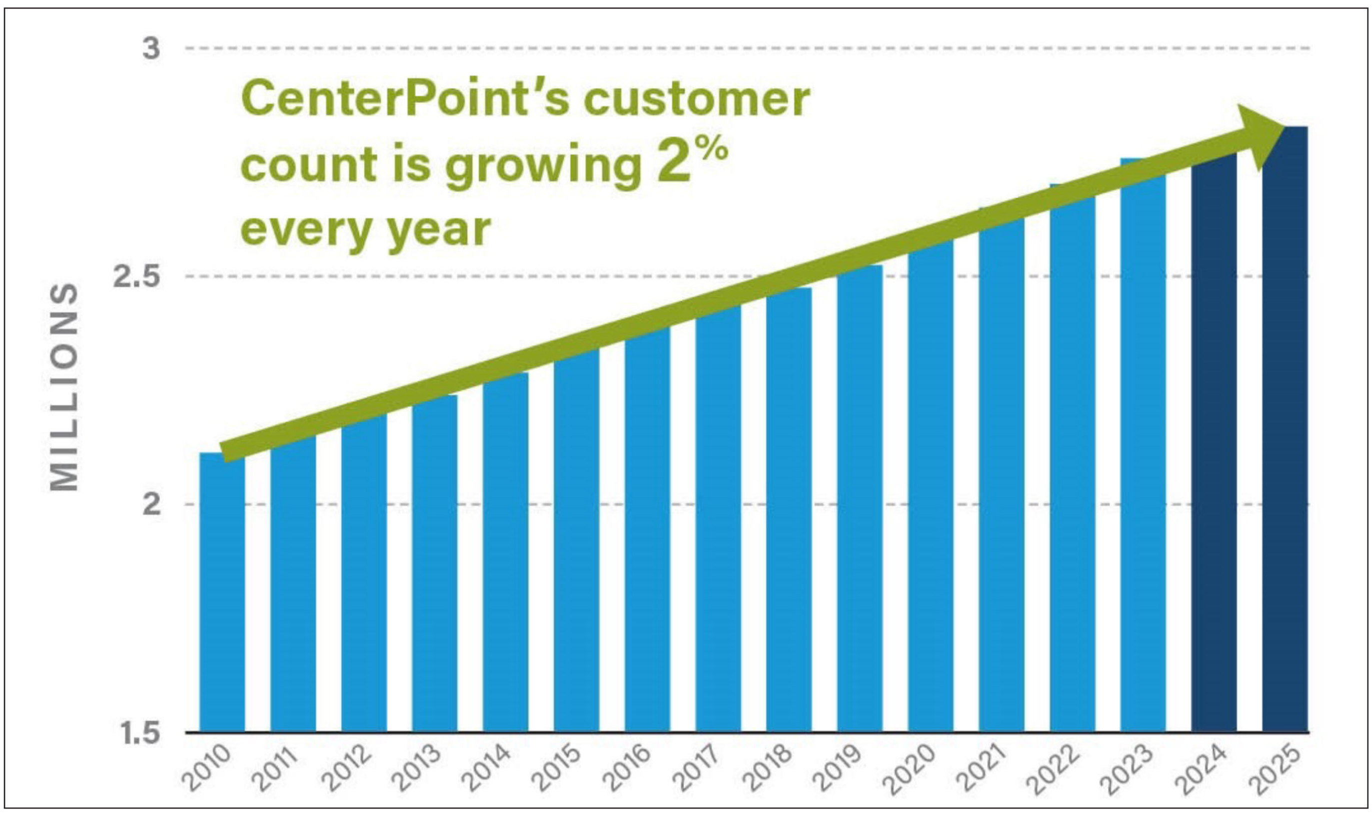
A map showing the locations of planned 2026-2028 resiliency plan actions.

A More Resilient Grid for a Fast-Growing Region

While the Greater Houston area may comprise just 2% of the geographic area of Texas, CenterPoint Energy's metered customers account for approximately 25% of the total electric load in the Electric Reliability Council of Texas (ERCOT) region. The number of customers in our service area is expected to continue growing by 2% annually for the foreseeable future — the equivalent of adding a city the size of Waco, Texas, every year.

At the same time, extreme weather events in our region are becoming more frequent and destructive. Since 1980, the Greater Houston counties that we serve have been impacted by 19 major windstorms and flood disasters that caused at least $1 billion in damage each — nearly half of which (9) have occurred since 2015. These storms have also become more destructive over time: Between 1980-2000, the average economic damage was $2.8 billion per storm; since 2000, the average is $24.9 billion per storm.

Since 1980, the Greater Houston counties that we serve have been impacted by **19 major windstorms and flood disasters that caused at least $1 billion in damage each** — nearly half of which (9) have occurred since 2015.



CenterPoint Energy serves more than 2.8 million residential, commercial and industrial customers across the Greater Houston area. The number of customers in CenterPoint's service area is expected to continue growing by 2% annually for the foreseeable future, the equivalent of adding a city the size of Waco, Texas, every year.

Working Together to Build a More Resilient Energy Future

CenterPoint's proposed SRP has been developed with input from local and state officials and emergency management offices, a comprehensive Hurricane Beryl after-action review, the Public Utility Commission if Texas and the independent, third-party expert Guidehouse. The resiliency action steps we've outlined in this plan also reflect important input from our customers, community leaders and other stakeholders.

Since August 2024, we have held dozens of community open houses, customer meetings and other opportunities to hear directly from our customers about their energy needs and priorities. Through these events, we've heard loud and clear the importance of building the grid of the future in order to better withstand increasingly extreme weather our region will face. Additionally, over the last three months, CenterPoint has conducted 30 meetings and listening sessions with elected leaders, emergency management agencies and independent experts and solicited their feedback on our plan during the draft stages.

As we advance and refine the proposed investments included in our 2026-2028 Systemwide Resiliency Plan, CenterPoint remains committed to continue working closely to identify specific community needs, prioritize projects and meet the future energy needs of customers. As part of this cooperative effort, we remain committed to long-term customer affordability and ensuring that every action included in this plan provides clear resiliency benefits for all our Greater Houston customers. For CenterPoint, we believe that by prioritizing customer affordability, while investing in long-term resiliency measures that reduce the future repair and restoration costs for our communities, we can provide the greatest value to our customers, now and in the future.

Taken together, the size and scope of the resiliency measures outlined in this plan, along with the near-term improvements we are completing through the multiple phases of GHRI, represent a major step toward achieving our goal — a goal shared by our customers — of building the most resilient coastal grid in the country.

2026-2028 Systemwide Resiliency Plan

CenterPoint Energy's 2026-2028 Systemwide Resiliency Plan details our efforts to build the most resilient coastal grid in the country. The plan is designed to help the Greater Houston area prepare for and mitigate the impacts of extreme weather and storms, as well as expand its capacity to meet future energy demands.

Focusing on our customers

The wide range of resiliency measures CenterPoint is proposing is expected to provide these benefits:

- Reducing outages by **1.3B minutes** into 2029
- Strengthening overall resiliency by **30%**
- Expanding the capacity of our system
- Saving **~$50M** per year in storm-related costs
- Avoiding **500K+** outages during a Beryl-like storm

Building the grid of the future

The actions in the plan, combined with CenterPoint's normal operations, will achieve the following:

Automation Devices	**100%** of lines serving the most customers will include devices capable of self-healing to reduce the impact of outages
Secure Substations	**99%** of substations will be raised above the 500-year flood plain to mitigate flood risk
Undergrounding	**50+%** of the electric system will be undergrounded to improve resiliency
Stronger Distribution Poles	**130,000** stronger, storm-resilient poles will be installed new, or replaced or braced existing to withstand stronger storms
Vegetation Management	**100%** of power lines will be cleared of hazardous vegetation every three years to reduce storm-related outages
Stronger Transmission Towers	**2,200+** transmission structures will be rebuilt or upgraded to be able to withstand extreme weather while improving overall reliability
Modernized Cables	**34,500** spans of underground cables will be modernized to reduce the frequency and impact of outages

CenterPointEnergy.com

CenterPoint Energy

CenterPoint Energy

For more information, contact
Communications
Media.Relations@CenterPointEnergy.com

For Immediate Release

CenterPoint Energy announces multi-year Systemwide Resiliency Plan to benefit communities and combat extreme weather threats, outages, and other hazards across Greater Houston

*CenterPoint Energy Houston Electric's enhanced **Systemwide Resiliency Plan (SRP)** expected to reduce outage impacts due to extreme weather and storms by 1.3 billion minutes into 2029*

100% of lines serving the most customers will have automation devices capable of self-healing; 99% of substations will be raised above the 500-year flood plain, more than 50% of CenterPoint's electric system will be undergrounded; and replace or install 130,000 stronger, more storm-resilient poles and braces

The 2026-2028 SRP will be the largest single resiliency investment in CenterPoint history and will help address the impact of a wide range of extreme weather and other threats

Houston – Jan. 31, 2025 – Today, as part of a company-wide commitment to build the most resilient coastal grid in the country, CenterPoint Energy submitted its enhanced **Systemwide Resiliency Plan (SRP)**, which is expected to reduce the impact of storm-related outages by over 1.3 billion minutes for its 2.8 million customers into 2029. The plan represents the largest single grid resiliency investment in the company's history. **CenterPoint's 2026-2028 SRP** will build on the progress made during the first two phases of the company's **Greater Houston Resiliency Initiative**, and is designed to help address the impacts of a wide range of extreme weather threats, including more powerful storms, hurricanes, wind events like derechos, flooding, extreme temperatures, tornadoes, wildfires and winter storms.

A rate case for Houston Electric occurs approximately once every four years and is part of an open and transparent regulatory process in which rates are set by the PUCT.

"As the energy capital of the world, the residents of the Greater Houston area expect and deserve an electric system that is safe, reliable, cost-effective and resilient when they need it most. We're determined to deliver just that. Our Systemwide Resiliency Plan represents an historic investment and is a major step on our strategic roadmap to becoming the most resilient coastal grid in the country. The array of resiliency actions will provide customers with clear benefits now and in the future, is cost-effective, and will build on the progress we've already made to date through the Greater Houston Resiliency Initiative. Taken together, we believe that these resiliency actions will help create a future with fewer outages coupled with faster restoration times for the customers that we are privileged to serve," said Jason Wells, President and Chief Executive Officer of CenterPoint Energy.