Illinois Commerce Commission

Assessment of Commonwealth Edison Company

Reliability Report and Reliability Performance

for Calendar Year 2011

Pursuant to 83 Ill. Adm. Code 411.140

October 9, 2013

1. Executive Summary

Commonwealth Edison Company ("ComEd") prepared and filed its "2011 Electric Power Delivery Reliability Report" ("Reliability Report") by Friday, June 1, 2012, in compliance with Section 16-125 of the Public Utilities Act ("Act") and the Illinois Commerce Commission's ("Commission's") electric reliability rules as found in 83 Illinois Administrative Code, Part 411.

The Staff Assessment Report ("Report") includes five significant areas: Historical Performance Relative to Targets, Analysis of ComEd's Year 2011 Reliability Performance, Trends in ComEd's Reliability Performance, ComEd's Plan to Maintain or Improve Reliability, and Potential Reliability Problems and Risks. These are sections 5 through 9 of the Report.

The number of customers who exceeded Service Reliability Targets three years consecutively increased from 407 in 2010 to 5,918 in 2011 (see Section 5). That was a 1,354% increase in customers who exceeded Service Reliability Targets each year in 2009, 2010, & 2011 versus customers who exceeded Service Reliability Targets each year in 2008, 2009, & 2010.

2011 saw a 28% and 45% increase, respectively, in weather- and tree-related interruptions over 2010 (see Section 6). ComEd attributes much of the increase to extreme weather.[1]

The four-year rolling average for ComEd system SAIFI has been trending down since 2008 while ComEd system CAIDI rollling average has been trending up in the same period (see Sections 7 and 9).

On a constant 1998 dollar basis, ComEd's distribution construction and maintenance expenditures for 2011 are below 1999 levels (see Section 8). ComEd's overall plan for future investment is at levels substantially higher than 2011 investment.

Undoubtedly, intense storm activity will stress the electric distribution infrastructure and expose any weaknesses or shortfalls in material conditions, maintenance, and the quality of vegetation management (see Section 9). In the field, Staff observed vegetation making contact with and threatening ComEd's overhead electric distribution lines and equipment. This is not consistent with Illinois Administrative Code 305.20:

> Trees that may interfere with ungrounded supply conductors should be trimmed or removed. *NOTE:* Normal tree growth, the combined movement of trees and conductors under adverse weather conditions, voltage, and sagging of conductors at elevated temperatures are among the factors to be considered in determining the extent of trimming required.

Trees should never interfere, i.e., touch, nor threaten circuit primaries during normal or adverse weather conditions during any part of the 4-year trim cycle.

Additionally, Staff observed many instances in the field where trees formed an overhead canopy above ComEd's overhead electric distribution lines and equipment. In many cases, though the overhead canopy was trimmed well away from the primaries, overhead canopies still present a significant reliability concern during adverse weather conditions (such as high winds, early wet snows, and heavy ice storms). Studies have shown that by removing overhead canopies above primaries, restoration times can be cut nearly in half[2] after an adverse weather event.

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[1] ComEd 2011 Reliability Report, page 1.

[2] S. Guggenmoos, "Increased Risk of Electric Service Interruption Associated with Tree Branches Overhanging Conductors. UAA Quarterly, 15(4), Fall 2007, S. Guggenmoos, "Storm Hardening the Electric System Against Tree-caused Service Interruptions. T&D World, Vol. 1, No. 12, Nov 18, 2010.

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2. Introduction

Beginning with the year 1999, and at least every three years thereafter, Section 16-125(d) of the Act and 83 Ill. Adm. Code 411.140 ("Part 411.140") require the Commission to assess the annual reliability report of each jurisdictional entity ("utility") and evaluate its reliability performance. Part 411.140 requires the Commission to:

A) Assess the reliability report of each utility.

B) Assess the utility's historical performance relative to established reliability targets.

C) Identify trends in the utility's reliability performance.

D) Evaluate the utility's plan to maintain or improve reliability.

E) Include specific identification, assessment, and recommendations pertaining to any potential reliability problems and risks that the Commission has identified because of its evaluation.

F) Include a review of the utility's implementation of its plan for the previous reporting period.

This document assesses ComEd's "2011 Electric Power Delivery Reliability Report" ("Reliability Report"), filed[3] on Thursday, May 31, 2012, and evaluates ComEd's reliability performance.

In producing this document, Staff relies on everything that may come to light during the review period up to the date of this document, in addition to the Reliability Report itself.

3. ComEd's 2011 Customer Base and Service Territory

ComEd provides electric service to roughly 3.8 million customers. ComEd's service territory encompasses over 400 municipalities in northern Illinois, including the City of Chicago.

4. ComEd's Electric Distribution System

Part 411.120(b)(3)(G) states that the utility is to report on the age, current condition, reliability and performance of its existing distribution and transmission system. To comply with the requirement that a utility report on the age of its existing distribution and transmission systems, ComEd provided age data on various types of equipment. The age data reported for the equipment included information on the median age, age distribution, and quantity by age. Table 1 lists the median age of some of the equipment that ComEd reported in its last five reports (2007 through 2011).

[3] ComEd filed its 2011 Reliability Report and its supplemental report in compliance with Section 16-125 of the Public Utilities Act and the Commission's electric reliability rules as found in 83 Illinois Administrative Code, Part 411.

Table 1. Median Age[4] (in years) of Typical Equipment

	2011	2010	2009	2008	2007
Lightning arresters					
Distribution	17	17	16	14	14
Transmission	9	8	7	14	15
Substation	11	10	10	12	12
Underground cables	19	19	18	17	18
Direct Buried	17	16	16	16	17
Cables in Conduit	23	22	22	23	32
Conductors					
Distribution Copper & Other	59	58	57	55	58
Distribution Aluminum	37	36	35	33	33
Transmission	41	40	39	37	36
Poles & Towers					
Distribution (mostly wood)	43	42	41	39	38
Transmission Steel poles	31	30	29	27	26
Transmission Wood poles	44	43	42	40	39
Transmission Towers	45	44	43	41	40
Distribution crossarms	34	34	34	32	32
Meters	12	12	11	13	13
Distribution transformers	17	17	16	15	15
Substation Transformers	33	33	32	31	30

Staff believes that the increasing median age of the existing equipment in service does not in all cases provide an indication of possible reduction in distribution or transmission system reliability performance. While some equipment, such as wooden distribution and transmission poles, deteriorate with age and require more intensive (i.e. more expensive) maintenance with each passing year to maintain original design capabilities other types of older equipment (such as transformers) can continue to be robust if it is well maintained. Staff believes that a better determinant of future reliability performance is how regularly and consistently such equipment is maintained. An increase in the number of interruptions due to equipment failures or malfunctions would provide a stronger basis than age alone to determine if that type of equipment is deteriorating to the point that the reliability of the electric system is reduced.

5. ComEd's Historical Performance Relative to Established Reliability Targets

83 Ill. Adm. Code 411.140(b)(4)(A-C) establishes electric service reliability targets that a utility must strive to meet. These targets specify limitations on customer interruptions as well as hours of interruption that a utility must strive not to exceed on a per customer basis. 83 Ill. Adm. Code 411.120(b)(3)(L) requires each utility to provide a list of every customer, identified by a unique number, who experienced controllable interruptions in excess of the service reliability targets, the number of interruptions and interruption duration experienced in each of the three preceding years, and the number of consecutive years in which the customer has experienced interruptions in excess of the service reliability targets.

In April 2004, ComEd, along with all other regulated Illinois electric utilities, agreed to report on <u>all</u> interruptions (controllable and uncontrollable) in relation to the service reliability targets for the reporting periods of 2003 through 2007, and to include the specific actions, if any, that the utility took or planned to take to address the customer

[4] Page G-3 through G-5 of ComEd's Reliability Reports for 2011 thru 2007 – Due to the refunctionalization of a portion of ComEd's equipment and enhancements in their data ComEd believes this analysis may not be directly comparable between some historical years.

reliability concerns. In January 2008, ComEd and the other utilities agreed to extend the agreement through the 2012 reporting period.

Table 2 summarizes the reliability targets defined in 83 Ill. Adm. Code 411.140(b)(4)(A-C) and the number of ComEd customers exceeding Service Reliability Targets in 2011, 2010, 2009, 2008 and 2007 per 83 Ill. Adm. Code 411.120(b)(3)(L) and the April 2004 & January 2008 agreements[5].

Table 2. Service Reliability Targets

Immediate primary source of service operation level	i. Maximum number of interruptions in each of the last three consecutive years	ii. Maximum hours of total interruption duration in each of the last three years	Customers exceeding Service Reliability Targets (i. &/or ii.) in **2011**[6]	Customers exceeding Service Reliability Targets (i. &/or ii.) in **2010**[7]	Customers exceeding Service Reliability Targets (i. &/or ii.) in **2009**[8]	Customers exceeding Service Reliability Targets (i. &/or ii.) in **2008**	Customers exceeding Service Reliability Targets (i. &/or ii.) in **2007**
69kV or above	3	9	0/0	0/0	0/0	0/0	0/0
Between 15kV & 69kV	4	12	0/0	0/0	0/0	0/1	0/0
15kV or below	6	18	**207/5711**	140/267	67/115	896/1,925	138/331
Total			**5918**	407	182	2,822	469

83 Ill. Adm. Code 411.140(b)(4)(D) states that "Exceeding the service reliability targets is not, in and of itself, an indication of unreliable service, nor does it constitute a violation of the Act or any Commission order, rule, direction, or requirement." ComEd appears to have a process in place to identify, analyze, and correct service reliability for customers who experienced a number or duration of interruptions that exceeds the targets in 83 Ill. Adm. Code 411.140(b)(4)(A-C).

The number and causes of interruptions for 83 Ill. Adm. Code 411.120(b)(3)(D) are shown for the ComEd system in Table 3. Interruptions in Table 3 were as defined in 83 Ill. Adm. Code 411.20[9].

[5] 2011 Reliability Report, Supplemental Report, Customers Experiencing Interruptions (controllable and uncontrollable).
[6] Pages 1 thru 132, ComEd's 2011 Reliability Report, Supplemental Report.
[7] Pages 1 thru 13, ComEd's 2010 Reliability Report, Supplemental Report.
[8] Pages 1 thru 5, ComEd's 2009 Reliability Report, Supplemental Report.
[9] The difference between the total of interruptions in Table 3 versus other parts of the Report can be traced to the differences in the definition of "Interruption" in Part 411.20 for scheduled interruptions initiated by a utility for purposes of the targets set forth in 83 Ill. Adm. Code 411.140(b)(4) and calculating reliability indices and scheduled interruptions that are reportable under 83 Ill. Adm. Code 411.120(b)(3)(C).

Table 3. Interruptions

Interruption Cause Category	2011	2010	2009	2008
Animal Related	2,724	2,854	2,990	2,747
Customer			-	-
Intentional	3,166	2,921	2,247	2,865
Other	1,032	549	497	400
Overhead Equipment Related	6,342	6,435	5,794	6,994
Public	1,551	1,577	1,566	1,974
Tree Related	11,414	7,879	5,096	8,127
Transmission & Substation Equip	64	78	78	62
Weather Related	9,214	7,172	3,395	6,100
Underground Equipment Related	8,268	8,379	7,264	7,486
Unknown	1,531	1,269	1,050	1,063
ComEd/Contractor Errors	318	290	260	287
Total	**45,624**	**39,403**	**30,237**	**38,105**

6. Analysis of ComEd's Year 2011 Reliability Performance

In Section C, Tables 5-9 (pages C-2 through C-11) of ComEd's 2011 Reliability Report, ComEd broke out the 2011 planned and unplanned interruptions into 61 separate cause categories in detail for the system as a whole and also for each of ComEd's four operating regions. Table 4 below compares, for the last three years, aggregations under leading cause categories that together represented roughly three-quarters of total annual interruptions.

Table 4. Leading Causes of Unplanned Interruptions[10]

	2011 Interruptions	% Improvement from 2010 to 2011	2010 Interruptions	% Improvement from 2009 to 2010	2009 Interruptions	% Improvement from 2008 to 2009	2008 Interruptions
Weather Related	**9,214**	**(28%)**	7,172	(111%)	3,395	44%	6,100
Animal Related	**2,724**	**5%**	2,854	5%	2,990	(9%)	2,747
Tree Related	**11,414**	**(45%)**	7,879	(55%)	5,096	37%	8,127
Overhead Equipment Related	**6,342**	**1%**	6,435	(11%)	5,794	17%	6,994
Underground Equipment Related	**8,268**	**1%**	8,379	(15%)	7,264	3%	7,486

83 Ill. Adm. Code 411.120(b)(3)(G)(v) states that the utility is to perform a satisfaction survey covering reliability, customer service and customer understanding of the utility's services and prices. Through a rulemaking (Docket No. 98-0878), the Commission designed and approved a single customer survey applicable to each Illinois utility on a yearly basis starting in 2000. The utilities joined forces and, through a competitive bidding process, selected Opinion Dynamics Corporation ("ODC") to implement the study. ODC asked customers to rate ComEd's performance on a scale of zero to ten where zero means the utility is doing a poor job and ten means the utility is doing an excellent job. The mean (or average) rating from the responses to each question is presented on pages G-10 through G-13 of ComEd's 2011 Reliability Report. A summary of some ratings is shown in Table 5.

[10] Page C-2 & C-3, Table 5: 2011 Planned and Unplanned Interruptions – System, 2011 ComEd Reliability Report.

Table 5. Summary of Customer Survey Responses
(average rating on the zero-to-ten scale)

Customer Class		2011	2010	2009	2008	2007	2006
Residential	Providing electric service overall (Overall Service)	**8.11**	8.39	8.51	8.30	8.13	8.27
	Providing reliable electric service (Service Reliability)	**8.03**	8.37	8.49	8.32	8.17	8.30
Non-Residential	Providing electric service overall (Overall Service)	**7.99**	8.31	8.67	8.49	8.54	8.41
	Providing reliable electric service (Service Reliability)	**8.05**	8.36	8.58	8.57	8.51	8.41

Table 6 provides another perspective on customer satisfaction from the viewpoint of customer reliability complaints[11] when values from this year's Reliability Report are compared to previous years. The bottom line of the table shows the calculated number of complaints per 1,000 customers and provides a relative measure of complaints from the years 2006 through 2011 for the system.

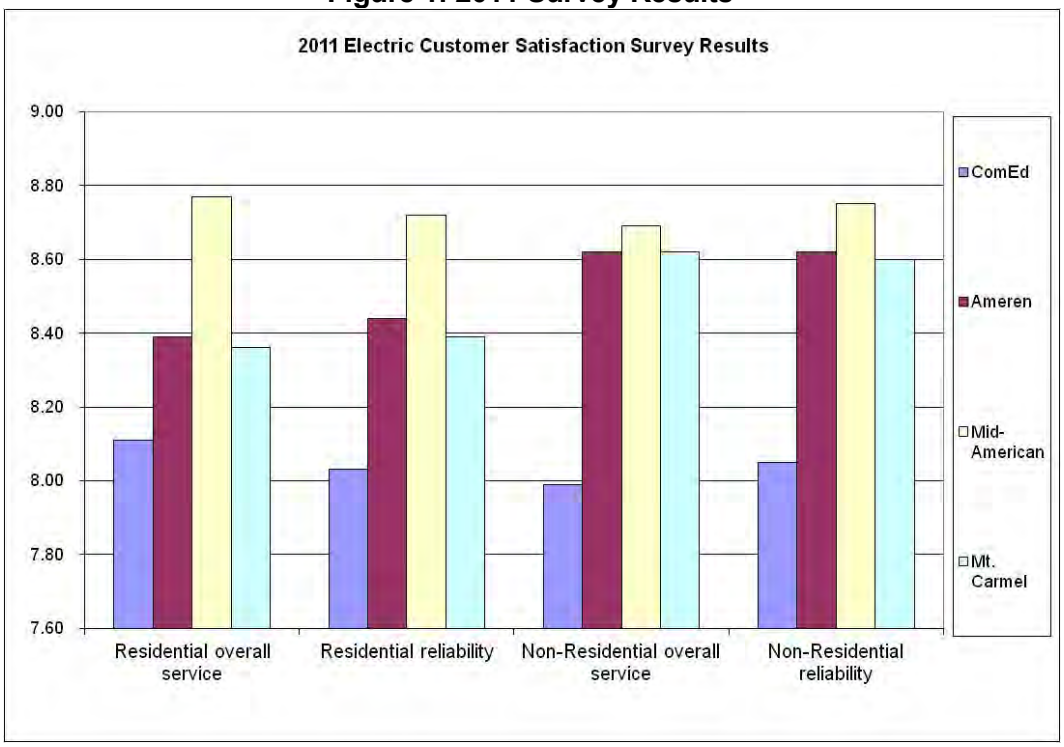
Table 6. Customer Complaints: System Total

	2011	2010	2009	2008	2007	2006
Nature of Complaints	**System Total**	**System Total**	**System Total**	**System Total**	**System Total**	**System Total**
Sustained Interruptions	**2,150**	1,938	1,598	1,995	2,784	2,579
Momentary Interruptions	130	110	201	286	374	346
Total Low/High Voltage	**139**	195	370	450	631	635
Totals	**2,419**	2,243	2,169	2,731	3,789	3,560
Customers Served	**3,796,214**	**3,785,054**	**3,769,233**	**3,781,274**	**3,775,345**	**3,731,505**
Complaints per 1000 Customers	**0.64**	0.59	0.58	0.72	1.00	0.95

Figure 1 compares ComEd's 2011 customer satisfaction ratings to those of the other reporting Illinois utilities.

[11] Table 17, Page G-15, ComEd's 2011 Reliability Report

Figure 1: 2011 Survey Results



83 Ill. Adm. Code 411.120(b)(3)(K) requires the utility to report the total number of customers that experienced a set number of interruptions during 2011. Figure 2 shows the ComEd customer interruption experience for the last five years. In Figure 2, the height of the bars indicate the number of customers who experienced a given number of interruptions during the year. Figure 3 shows the trend for the number of customers experiencing 5, 6, 7 or more interruptions for each of the last five years.

Figure 2: Customers Interruption Experience

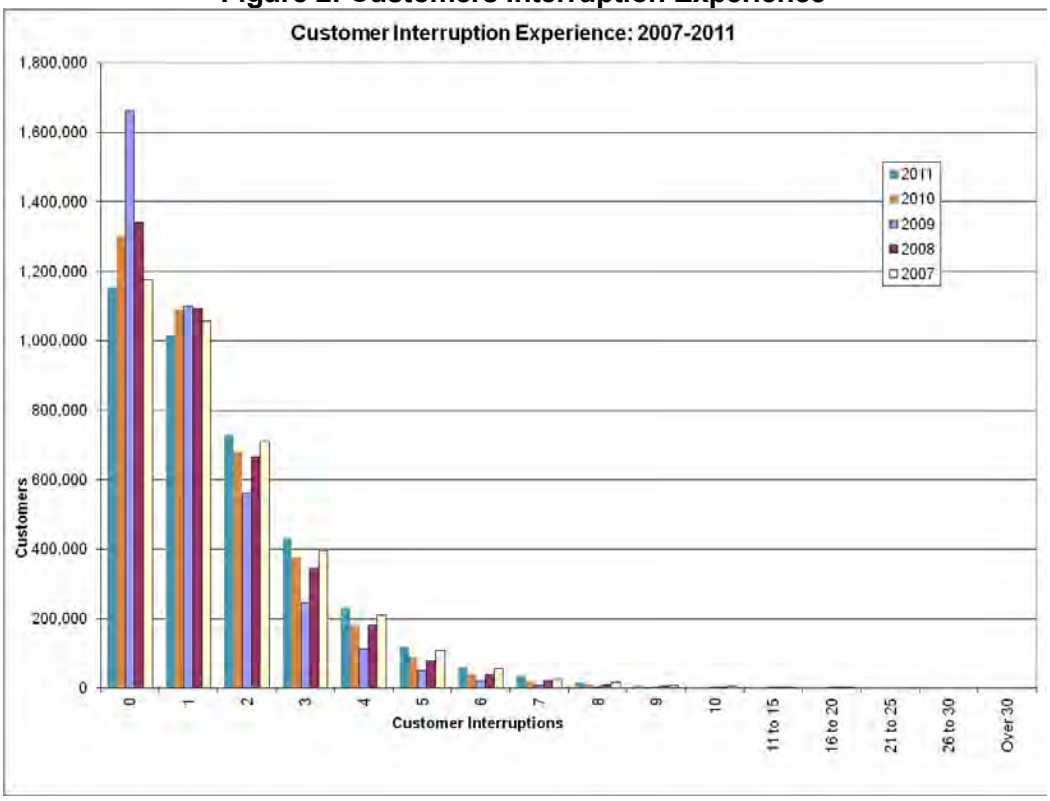
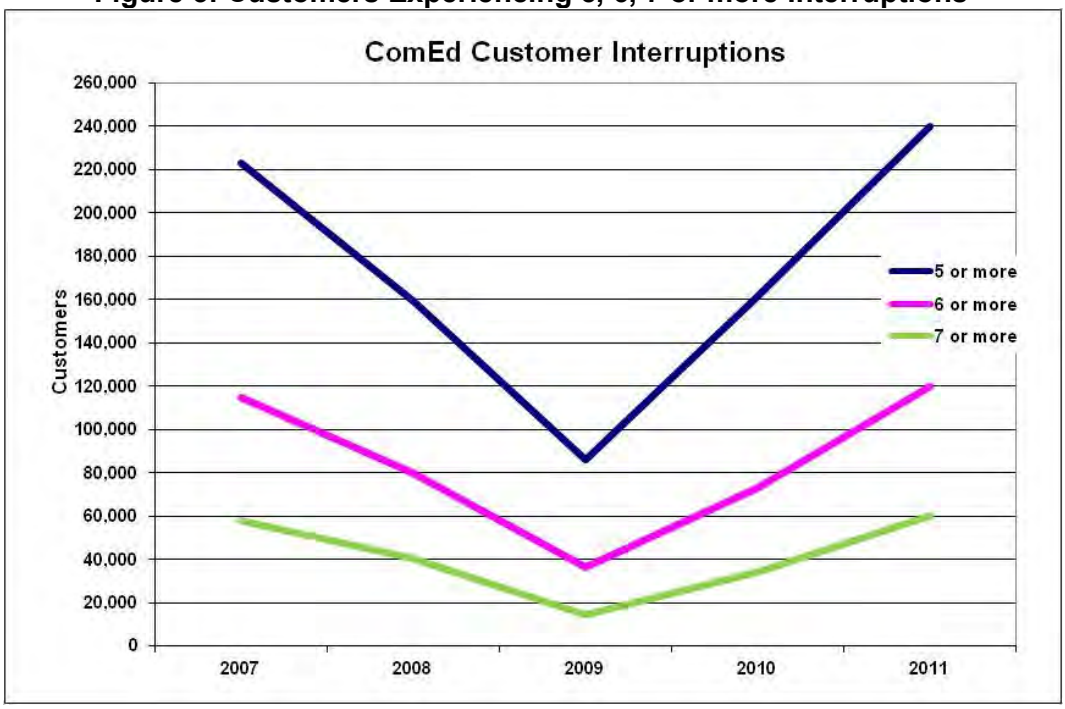


Figure 3: Customers Experiencing 5, 6, 7 or more Interruptions



83 Ill. Adm. Code 411.120(b)(3)(I)&(J) requires the reporting utility to list its worst performing circuits ("WPC") (subsection I) and state (subsection J) what corrective actions are planned to improve those circuits' performance. ComEd selected its WPCs from those distribution circuits with the worst performance (highest reliability index scores) from each of its four operating areas and for each of the three reliability indices. This list totaled 112 circuits, and ComEd classified them as its worst 1% performers. Per subsection J, ComEd

listed the date, number of customers affected, length of time, and cause of each interruption for each of these 112 circuits. All of the work planned for these 112 circuits was completed by December 31, 2011.

Worst Performing Circuit Repeats from Previous Reports

Of the 112[12] WPCs in ComEd's 2011 Reliability Report, 11[13] (Table 7) represented repeats from one or more of the years 2007 through 2010.

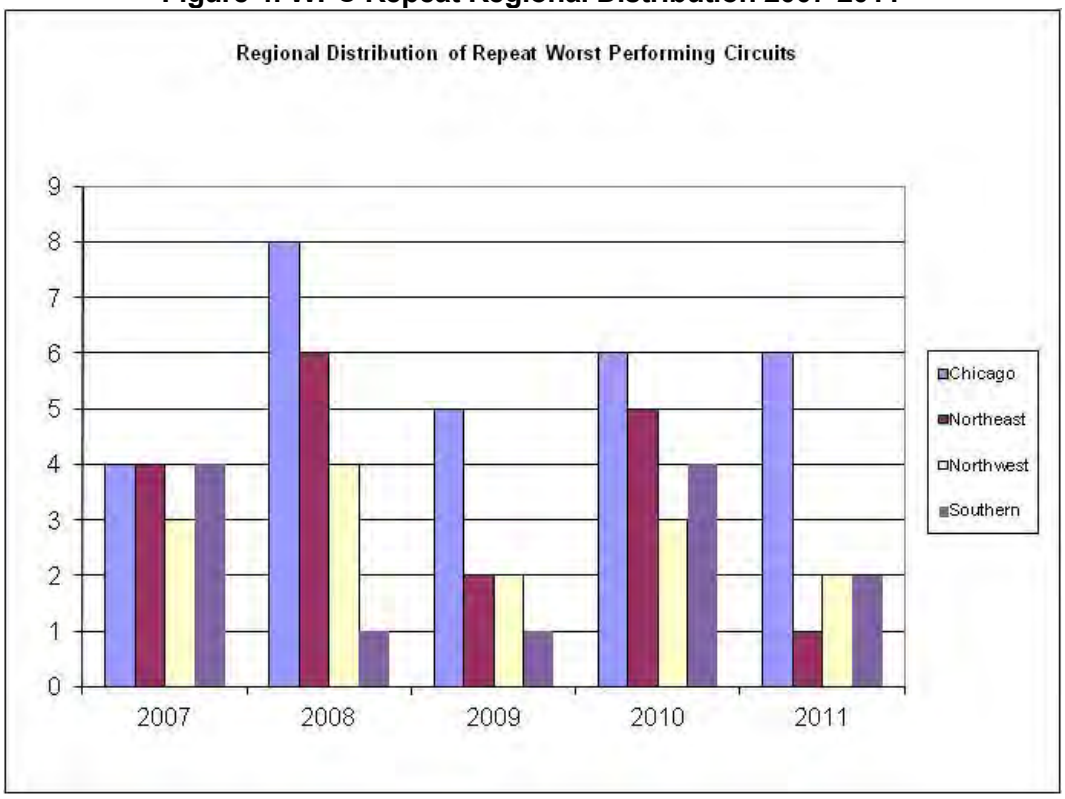
Table 7. 2011 Worst performing circuit repeats within the last 5-years[14]

Feeder ID & Customers Served on 12/31/11	Region	Communities	Prior WPC	Urban or Rural	Ckt Length	DA Installed	Last Tree Trim
C298 970	CHICAGO	CHICAGO, NILES	SAIFI/CAIFI-2007	URBAN OH	7.4	Yes	Dec 2011
GRDX30 1,050	CHICAGO	CHICAGO	SAIFI/CAIFI-2009	URBAN UG	12.2	No	Jun 2009
X5481 77	CHICAGO	CHICAGO	SAIFI/CAIFI-2007	URBAN OH	2.2	No	Feb 2009
X7149 1,688	CHICAGO	HARWOOD HEIGHTS, CHICAGO	SAIFI/CAIFI-2007	URBAN OH	8.3	Yes	Jun 2010
Z15087 1,236	CHICAGO	CHICAGO	**SAIFI/CAIFI-2007, SAIFI/CAIFI-2008, SAIFI/CAIFI-2010**	URBAN OH	13.5	Yes	May 2009
Z17445 2,626	CHICAGO	CHICAGO	SAIFI/CAIFI-2010	URBAN UG	6.7	Yes	Jan 2012
W3915 738	NORTHEAST	WINFIELD, WINFIELD TWP, WHEATON, MILTON TWP	SAIFI/CAIFI-2008	URBAN OH	17.3	No	Dec 2011
E175 1,140	NORTHWEST	WONDER LAKE, MCHENRY TWP	SAIFI/CAIFI-2008	URBAN OH	19.4	Yes	Dec 2008
E5114 710	NORTHWEST	DORR TWP, BULL VALLEY, WOODSTOCK	SAIFI/CAIFI-2008	URBAN UG	44.2	No	Aug 2008
G698 481	SOUTHERN	EVERGREEN PARK	CAIDI-2010	URBAN OH	2.7	No	Jun 2008
W664X 318	SOUTHERN	OAKBROOK, WESTMONT	**SAIFI/CAIFI-2007, SAIFI/CAIFI-2010**	URBAN UG	16.1	No	Jan 2011

Figure 4 illustrates the distribution of these WPC repeats in ComEd's regions.

[12] 112 represents approximately 2% of all ComEd distribution circuits.
[13] Staff considers a circuit to be a WPC Repeat if it had previously been a WPC for any reason. ComEd considers a Circuit to be a WPC Repeat if it had previously been a WPC in the Same Category list, i.e. a WPC frequency to WPC frequency or WPC duration to WPC duration.
[14] See Table 10 for a definition of each reliability statistic

Figure 4: WPC Repeat Regional Distribution 2007-2011



ComEd has a finite number of distribution circuits in its system and, with the selection of the worst performing circuits each year out of that finite pool, Staff is not surprised that in each assessment year there would be a small number of repeat circuits from the previous four years. Staff reviews the trending of these repeat circuits because there is a concern that the number of repeats from previous years may be indicative of (1) inadequacies in inspections and/or (2) non-completion of needed corrective actions and/or (3) non-completion of subsequent regular preventive maintenance for worst performing circuits from 2007 through 2010. On page J-1 of ComEd's Reliability Report, ComEd stated that it "*proactively identifies and reviews circuits that have repeated on the one percent list in the previous five years*."

Figure 5: 2011 WPC Overhead & Underground distribution by Region

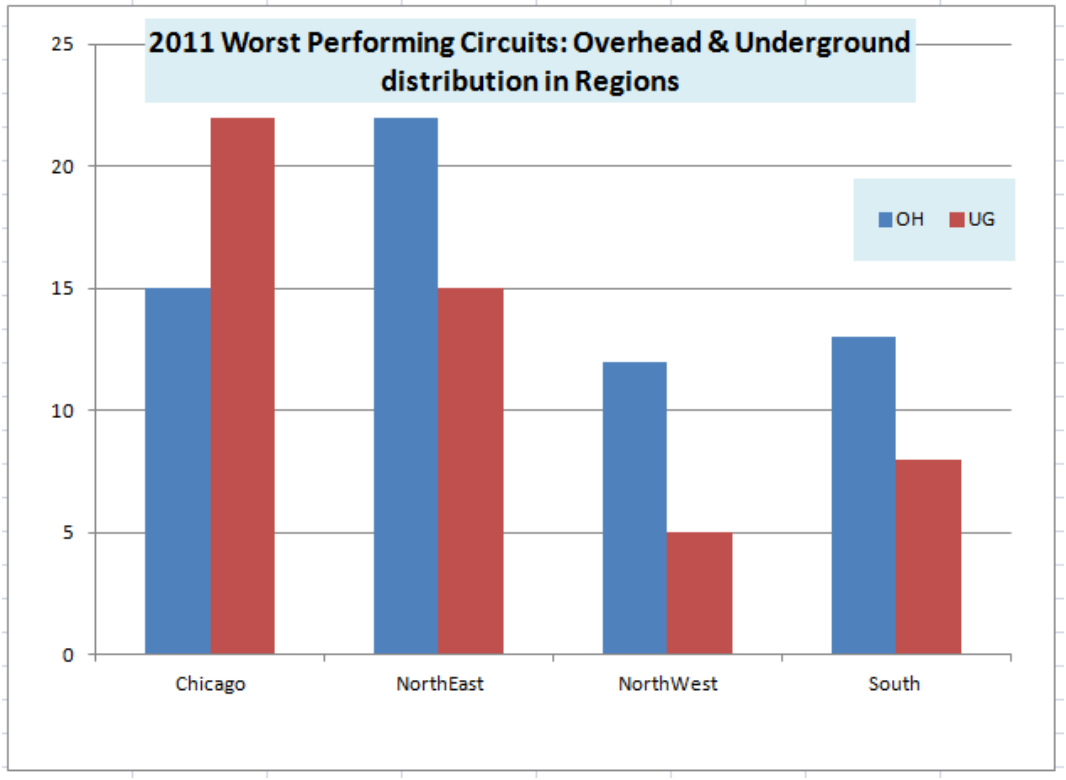


Figure 5 shows that predominantly underground circuits make up a large portion of the 2011 worst performing circuits.

Figure 6: 2011 WPC Automatic Line Recloser(s) Installed distribution by Region

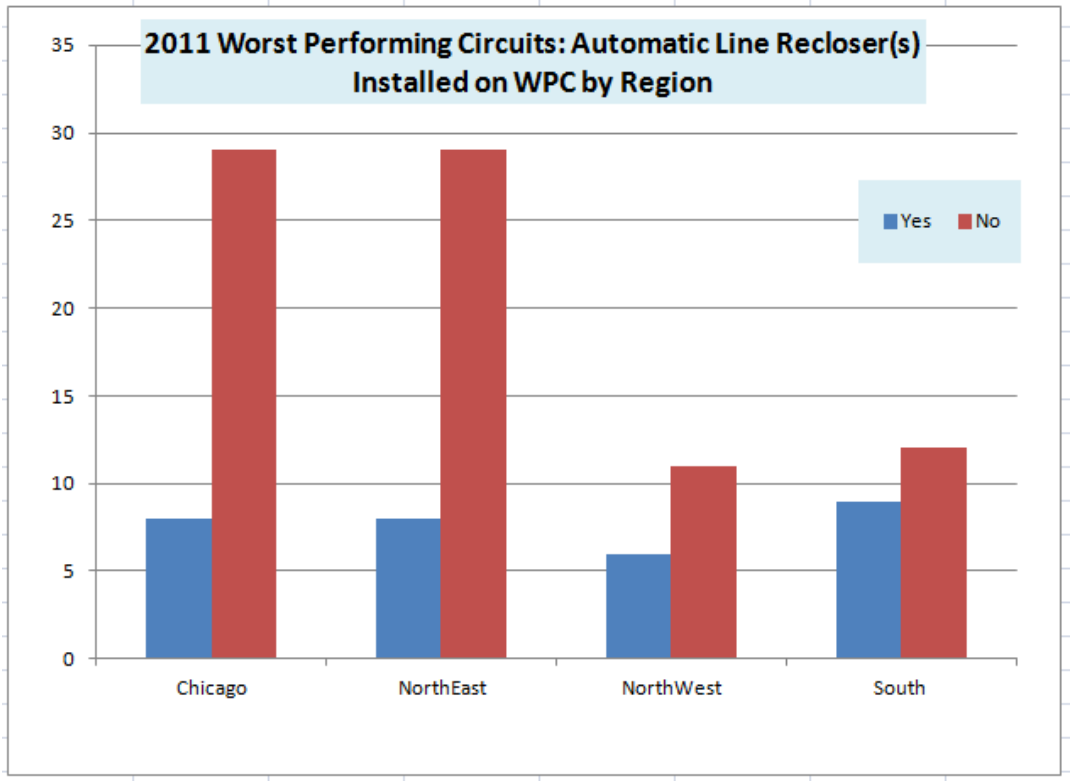


Figure 6 shows that a majority of the worst performing circuits in every region already have automatic line recloser(s) installed, indicating to Staff that a large number of circuits have automatic line recloser(s) deployed.

Field Inspections

To evaluate the overall trend of conditions in ComEd's service territory, Commission Staff conducted seven field inspections in 2011, Table 8, and four fence line (from outside the substation fence) substation inspections, Table 9. The purpose of the inspections was for Staff to see if there were any obviously visible reasons for poor reliability performance. Staff looked for problems on circuits, such as poor tree trimming practices, broken or damaged equipment, rotten poles, and overly slack spans (low sagging lines). At substations, Staff looked for problems such as low or leaking oil in equipment, load tap changers regularly operated at extreme positions, and poor maintenance practices.

Table 8. Field Inspections in 2012

Circuit	Region	Communities Served	Date Inspected
R6378 (1)	Northwest	ROCKFORD, ROCKFORD TWP, SHIRLAND RURAL, MACHESNEY PARK	June 18
C298(1)	Chicago	CHICAGO, NILES	October 3
E791(1)	Northwest	BULL VALLEY, WONDER LAKE, GREENWOOD, GREENWOOD TWP	October 3
J5672(2)	Southern	LOCKPORT TWP, CRESTHILL, JOLIET, LOCKPORT	October 9
Random		MENDOTA AREA	June 18
Random		MULTIPLE LOCATIONS NEAR: WONDER LAKE, WOODSTOCK, MARENGO, CHERRY VALLEY	October 3
Random		JOLIET AREA	October 9

Notes to Table 8:

1. Circuits drawn from the list of 112 worst performing circuits ("WPC")
2. Circuit drawn from the list of circuits with greatest number of tree contacts

Table 9. Substation Inspections in 2012

Substation Inspections	Date Inspected
Roscoe Bert (fence-line inspection)	June 18
Niles (fence-line inspection)	October 3
Wonder Lake (fence-line inspection)	October 3
Joliet Central (fence-line inspection)	October 9

A log of Staff's field observations is contained in Appendix A. Appendix A contains only a few of the many pictures taken by Staff. Additional pictures can be found later in Section 9 – Potential Reliability Problems and Risk.

7. Trends in ComEd's Reliability Performance

Listed in Table 10 are ComEd's reliability indices as reported in the 2011 Reliability Report (for all interruptions) for ComEd's overall system, as well as each region, in comparison to the system values reported by the other utilities for 2011.

Table 10 Comparison of reliability indices for 2011

	CAIDI (minutes)	CAIFI (interruptions)	SAIFI (interruptions)
ComEd System Total	**366**	**2.28**	**1.57**
ComEd Chicago Region	**189**	**2.04**	**1.20**
ComEd Northeast Region	**582**	**2.42**	**1.94**
ComEd Southern Region	**216**	**2.30**	**1.67**
ComEd Northwest Region	**352**	**2.13**	**1.49**
Ameren	**234**	**1.92**	**1.35**
MidAmerican	**86.55**	**2.588**	**2.0387**
Mt. Carmel	**153.83**	**6.36**	**6.26**

CAIDI: Customer Average Interruption Duration Report (cay' dee). This represents, for the group of customers that actually had one or more interruptions, how long, on average, the interruptions lasted.

CAIFI: Customer Average Interruption Frequency Index (cay' fee). This represents the interruption frequency for the group of customers that had interruptions. **A CAIFI index much higher than SAIFI suggests that subsets of customers experienced significantly more frequent interruptions than the overall system average.**

SAIFI: System Average Interruption Frequency Index (say' fee). This represents the number of customer interruptions divided by total system customers.

The reliability indices required by the Commission rules and provided by ComEd[15] include storm related interruptions. Staff expects that the better designed and maintained an electric system is, the smaller the number (CAIFI & SAIFI indices) or magnitude of storm related problems and the quicker the restoration of the electric system would be, also resulting in a lower system average customer interruption time (CAIDI index).

In Tables 18b, 18c, 18d, and 18e of ComEd's 2011 Reliability Report, ComEd listed reliability indices that vary from the indices as defined in 83 Ill. Adm. Code 411.20. Staff commends the use by ComEd's engineers and planners of all available tools for their own analyses and reliability improvement purposes. While Staff does look at storms and company-generated statistics that exclude purported storms to help explain year to year variations in reliability indices, Staff believes the long term trends of indices with all available data included are the least potentially problematic performance indicators. In Docket Nos. 07-0066, 07-0067, and 07-0068, Staff demonstrated how reliability indices that attempt to exclude storm periods could be misleading[16] and unsuitable[17] for Commission use. Staff used the reliability indices as required by the Commission rules.

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[15] Page H-2, Table 18a: Reliability Indices for 2011, ComEd 2011 Reliability Report.

[16] "… Utilities that choose to adequately maintain their electric delivery facilities and workforces might significantly reduce the number and duration of electric service interruptions that their customers experience during storms. The reductions could cause Standard 1366 to identify fewer Major Event Days. Conversely, utilities that fail to adequately maintain their electric delivery systems and workforces might increase the number and duration of electric service interruptions that their customers experience during storms and cause Standard 1366 to identify more Major Event Days. With a larger number of Major Event Days, the utility with the inferior maintenance programs or too-small workforce might appear in the resulting reliability statistics to be performing better than the utility with the superior maintenance program and bigger workforce. …" Docket No. 07-0066 Attachment Q to Order dated January 24, 2007; Docket No. 07-0067 Attachment B to Attachment to Order dated January 24, 2007, Docket No. 07-0068 Attachment Q to Attachment to Order dated January 24, 2007.

[17] "…If Ameren utilities could classify a significant number of the electric service interruptions their customers experience as caused by the weather and use a method … to make many of those weather interruptions disappear from their statistics, then they could report reliability to the Commission that their customers could only wish for, but had never actually seen. … The disturbing possibility that Standard 1366 could alter reliability statistics to favor utilities with poor maintenance programs and inadequate workforces seems to Staff to make Standard 1366 unsuitable for Commission use. …" Docket No. 07-0066 Attachment Q to Order dated January 24, 2007; Docket No. 07-0067 Attachment B to Attachment to Order dated January 24, 2007, Docket No. 07-0068 Attachment Q to Attachment to Order dated January 24, 2007.

Figure 5 illustrates ComEd's CAIDI indices over the last five years in each region. Note that **lower** bar sizes in Figure 5 represent **better** performance.

Figure 5: ComEd CAIDI 2007-2011

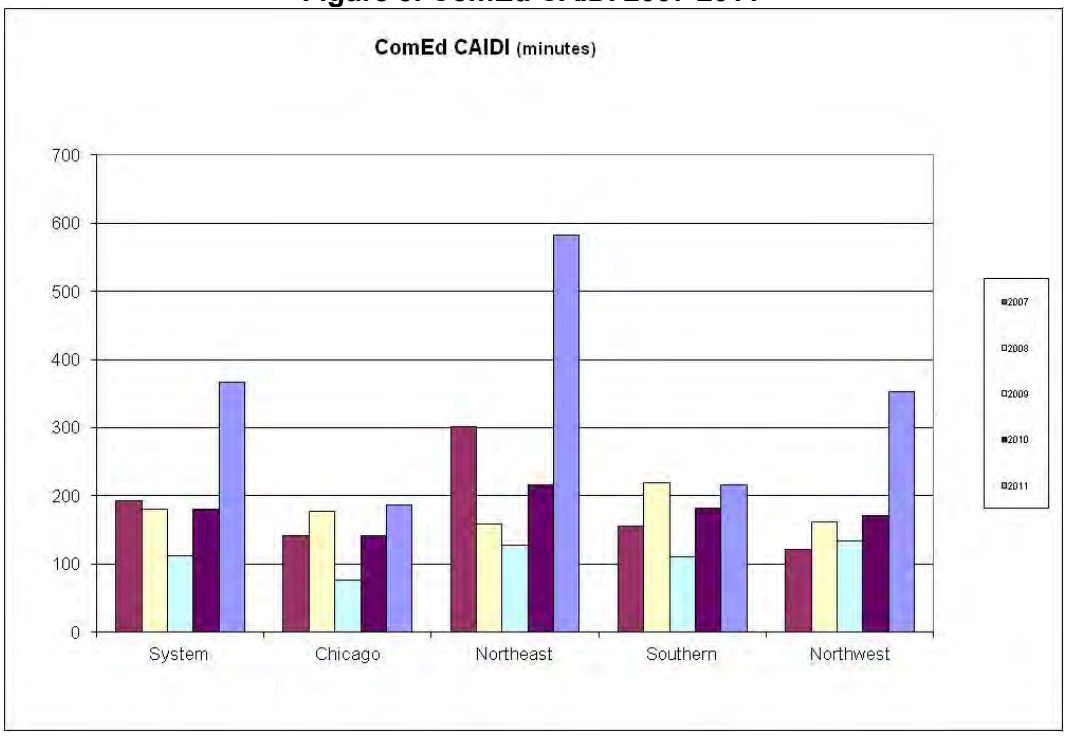


Figure 6 shows a comparison of CAIDI values reported for the years 2007 through 2011 by the utilities.

Figure 6: CAIDI by Utility 2007-2011

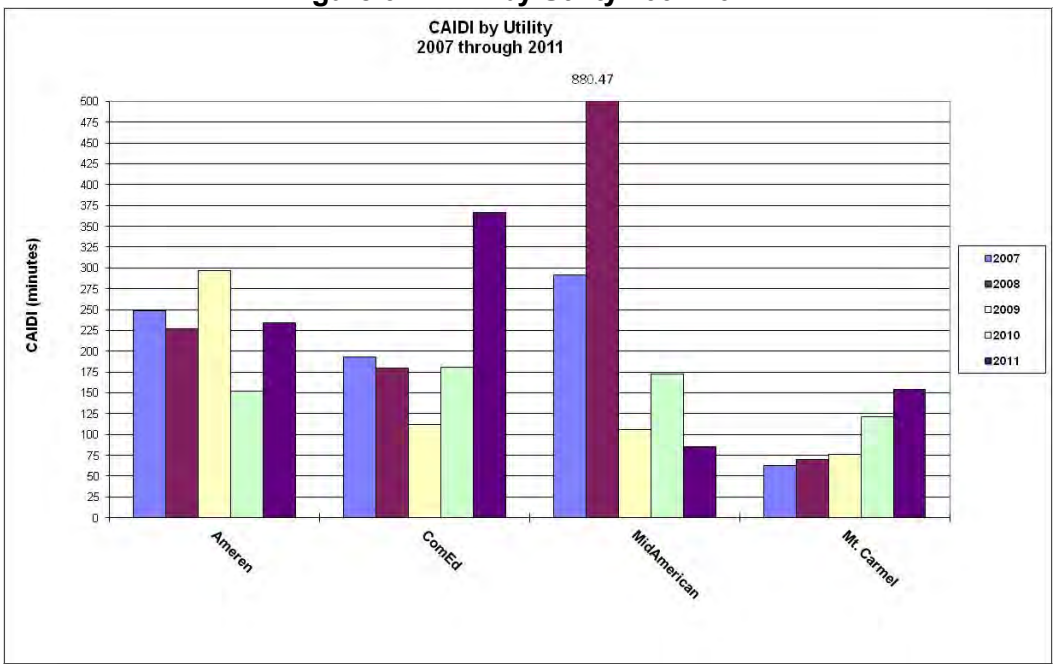


Figure 7 shows a comparison of CAIDI values for the worst circuit for each of the utilities from 2007 through 2011.

Figure 7: Worst-Circuit CAIDI by Utility 2007-2011

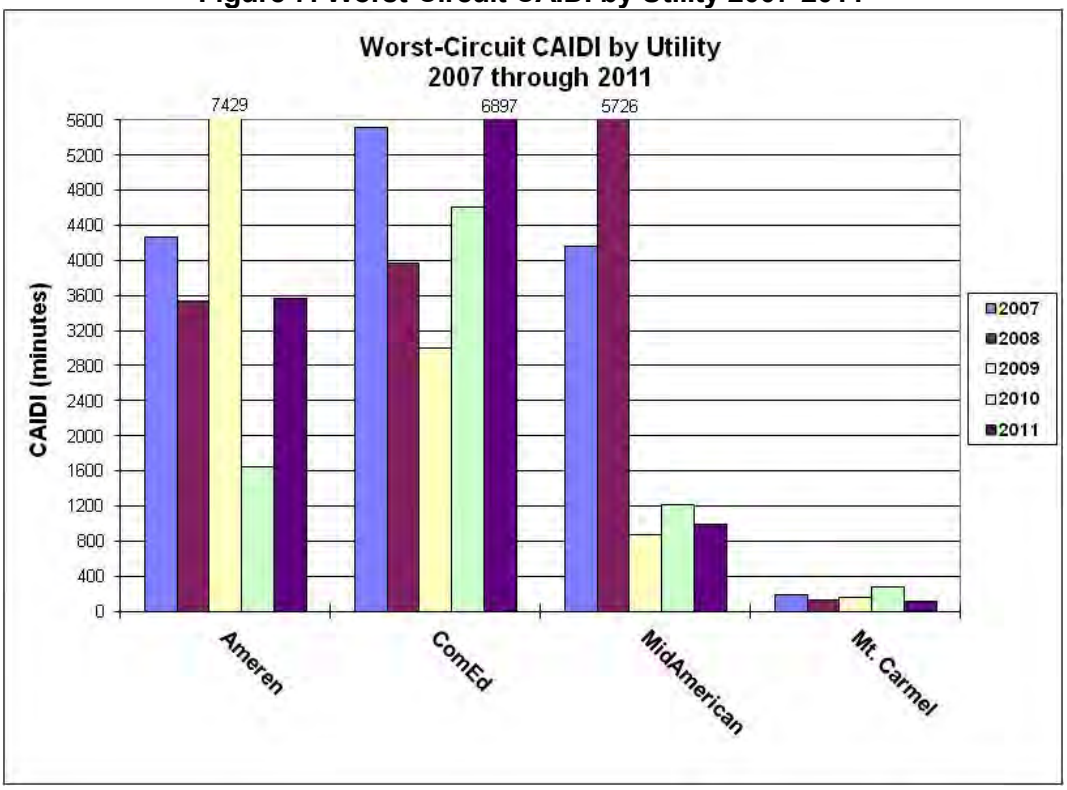


Figure 8 shows ComEd's CAIFI performance over the last 5 years for all ComEd Regions. Note that **lower** bar sizes in Figure 8 represent **better** performance.

Figure 8: ComEd CAIFI 2007-2011

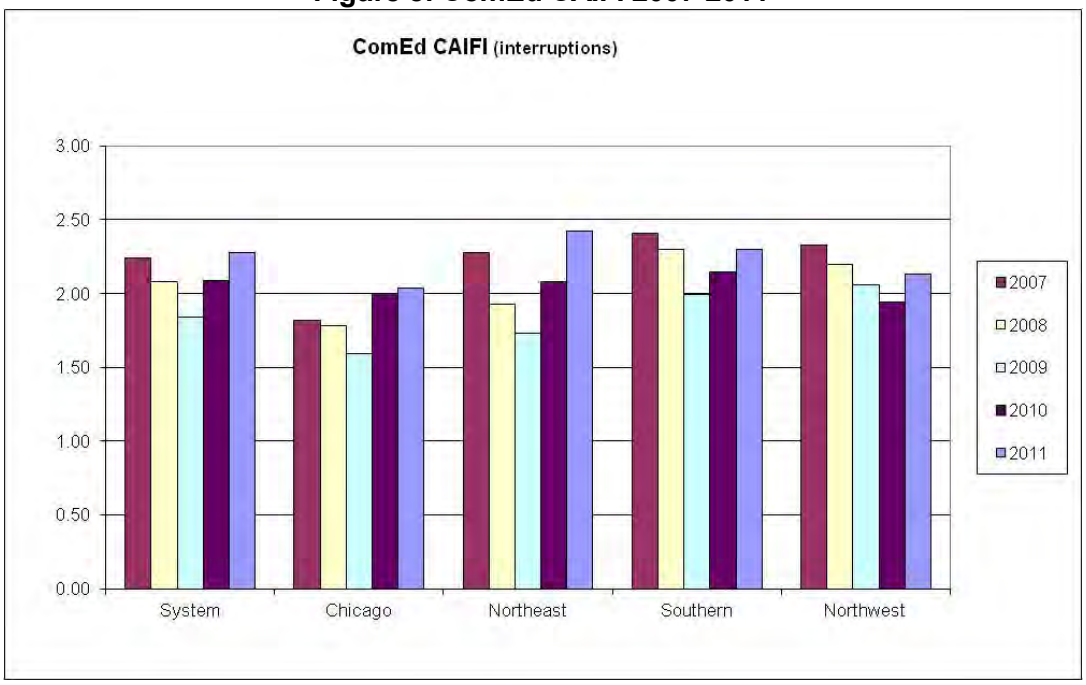


Figure 9 shows a comparison of CAIFI values reported for the years 2007 through 2011 by the utilities.

Figure 9: CAIFI by Utility 2007-2011

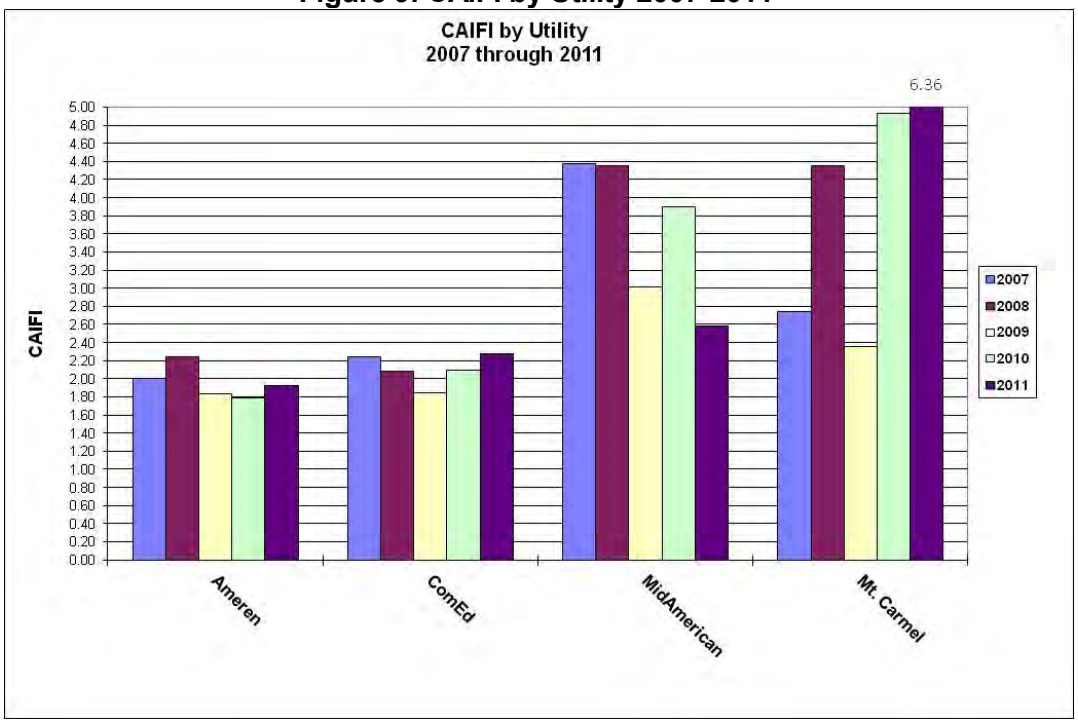
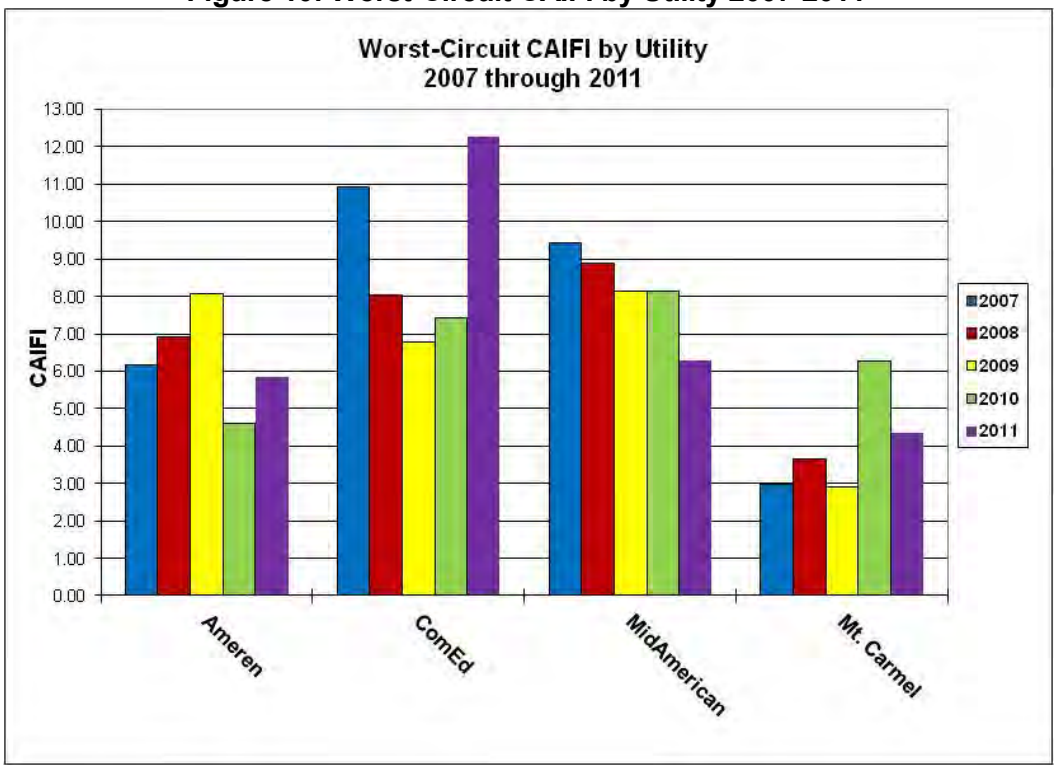


Figure 10 shows a comparison of CAIFI values for the worst-circuit[18] for each of the utilities in 2007 through 2011.

Figure 10: Worst-Circuit CAIFI by Utility 2007-2011



[18] ComEd's worst performing CAIFI/SAIFI circuit in 2011 was circuit GRDX30 in the Chicago Region – see page J-7 of ComEd's 2011 Reliability Report

Figure 11 shows ComEd's SAIFI performance over the last 5 years for all ComEd Regions. Note that **lower** bar sizes in Figure 11 represent **better** performance.

Figure 11: ComEd SAIFI 2007-2011

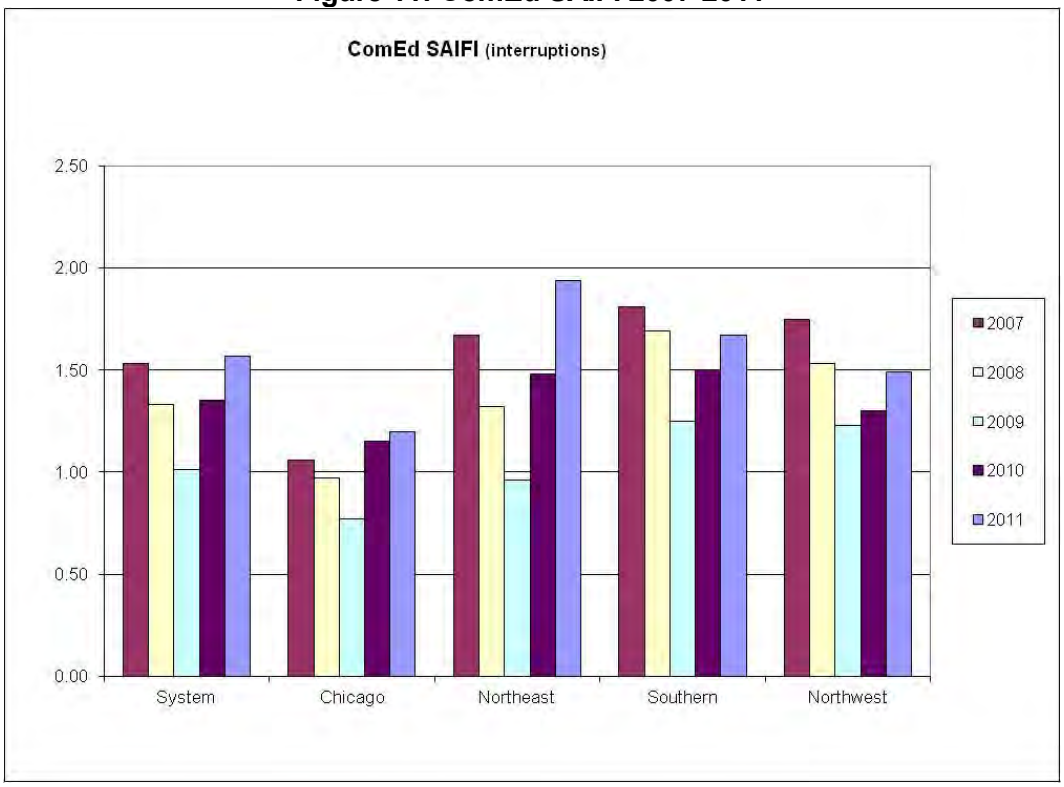


Figure 12 below shows a comparison of SAIFI values reported for the years 2007 through 2011 by the six utilities.

Figure 12: SAIFI by Utility 2007-2011

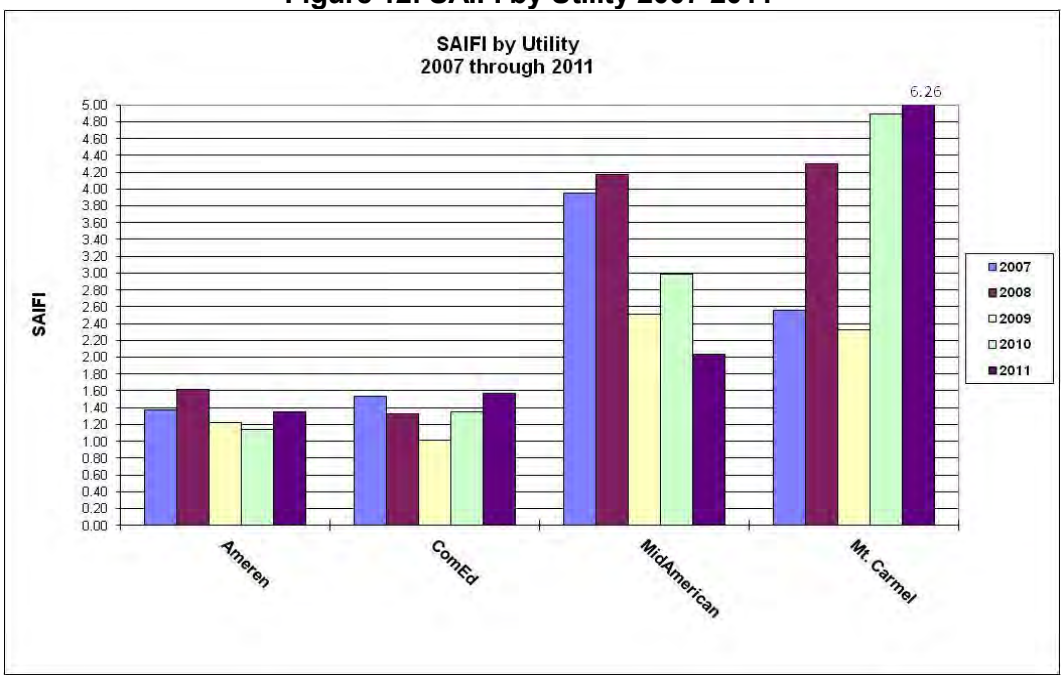
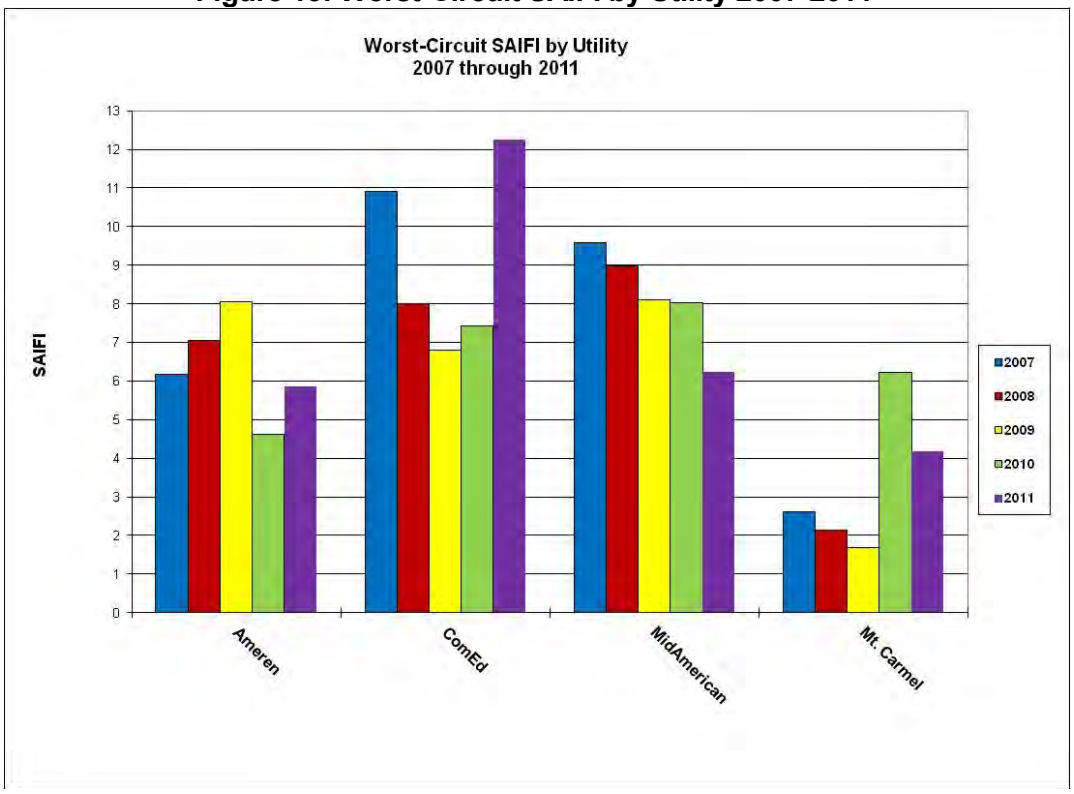


Figure 13 shows a comparison of SAIFI values for the worst performing circuit for each of the six utilities for 2006 through 2010. [19]

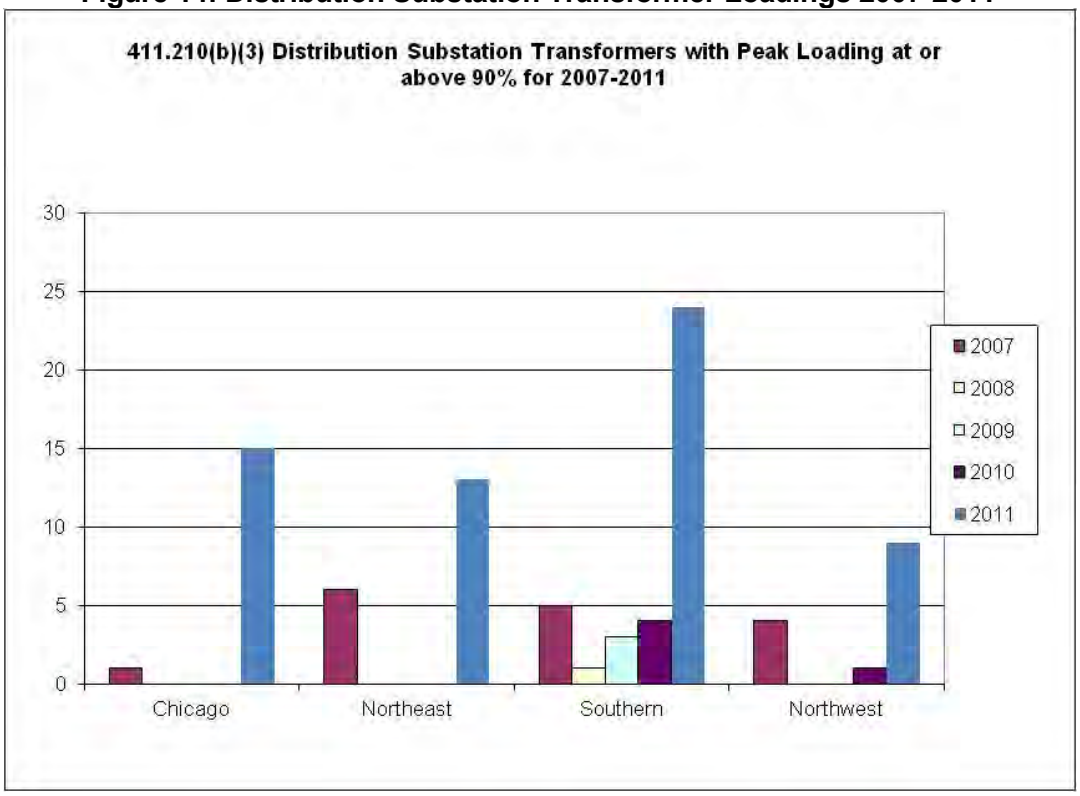
Figure 13: Worst-Circuit SAIFI by Utility 2007-2011



83 Ill. Adm. Code 411.210(b)(3) states that each utility having 1,000,000 or more customers is to provide a list of substation transformers that had a peak loading that equaled or exceeded 90% of their rated normal capacity. Figure 14 shows the historical distribution, by region, of substation transformers with a peak loading at or above 90% in the last 5 years, 2007-2011.

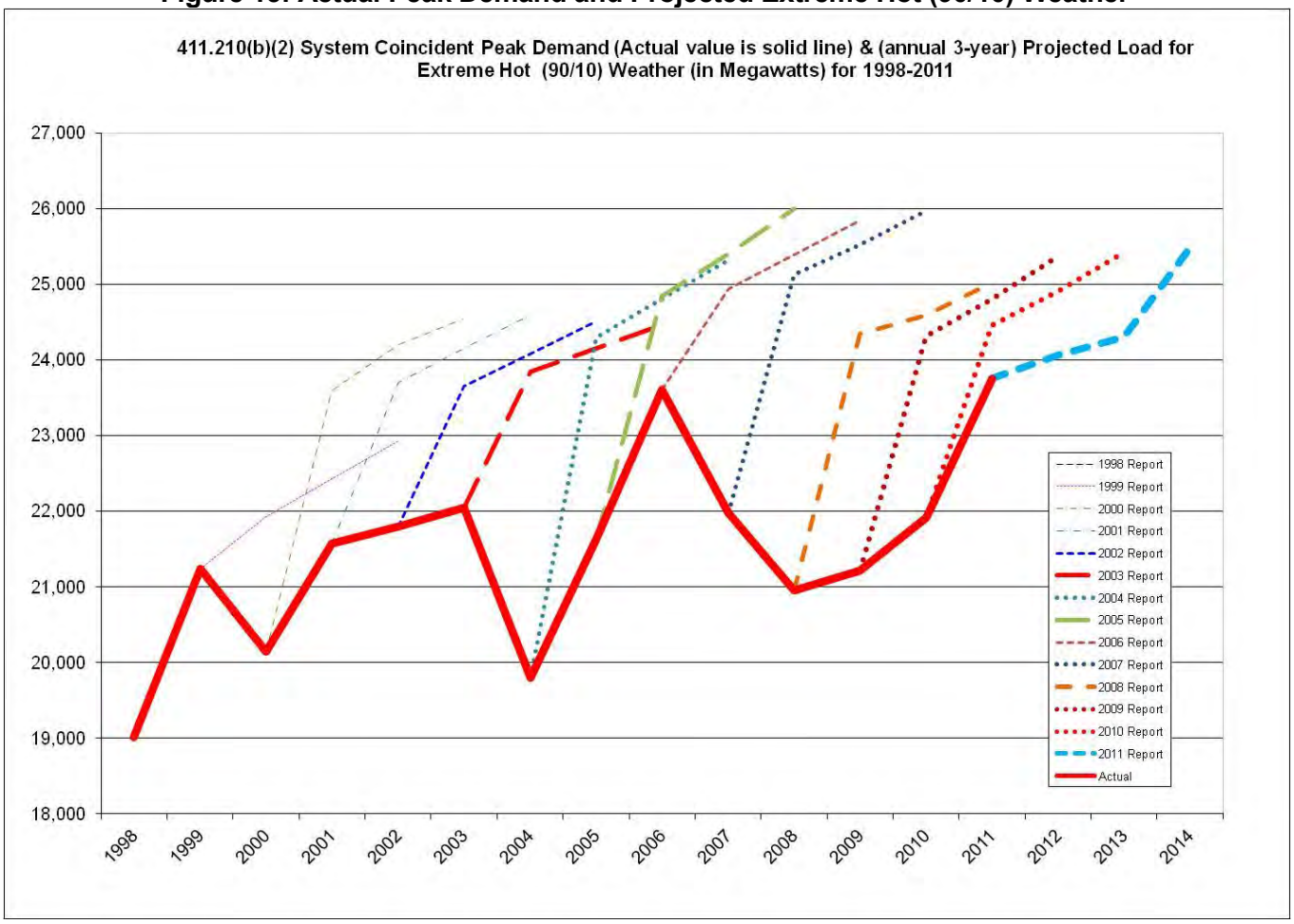
[19] ComEd's worst performing SAIFI/CAIFI circuit in 2011 was circuit GRDX30 in the Chicago Region – see page J-7 of ComEd's 2011 Reliability Report

Figure 14: Distribution Substation Transformer Loadings 2007-2011



In Figure 15, the solid red line represents actual annual peak demand while the lighter dashed lines represent the projected extreme hot weather load forecast used to plan capacity expansions in the system.

Figure 15: Actual Peak Demand and Projected Extreme Hot (90/10) Weather



When actual system peak loads approach the extreme hot weather load projections used for capacity expansion planning, the trend in the number of transformers that exceed the criterion in 83 Ill. Adm. Code 411.210(b)(3) could signify reliability risks in the future. High transformer loadings can impact reliability in three ways: (1) when a substation transformer is loaded over its normal capacity rating for a length of time, the likelihood increases that the transformer may fail[20] due to cumulative thermal deterioration from overloading; (2) when a transformer is highly loaded, system reconfiguration flexibility is reduced if other failures occur in the system or if greater-than-expected load growth occurs; and (3) a trend toward a higher number of transformers exceeding the criterion in 83 Ill. Adm. Code 411.210(b)(3) at or below planning criterion load levels may signify inadequate substation capacity expansion planning.

8. ComEd's Plan to Maintain or Improve Reliability

With information from 83 Ill. Adm. Code 411.120(b)(3)(G)(iii & iv), Figures 16 and 17 display "Construction and Maintenance Expenditures" in current and constant dollars for Distribution and Transmission, respectively.

[20] Higher operating temperatures, dependent in part on loading, shorten transformer life.

Figure 16: Distribution Construction & Maintenance Expenditures 1998-2011

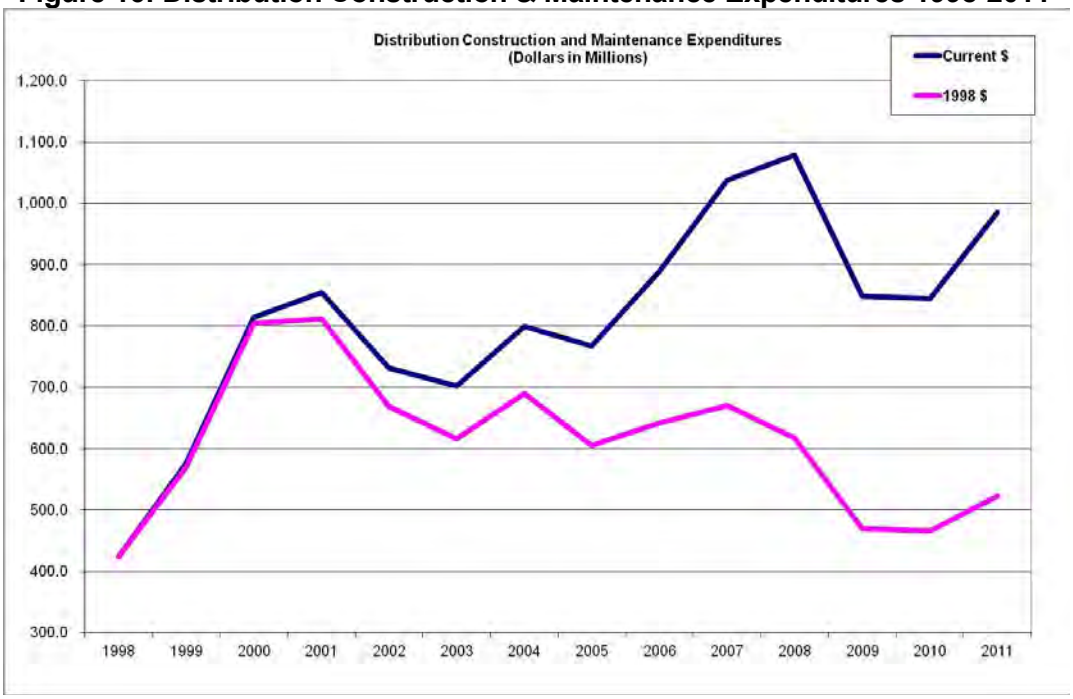
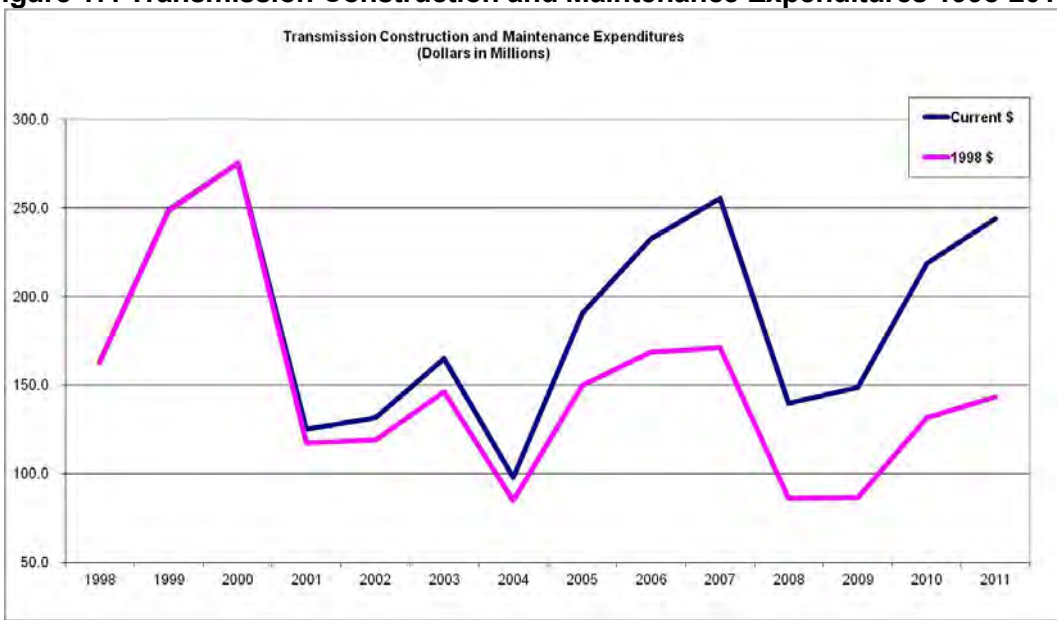


Figure 17: Transmission Construction and Maintenance Expenditures 1998-2011



Pages A-1 through A-8, including Table 1 on pages A-5 through A-8, of its 2011 Reliability Report detail ComEd's plans for future investment as required by 83 Ill. Adm. Code 411.120(b)(3)(A). A summary of the current plan is shown in Table 11 along with total variances from previous plan years.

Table 11 Future Investment Plan ($'s in Millions)

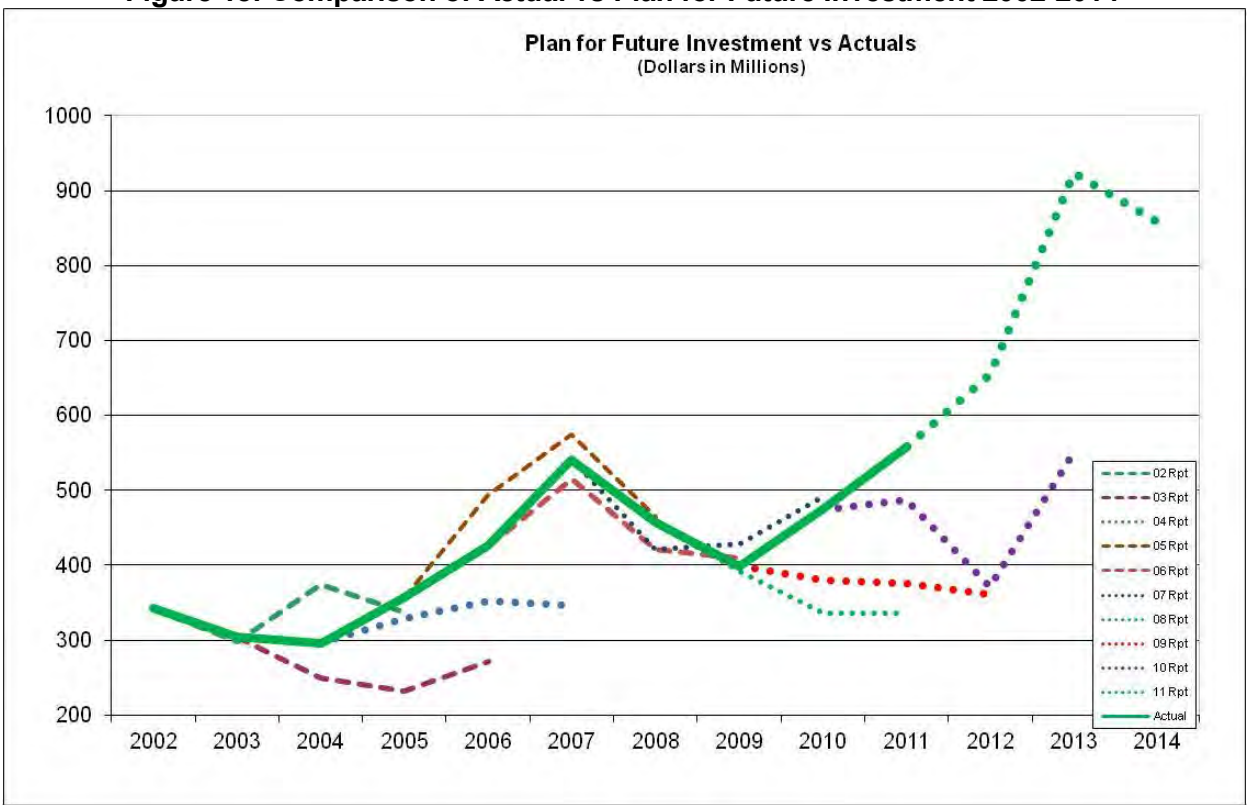
Pages A-5 through A-8 of 2011 Reliability Report

	Plan 2012	Plan 2013	Plan 2014
Transmission System Improvements [see page A-5]	193	361	303
Distribution Capacity [see page A-6]	60	78	82

Substation [see page A-6]	70	62	36
4kv, 12kv, & 34kv Ckt Improvemetns [see page A-67	168	261	283
Inspection and Maintenance [see page A-8]	164	161	154
	655	**923**	**858**
Variance from plan in 2010 Report	284	371	
Variance from plan in 2009 Report	294		

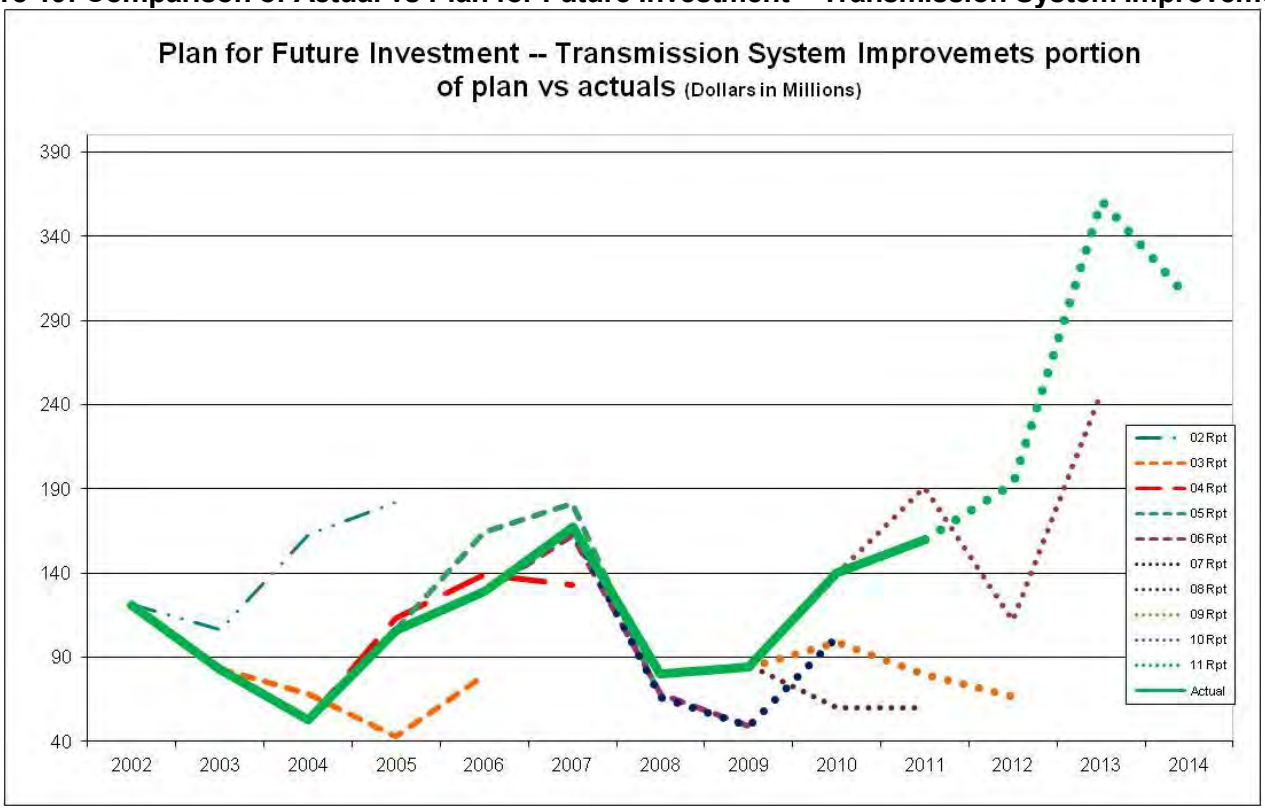
Greater detail of actual (using information from Part 411.120(b)(3)(B)) and projected investment plans (83 Ill. Adm. Code 411.120(b)(3)(A) information from the 2002 through 2011 Reliability Reports) is illustrated in Figures 18 through 23.

Figure 18: Comparison of Actual vs Plan for Future Investment 2002-2014



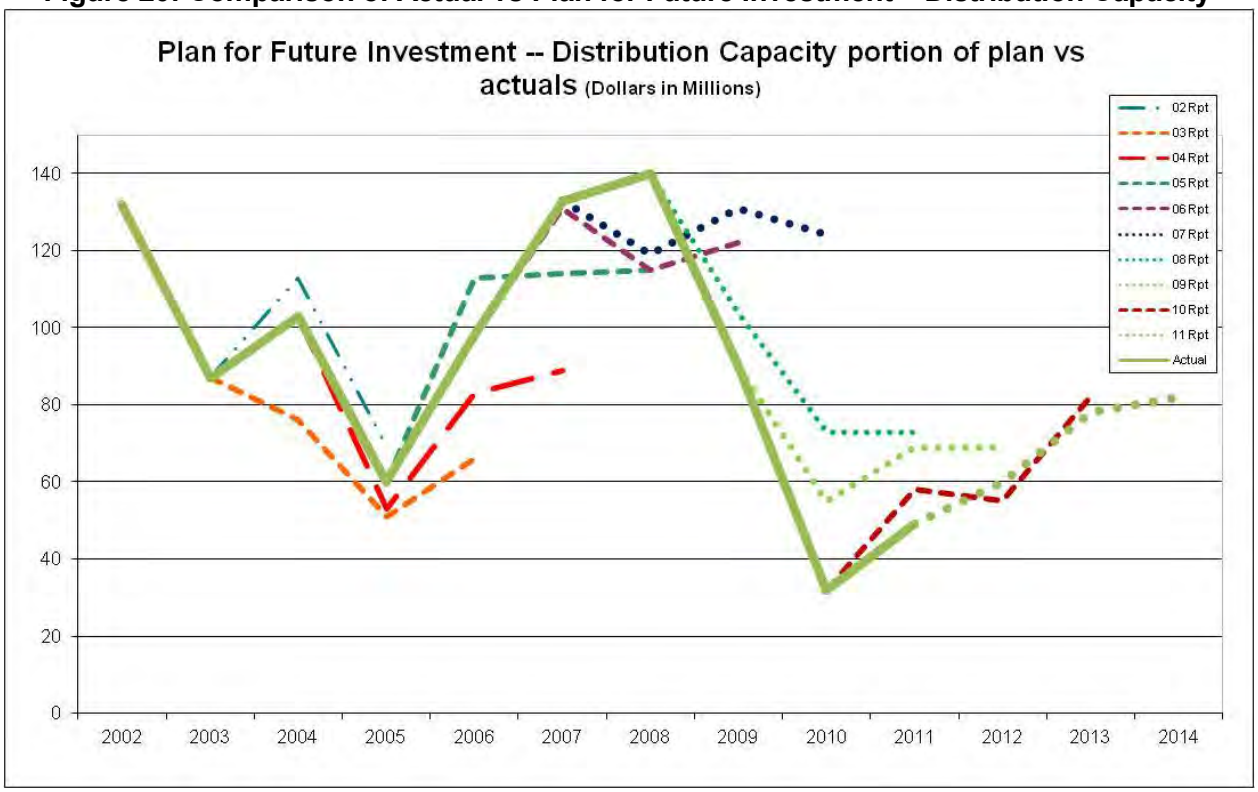
ComEd describes its plan for future investment on pages A-1 through A-4 of its 2011 Reliability Report.

Figure 19: Comparison of Actual vs Plan for Future Investment – Transmission System Improvements



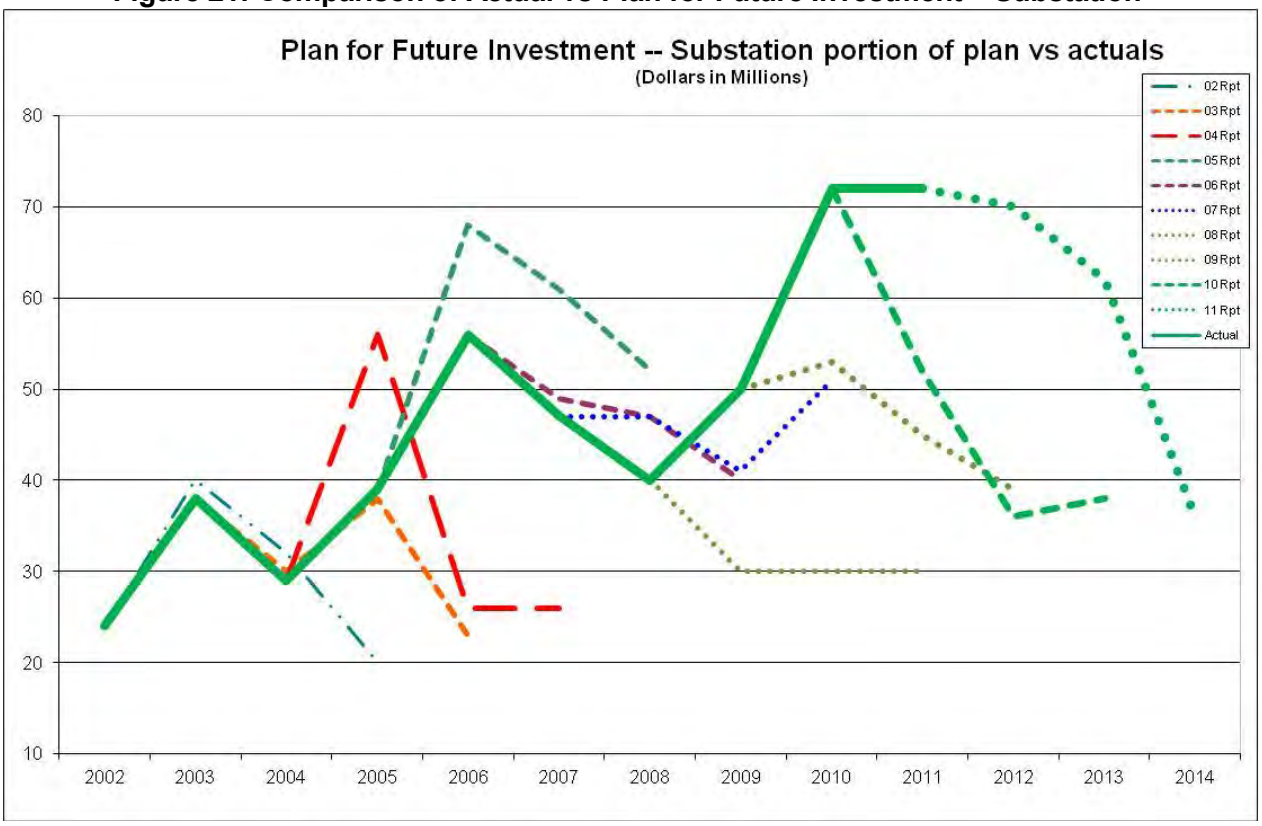
ComEd describes details of its plan for the Transmission System on page A-5 of the 2011 Reliability Report.

Figure 20: Comparison of Actual vs Plan for Future Investment – Distribution Capacity



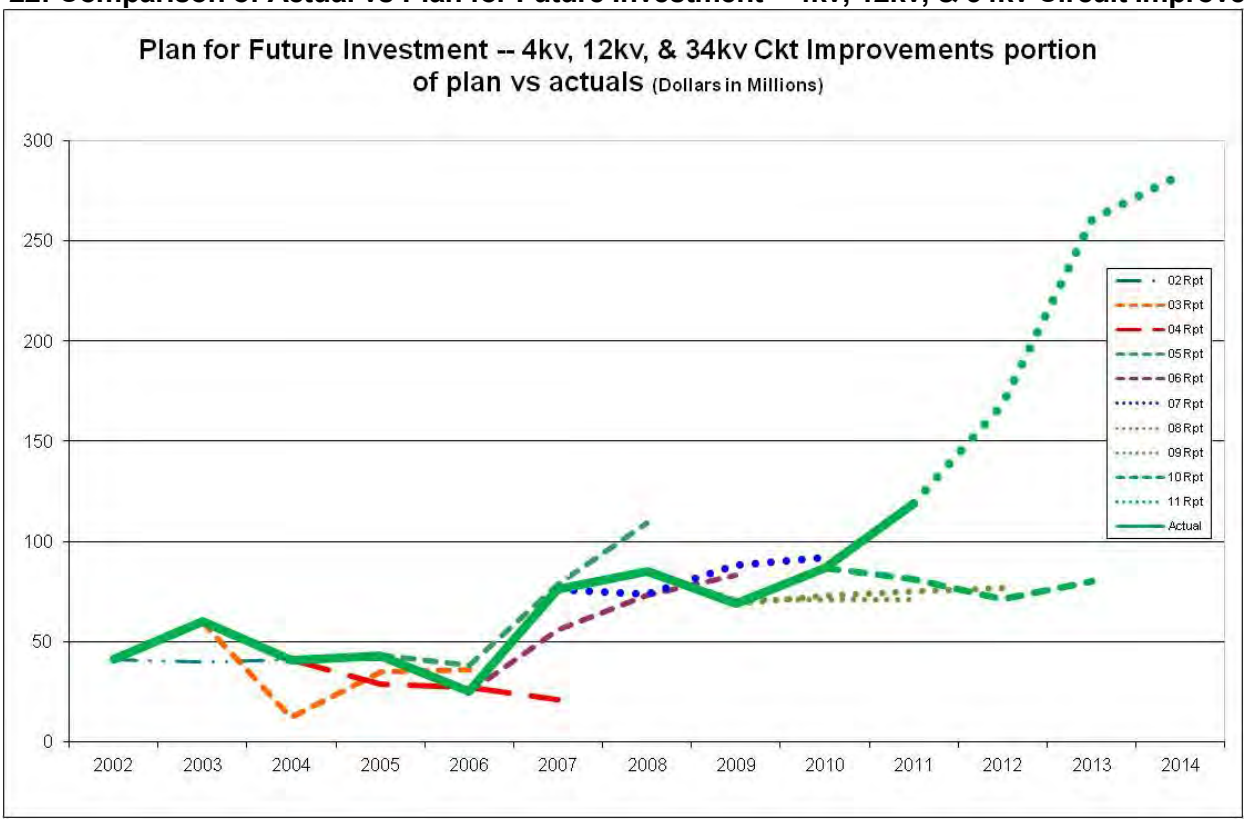
ComEd describes details of its plan for Distribution Capacity on page A-6 of its 2011 Reliability Report.

Figure 21: Comparison of Actual vs Plan for Future Investment – Substation



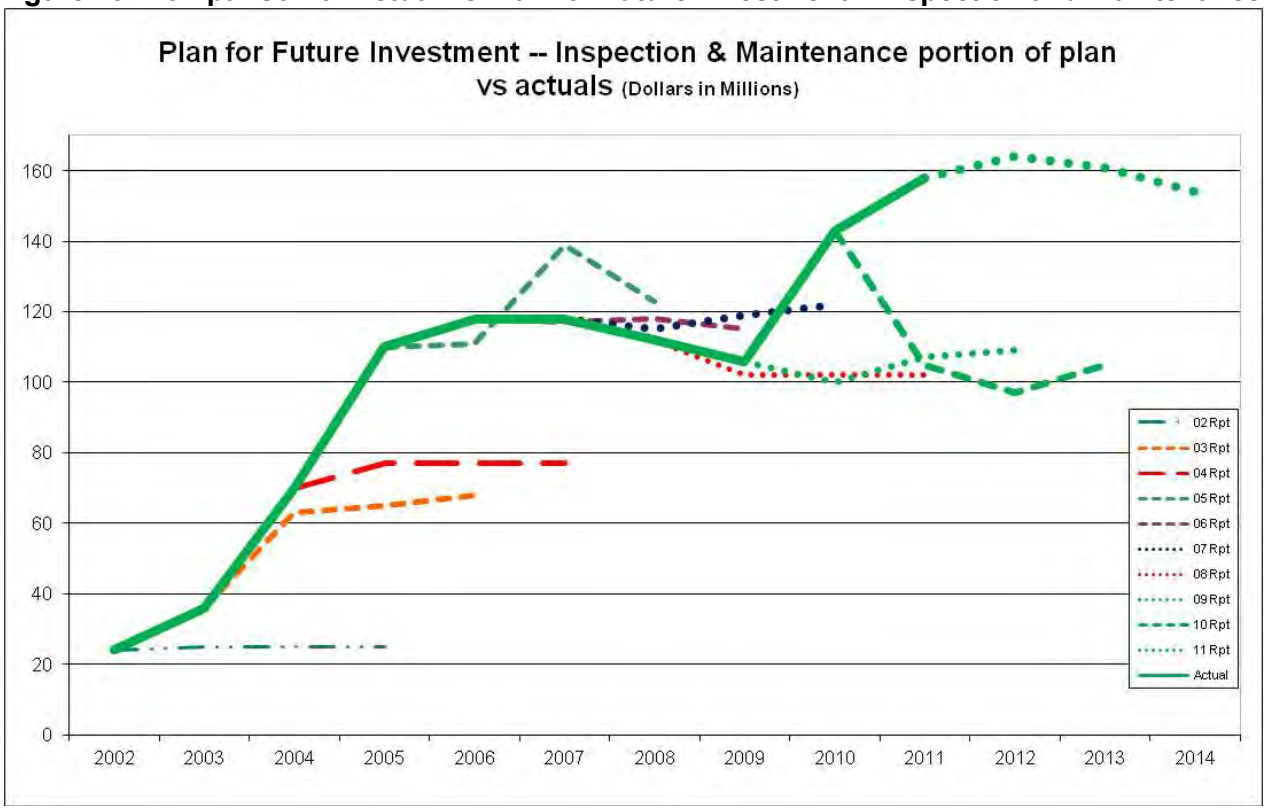
ComEd describes details of its plan for Substations on page A-6 of the 2011 Reliability Report.

Figure 22: Comparison of Actual vs Plan for Future Investment – 4kv, 12kv, & 34kv Circuit Improvements



ComEd describes details of its plan for 4, 12, and 34kV Circuit improvements on page A-7 of its 2011 Reliability Report.

Figure 23: Comparison of Actual vs Plan for Future Investment – Inspection and Maintenance



ComEd describes details of its plan for Inspection and Maintenance on page A-8 of its 2011 Reliability Report.

9. Potential Reliability Problems and Risks

Efficiency

Trends in spending levels alone do not explain how well ComEd is addressing reliability issues unless there is some indication of how efficiently that spending is applied. For example, if all else were equal, then spending patterns similar to those in the mid 1990's would be a cause for alarm because the spending patterns of the mid-1990's were a precursor to the reliability problems of 1999. However, rarely are all things equal and a good example of this would be to look at the strides made by the utility industry in capabilities of distribution and substation automation technologies and costs over the past 20 years.

Reviews of spending patterns, spending levels and inspections by Staff of actual conditions in the field with assessment of work that should be done and is actually getting done is the most effective way to determine the status of plans to maintain and improve reliability.

Attachment A is Staff's "Field Inspection Log" of Staff's field inspections listed in Table's 8 and 9, earlier in this report, as well as a sample of many pictures taken in the field by Staff.

Staff observed in the field instances where more careful investment or careful attention to detail would yield greater reliability returns on ComEd's reliability investment. Staff found one example at Roscoe Bert Substation where ComEd had not kept up with vegetation management around the substation. Pictures 1 and 2 show how vegetation was allowed to grow through and over the station fencing allowing an easy pathway for animals (and possibly people) into the substation yard.

Picture 1: 698 **Roscoe Bert Substation – Vegetation growing over and through station fence**

Picture 2: 704 **Roscoe Bert Substation – Vegetation growing over and through station fence with missing down guy guards**

While inspecting Joliet Central Substation, Staff noted heavy rust on towers highlighted in red on Picture 3. Staff also observed a static wire protecting one high voltage line entering the substation (highlighted in blue on Picture 3) but no static wire was observed protecting the other high voltage line entering the substation. Staff is uncertain if adequate direct-stroke lightning protection is being provided for the substation as had been suggested in Recommendation Eight-3 of Liberty's First Report on the Investigation of Commonwealth Edison's Transmission and Distribution Systems[21]. While ComEd's study of September 9, 2002 determined

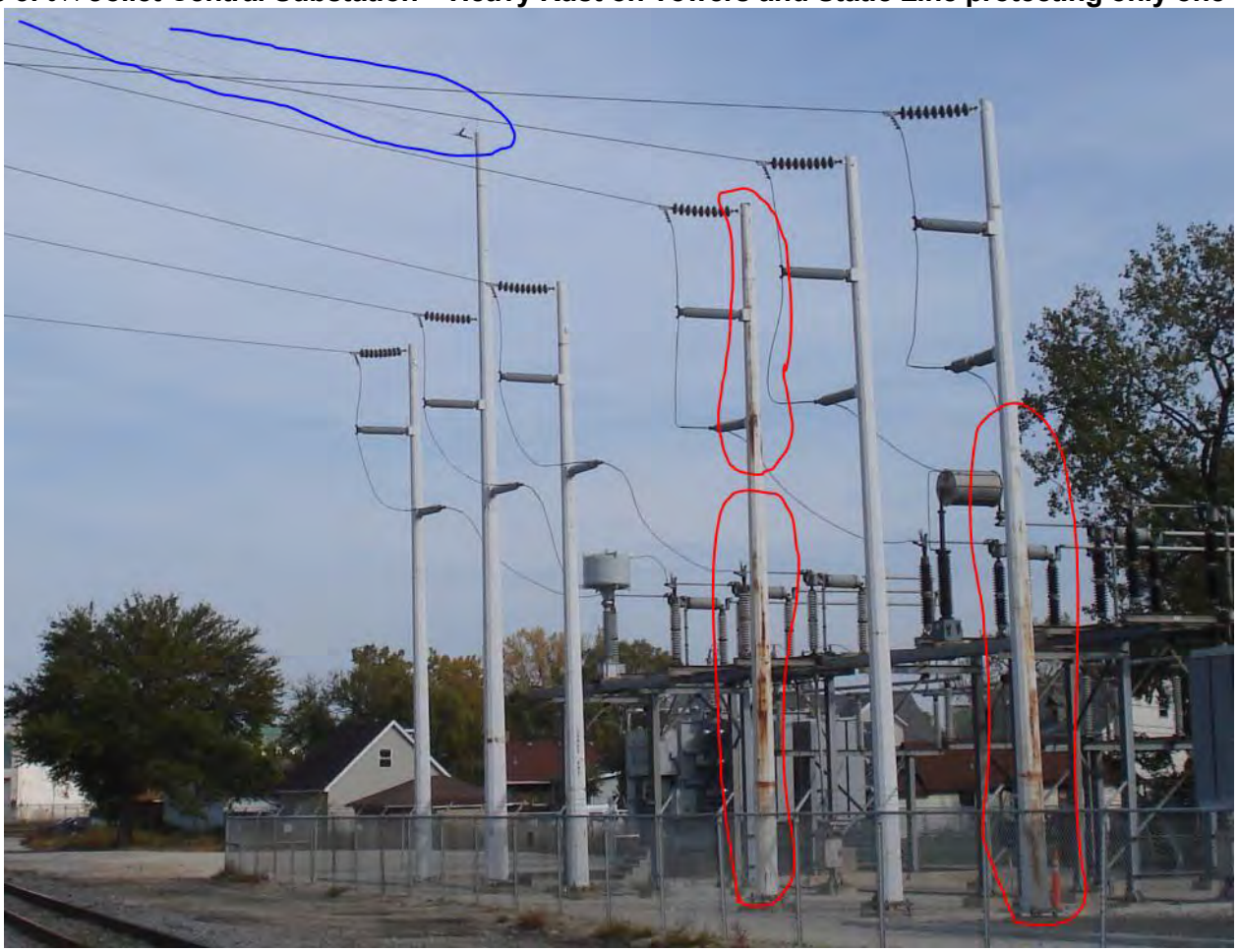
[21] **Chapter 8, Page VIII-19, May 2000, The Liberty Consulting Group First Report: Investigation of Commonwealth Edison's Transmission and Distribution Systems; Recommendation Eight-3**: *ComEd should install shielding in all new substations to provide direct-stroke lightning protection. Furthermore, ComEd should review all existing substations and develop a program to provide direct-stroke protection where economically feasible*. To meet good utility practices, ComEd needs to provide better lightning protection in its substations through the proper use of shield wires, lightning masts, and other shielding devices. Some substations on the ComEd system have adequate protection as a result of properly shielded transmission line routing, large adjacent structures, and buildings. An example of such a substation is the LaSalle 138-12 kV TDC in downtown Chicago. However, other substations are vulnerable to direct lightning strokes. [Emphasis added]

In the **Summary Verification Report: Commonwealth Edison's Implementation of Recommendations and Progress on Improvement Initiatives**, December 20, 2004, Prepared by Liberty Consulting Group for the Commission Liberty noted in its verification of Recommendation Eight-3 that:

- In its April 2002 report, Liberty indicated that ComEd had applied standards for installing shielding for its new 69kV, 138kV, and 345kV substations, but it had not performed a study to determine the cost-benefits of installing shielding for its existing substations. In its June 2003 report, Liberty confirmed that ComEd completed the study.
- ComEd completed a study on September 9, 2002, that included the analyses of lighting stroke densities and bus outage probabilities at selected representative substations across ComEd's transmission system. The study considered the actual numbers of bus outages caused by lightning, substation priorities based on criticality, and the cost-benefits of installing shielding in existing substations. On the basis of this study, which pertained to the unshielded 138kV substations constructed before 2000, ComEd concluded that installing direct-stoke shielding in the pre-2000 138kV substations was not justified, except in some critical TSS substations.
- In the course of performing the study, ComEd determined that the older style silicon carbide substation arresters had an unacceptable failure rate. Fragmenting porcelain parts from failed silicon carbide arresters caused at least three bus outages. Since about 69 percent of its arresters are the silicon carbide type, ComEd said that its management is considering a $2.75 million twelve-year arrester replacement

that it was not cost justified to install shielding in existing substations for protection from direct-stroke lightning strikes, the economies of such retrofits may have changed substantially in the past eleven years. Staff recommends ComEd review and update its findings from the September 9, 2002, Direct-Stroke Lightning Protection Study for existing substations.

Picture 3: 914 **Joliet Central Substation – Heavy Rust on Towers and Static Line protecting only one Circuit**



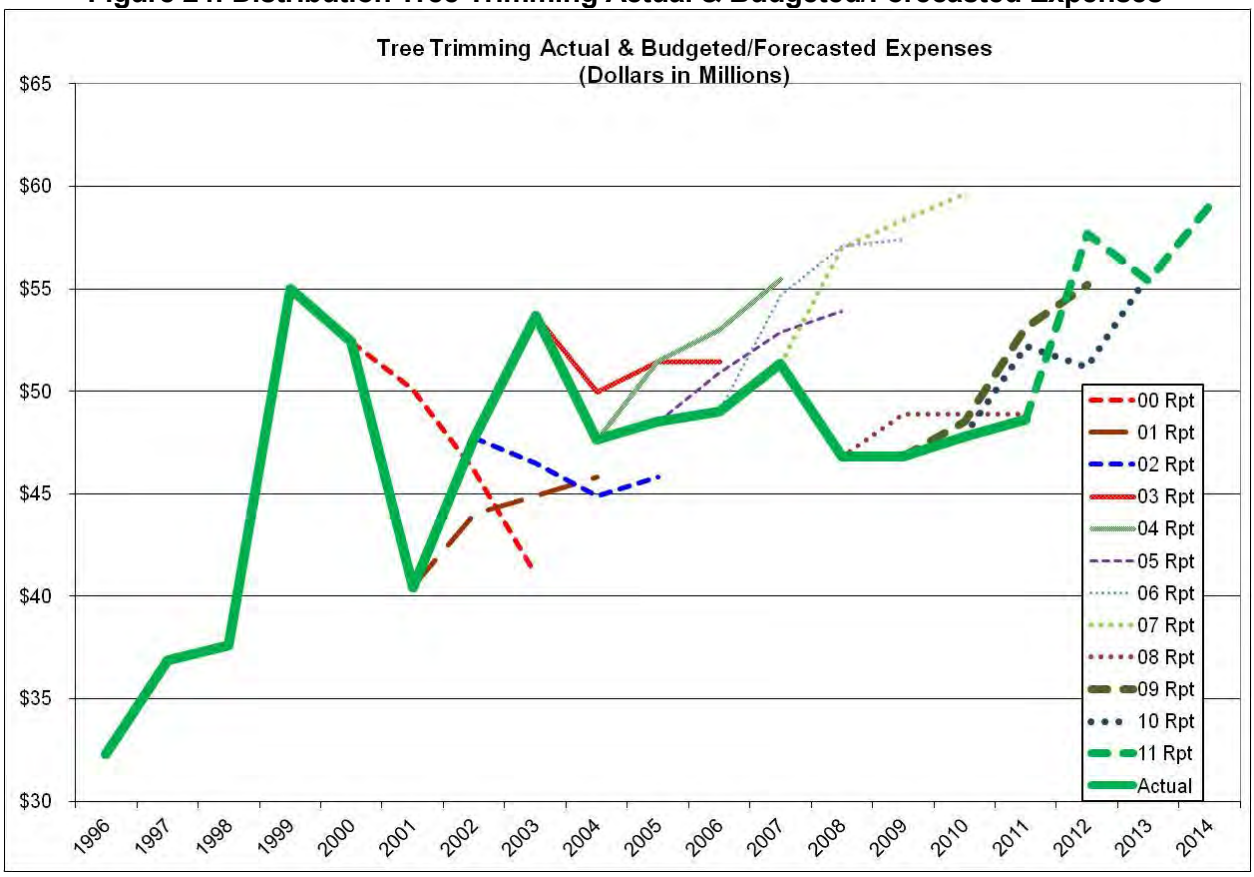
Inspection and Maintenance is one activity where cost moderation or even reductions are difficult to achieve without impacting reliability. Illustrative of this are the actual distribution tree trimming (vegetation management) expenditures from 1996 through 2011 as well as the three-year budget/forecasts[22] associated with the current and previous report analyses shown in Figure 24. The quality as well as quantity (illustrated by Pictures 1, 2, 4 & 5) of vegetation management can significantly impact the number of customer-experienced interruptions during adverse weather conditions as well as more normal conditions. The overall distribution tree trimming spending trend of Figure 24 has been upward with four-year cyclical spending peaking in 1999, 2003, and 2007.

program, to be applied based on substation criticality. ComEd considers this program as viable and cost effective if applied with priorities weighted to provide the greatest reliability benefits.

- ComEd satisfied Liberty's concern regarding substation lightning protection by the implementation of its plan to replace all poor performing arresters.

[22] The first year in the future is a budget number followed by two forecast numbers.

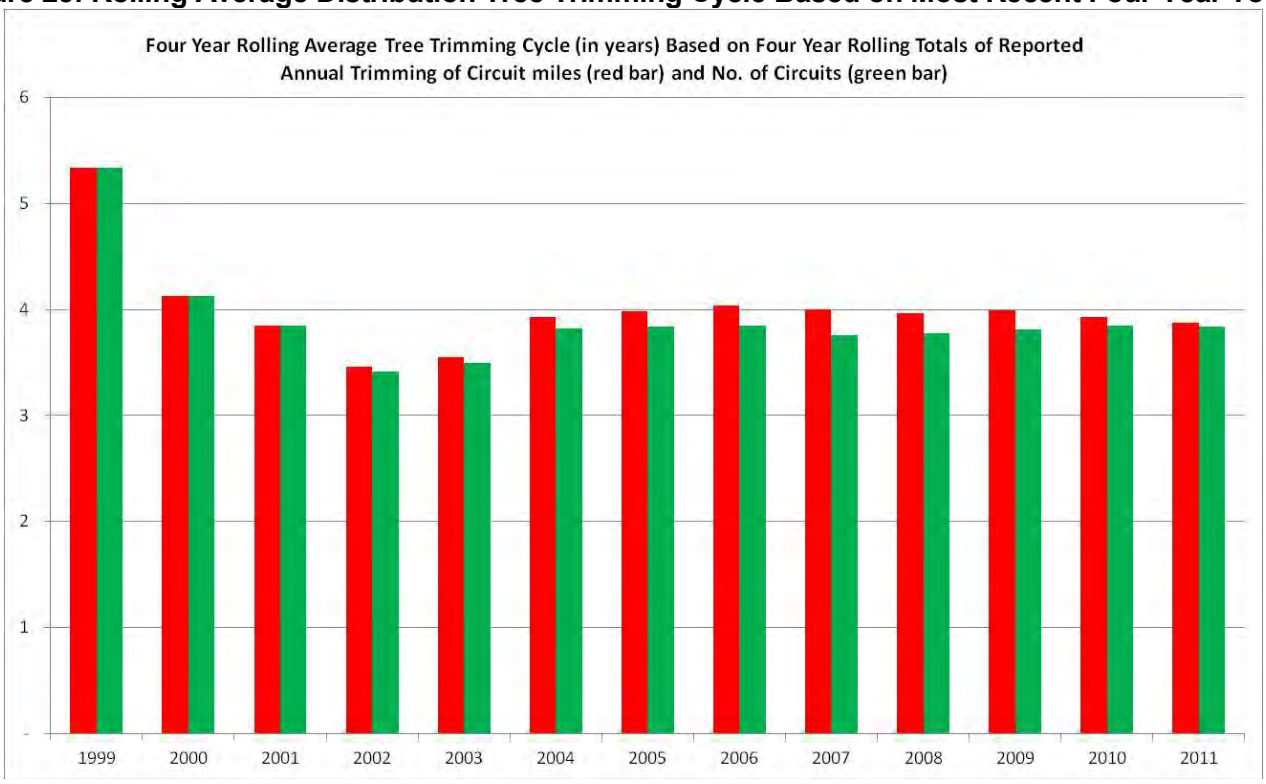
Figure 24: Distribution Tree Trimming Actual & Budgeted/Forecasted Expenses



On January 29, 2002, ComEd reaffirmed its commitment[23] to a four-year tree trimming cycle. Figure 25 indicates, based on most recent four year rolling totals of reported circuits trimmed, that ComEd has been on a four-year cycle since the year 2000.

[23] January 29, 2002, David Helwig, ComEd, to ICC Staff, "… ComEd will remove vegetation to ensure that vegetation does not grow back into contact with ComEd's overhead electric distribution lines or grow or deteriorate into a position or a condition that threatens ComEd's overhead electric distribution lines, electric service reliability, employees, or the general public before ComEd returns to trim again in a maximum of four years …"; additionally, ComEd has made commitments to address Liberty Recommendations to bring ComEd's performance in line with good utility practices that are summarized in Liberty's "Final Report of the Investigation of Commonwealth Edison's Transmission and Distribution Systems" **http://www.icc.illinois.gov/downloads/public/en/010416ComEdLib4.zip** which is a summary of Liberty's First, Second, and Third reports: **http://www.icc.illinois.gov/downloads/public/ng/Liberty%20Report.zip** **http://www.icc.illinois.gov/downloads/public/en/000717ComEd2.zip** **http://www.icc.illinois.gov/downloads/public/en/001019ComEdLib3.zip**

Figure 25: Rolling Average Distribution Tree Trimming Cycle Based on Most Recent Four Year Totals



Tree Conditions

> …[I]t is generally accepted that the single largest cause of electric power outages occurs when trees, or portions of trees, grow or fall into overhead power lines. The odds are that every single electric customer in the US and Canada has, at one time or another, experienced a sustained electric outage as a direct result of a tree and power line conflict.[24]

Tree conditions near ComEd's overhead electric distribution lines are required to meet NESC Rule 218(A)(1) as adopted from the 2002 NESC by the Commission in 83 Ill. Adm. Code 305.20 on June 15, 2003.

NESC Rule 218(A)(1) and its associated note state the following:

> Trees that may interfere with ungrounded supply conductors should be trimmed or removed.
>
> *NOTE:* Normal tree growth, the combined movement of trees and conductors under adverse weather conditions, voltage, and sagging of conductors at elevated temperatures are among the factors to be considered in determining the extent of trimming required.

Staff observed trees making contact with ComEd's overhead electric distribution lines and observed where trees and other vegetation had grown into a position that threatened ComEd's overhead electric distribution lines and equipment. See examples in Pictures 4 & 5 as well as Appendix A.

[24] U.S.-Canada Power System Outage Task Force, Final Report on the August 14th Blackout in the United States and Canada: Causes and Recommendations (April 2004) (Final Blackout Report).

Picture 4: 720 **Unknown Feeder near Roscoe Bert – Trees into Primary with burning on branches from contact with Primary**

Picture 5: 732 **Feeder R6378 Vine covered pole**

Staff recommends ComEd continue to investigate problem areas and modify programs to advance *and maintain* a four-year (minimum) tree trimming cycle throughout its service territory that is in compliance with NESC Rule 218.

Staff observed many instances in the field where trees formed an overhead canopy above ComEd's overhead electric distribution lines and equipment. While in many cases the overhead canopy has been trimmed well away from the primaries, nevertheless these overhead canopies present a significant reliability concern during adverse weather conditions (such as high winds, early wet snows, and heavy ice storms). Studies have shown that by removing overhead canopies above primaries, restoration times can be cut nearly in half[25] in those areas after an adverse weather event.

Staff continues to recommend that, as ComEd makes additional progress in re-establishing the trim zones and removing dead wood above conductors of its distribution circuits, ComEd investigate additional ways to address danger and hazard trees (defined in ANSI A300 72.5[26] and 72.8[27]). By addressing danger and hazard trees sooner rather than later, ComEd can moderate future costs of vegetation management while improving reliability.

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[25] S. Guggenmoos, "Increased Risk of Electric Service Interruption Associated with Tree Branches Overhanging Conductors. UAA Quarterly, 15(4), Fall 2007, S. Guggenmoos, "Storm Hardening the Electric System Against Tree-caused Service Interruptions. T&D World, Vol. 1, No. 12, Nov 18, 2010.

[26] ANSI A300 72.5 **danger tree:** A tree on or off the right-of-way that could contact electric supply lines.

[27] ANSI A300 72.8 **hazard tree:** A structurally unsound tree that could strike a target when it fails. As used in this clause the target of concern is electrical supply lines.

Staff observed many instances in the field where customers and municipalities planted trees and vines near or directly below primaries, which will be sources of future maintenance expenses and reliability issues.

Staff recommends ComEd pursue more opportunities to educate customers about the reliability consequences of planting some types of vegetation beneath or near ComEd's distribution equipment.

Maintenance

Adequate preventive and corrective maintenance programs, which include a well-planned vegetation management program discussed earlier, are the most important factors that influence long-term customer reliability.

Unfortunately, maintenance programs are one area where a company can cut spending quickly and have an immediate impact on short-term income statement performance with minimal impact on short-term reliability performance[28]. Figure 23[29] on page 33 illustrates ComEd's projected and actual spending pattern for "Inspection and Maintenance". The projected inspection and maintenance expenditures for 2012-2014 are at or above actual recent spending levels. All things being equal, Staff would expect reliability performance to improve if higher spending patterns are sustained.

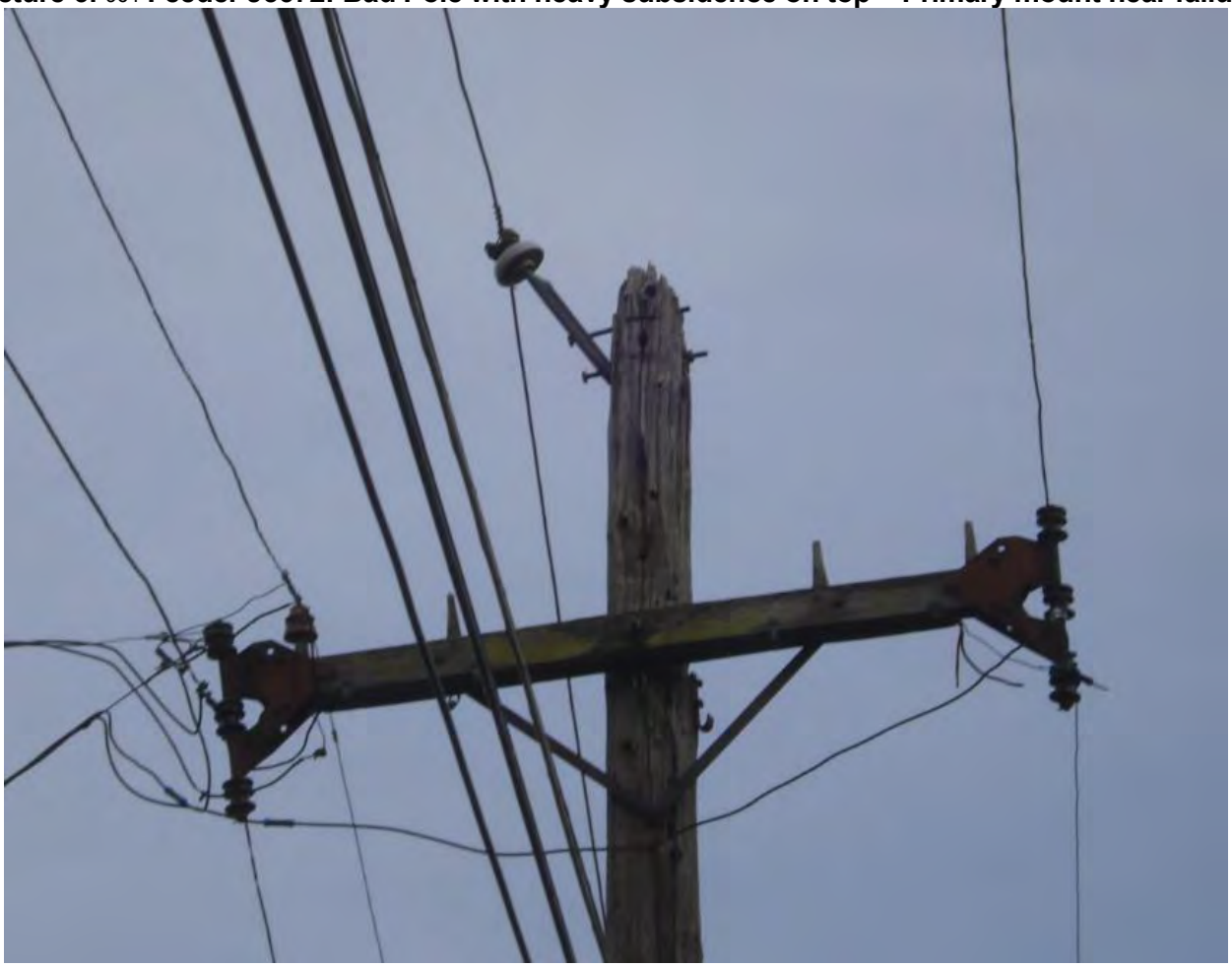
During field visits, Staff observed a large number of bad poles, shell rotted poles, and bad pole tops. Table 1 on page 2 of this report shows the median age for distribution poles increasing every year with the median age now at 43 years, meaning that half of ComEd's over 1.3 million wooden distribution poles are over 43 years old. This was graphically illustrated in ComEd's Report on page G-4.

Close examination of the graph shows approximately 150,000 distribution poles that are 61 or more years old. Picture 6 illustrates what some of these older poles look like and why they lead to hardware failures and are unlikely to survive many more storm events.

[28] Staff would expect a delay of up to several years between when maintenance expenditures are cut and when material impacts will be apparent in reliability performance. An analogy would be the depressed spending levels for distribution in 1995-1998 and the service reliability problems of 1998 and 1999.

[29] The data that makes up Figure 23 is collected from Sections A and B of the current and previous ComEd Reliability Reports.

Picture 6: 964 **Feeder J5672: Bad Pole with heavy subsidence on top – Primary mount near failure**



Pictures 7 & 8 represent corrective maintenance items that need to be addressed. In the case of the blown lightning arrestor in Picture 7 and the bad pole & broken cross-arm brace in Picture 8, these should be corrected in order to maintain the full design strength and resiliency to reduce the chance of failure of the facility during future severe weather events.

Picture 7: 736 **Feeder Unknown Blown Arrestor**

Picture 8: 930 **Feeder J5672: Shell Rotted Pole & Subsidence on Top, Disconnected cross-arm brace, Discolored Transformer Tank possibly due to overheating in the past**

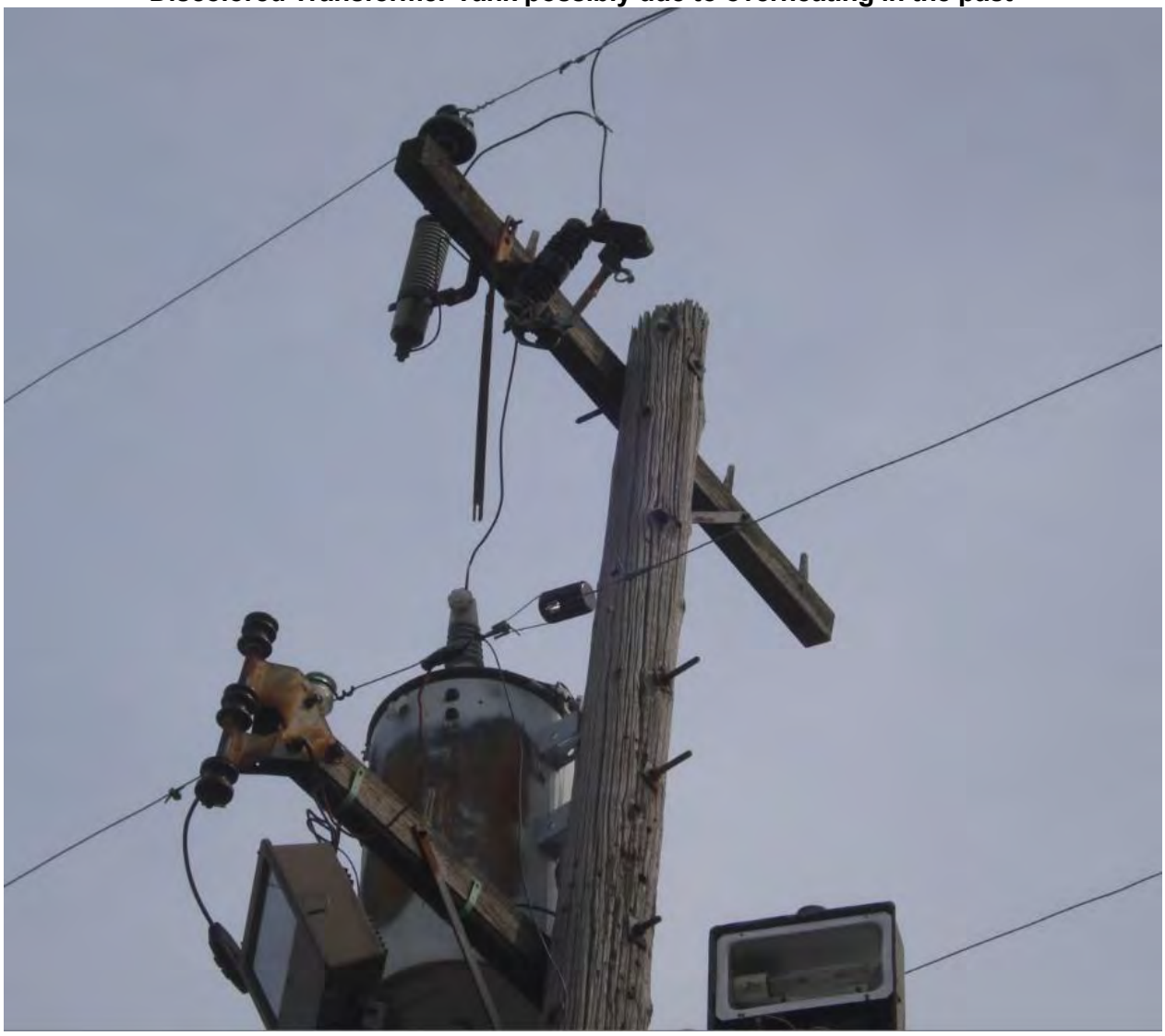


Figure 27 represents the annual total O&M dollars spent per ComEd customer from 1997 through 2011. The trend shows a distinct saddle shape with peaks in 2000, 2008 and again in 2011. Over time, Staff would expect the trend to steadily increase and not sink to 2004 or 1997 levels.

Figure 27: Total O&M Spent by ComEd per Customer

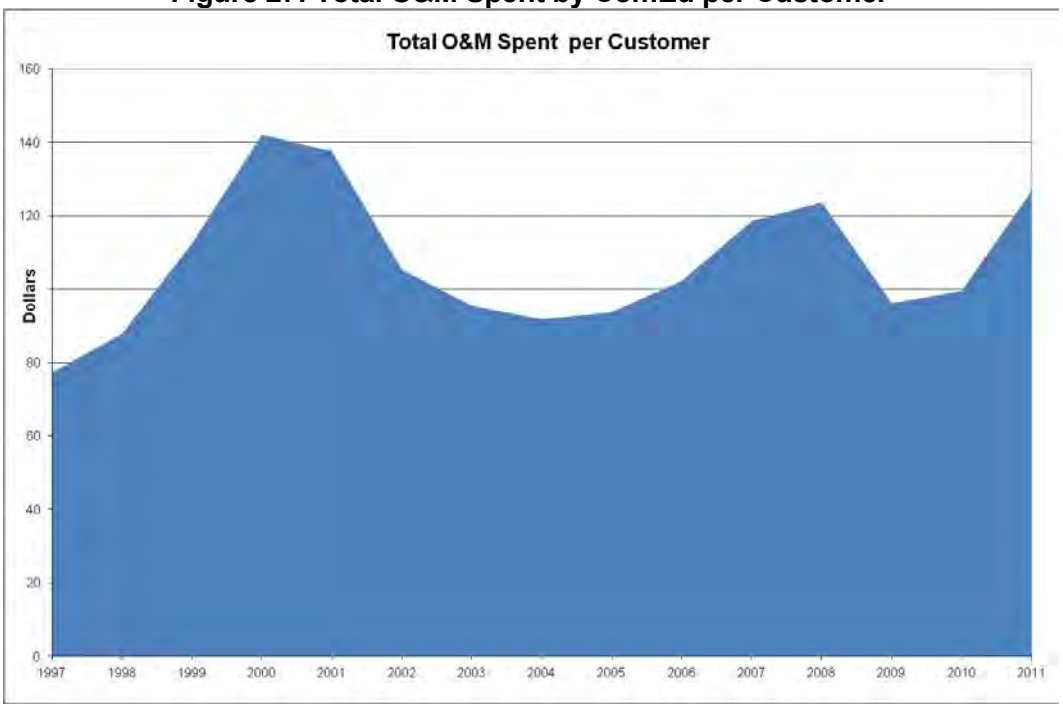
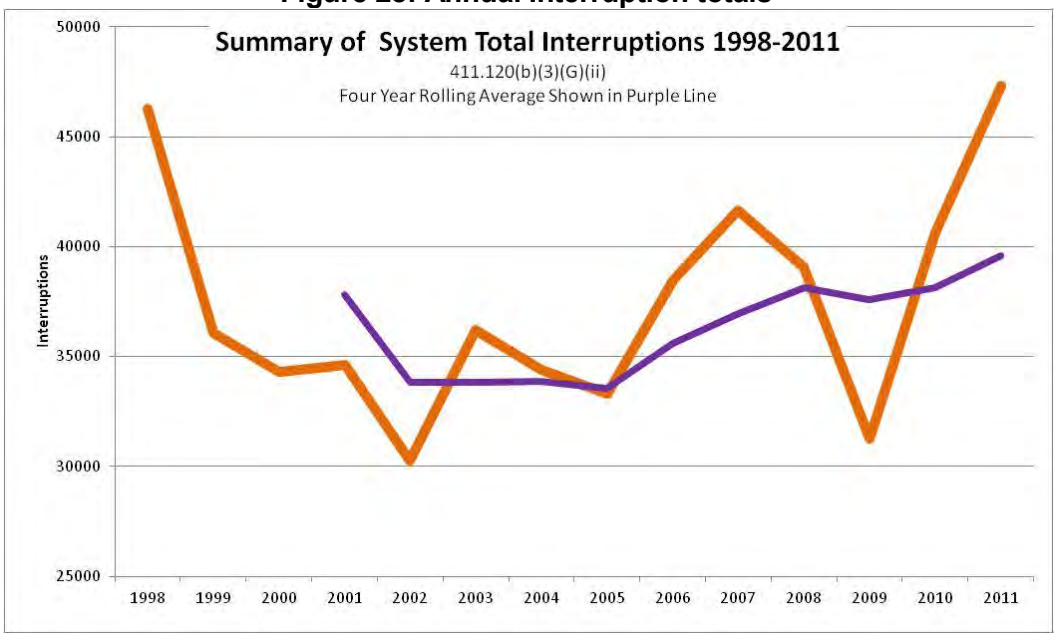


Figure 28 shows the trend in total annual system interruptions from 1998 through 2011 as identified in ComEd's responses to 83 Ill. Adm. Code 411.120(b)(3)(G)(ii)[30]. Staff would expect that, over time, ComEd's system total interruption levels should be in line with the 2000-2005 time period, though Staff would also expect years when rare severe storm events would push totals above those levels[31] as seen with recent weather events.

Figure 28: Annual Interruption totals



[30] The 2011 System Total of 47,325 interruptions is from Table 12 on Page G-8 of ComEd's 2011 Report.
[31] With total interruption levels returning to the lower levels in subsequent years.

Figure 29 shows the Annual ComEd System SAIFI since 1998 and the 4-year rolling average trend since 2001. While not as low as the 2002-2006 period, the 4-year rolling average trend has been moderating since 2008 and staying below 1.4.

Figure 29: Annual System SAIFI and Trends

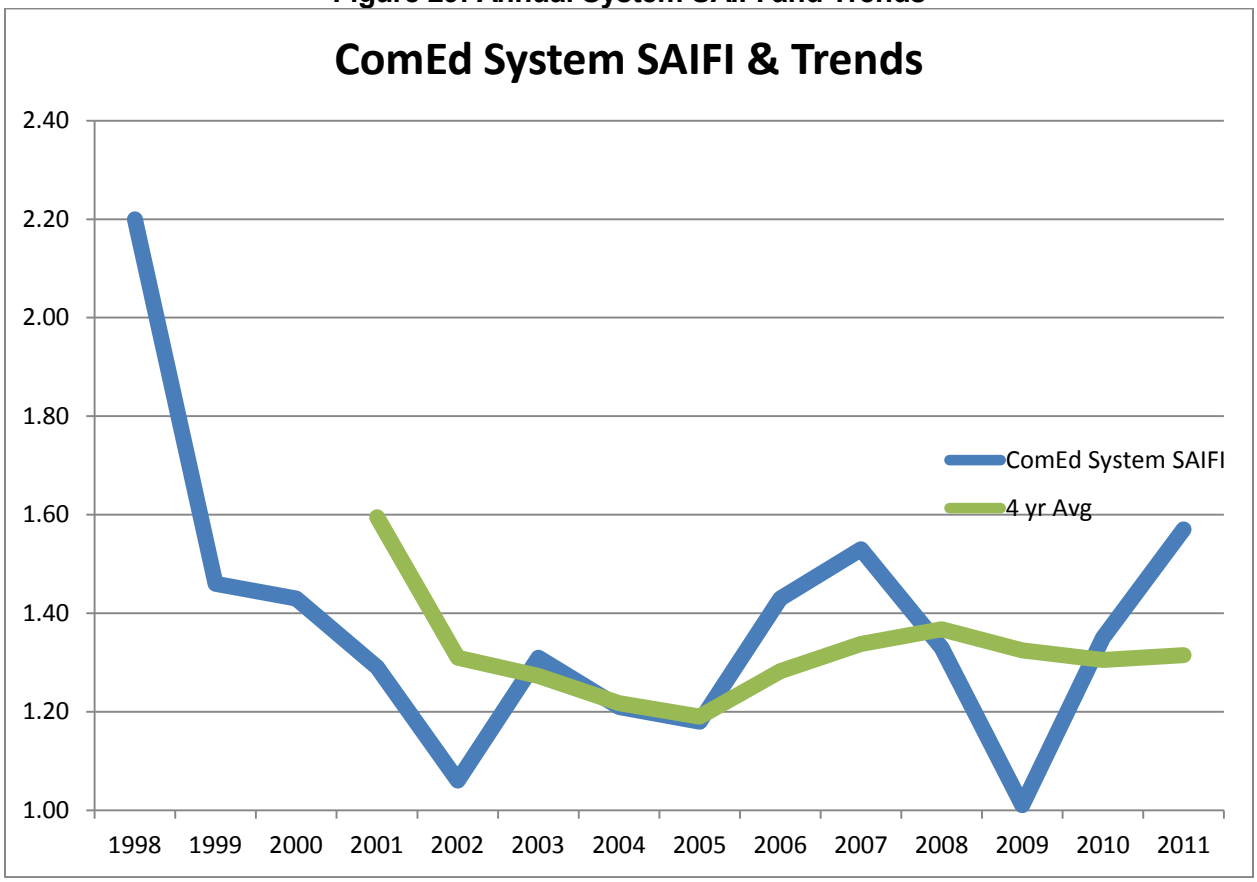


Figure 29 shows the Annual ComEd System CAIDI since 1998 and the 4-year rolling average trend since 2001. Since 2005 the CAIDI 4-year average has been slowly trending higher.

Figure 30: Annual System CAIDI and Trends

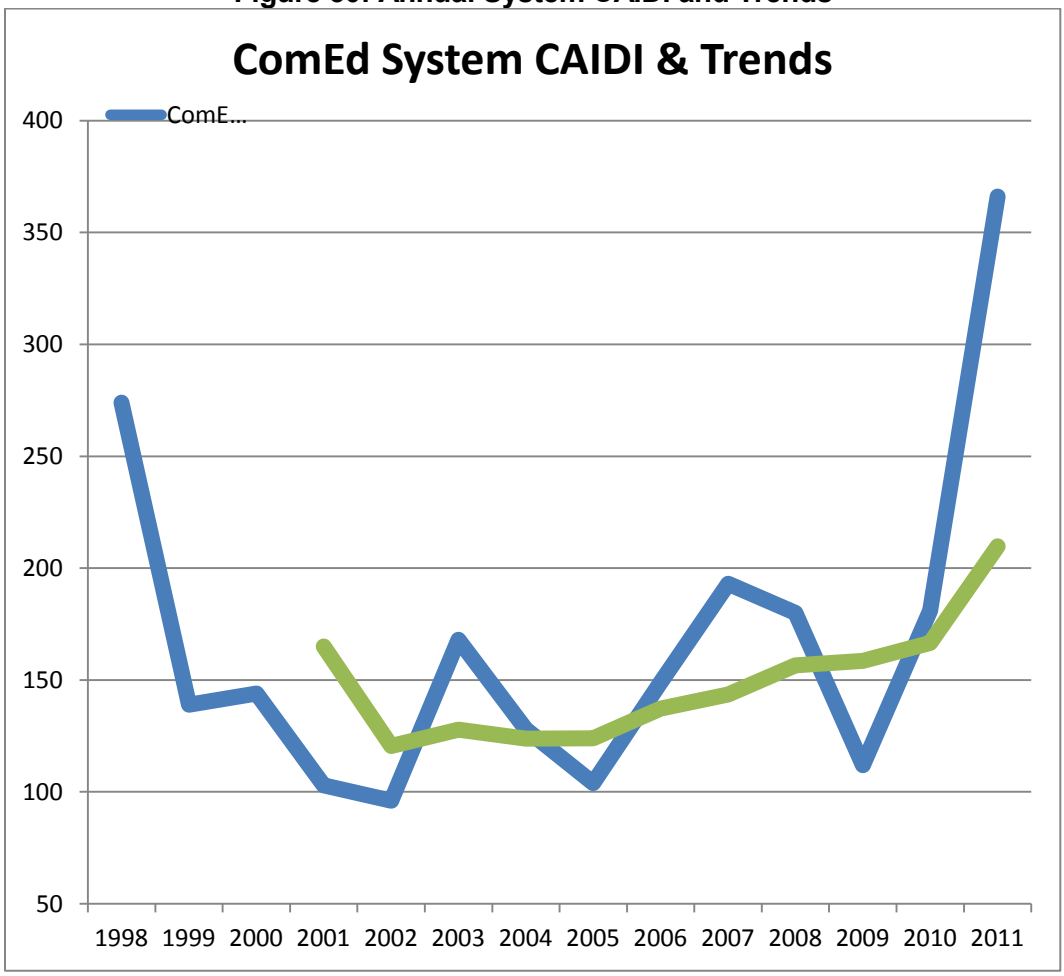
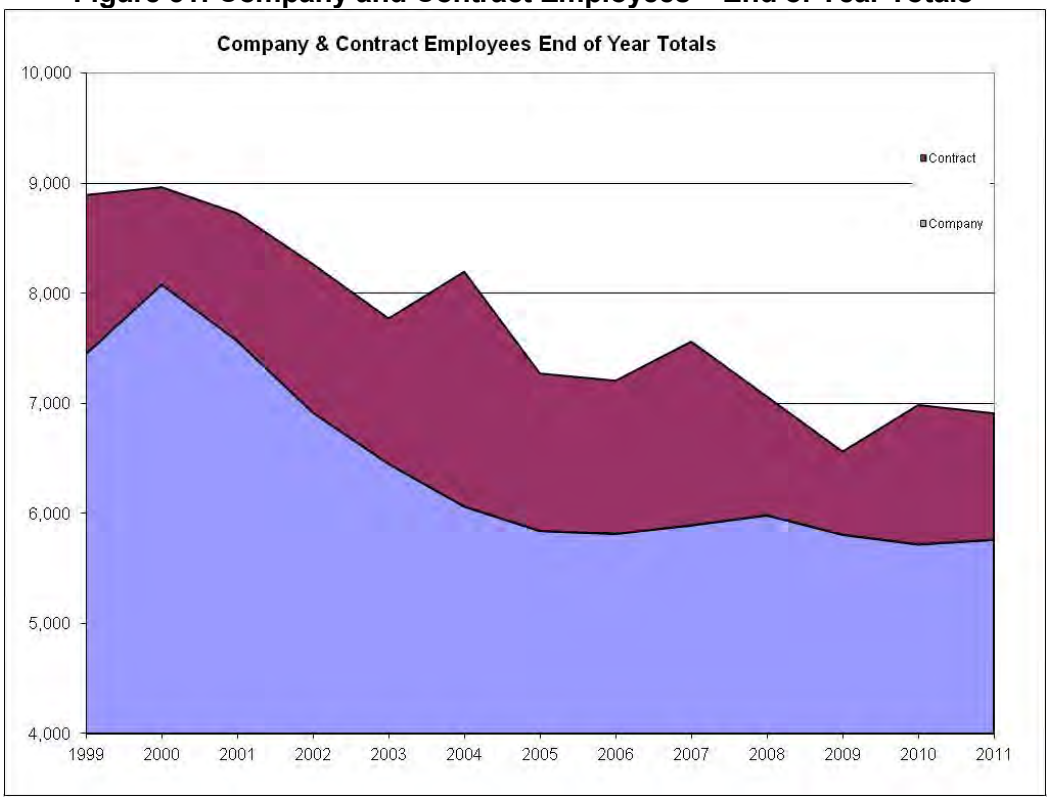


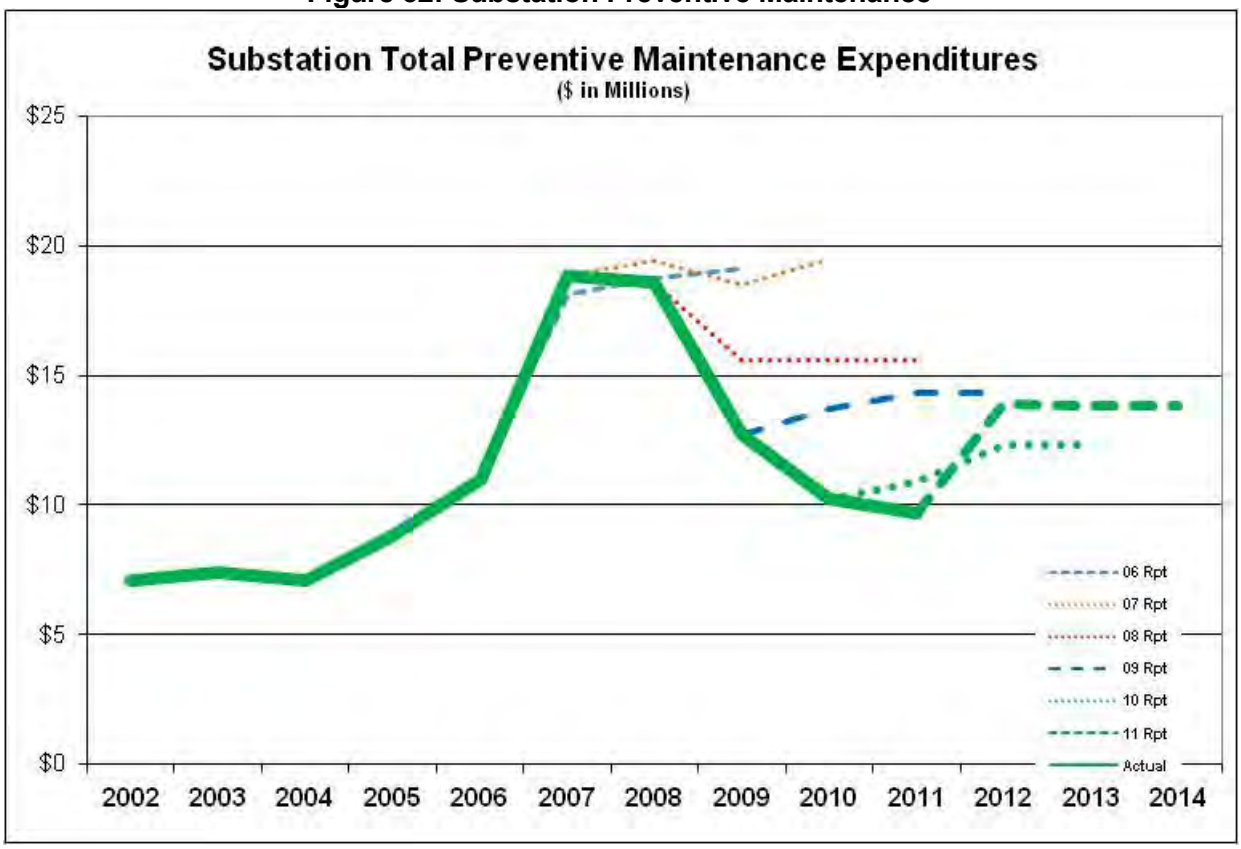
Figure 31 shows the overall downward trend of combined company & contract employees, which was down 22% from 1999 to 2011 (including the 5.3% increase from 2009 to 2011).

Figure 31: Company and Contract Employees – End of Year Totals



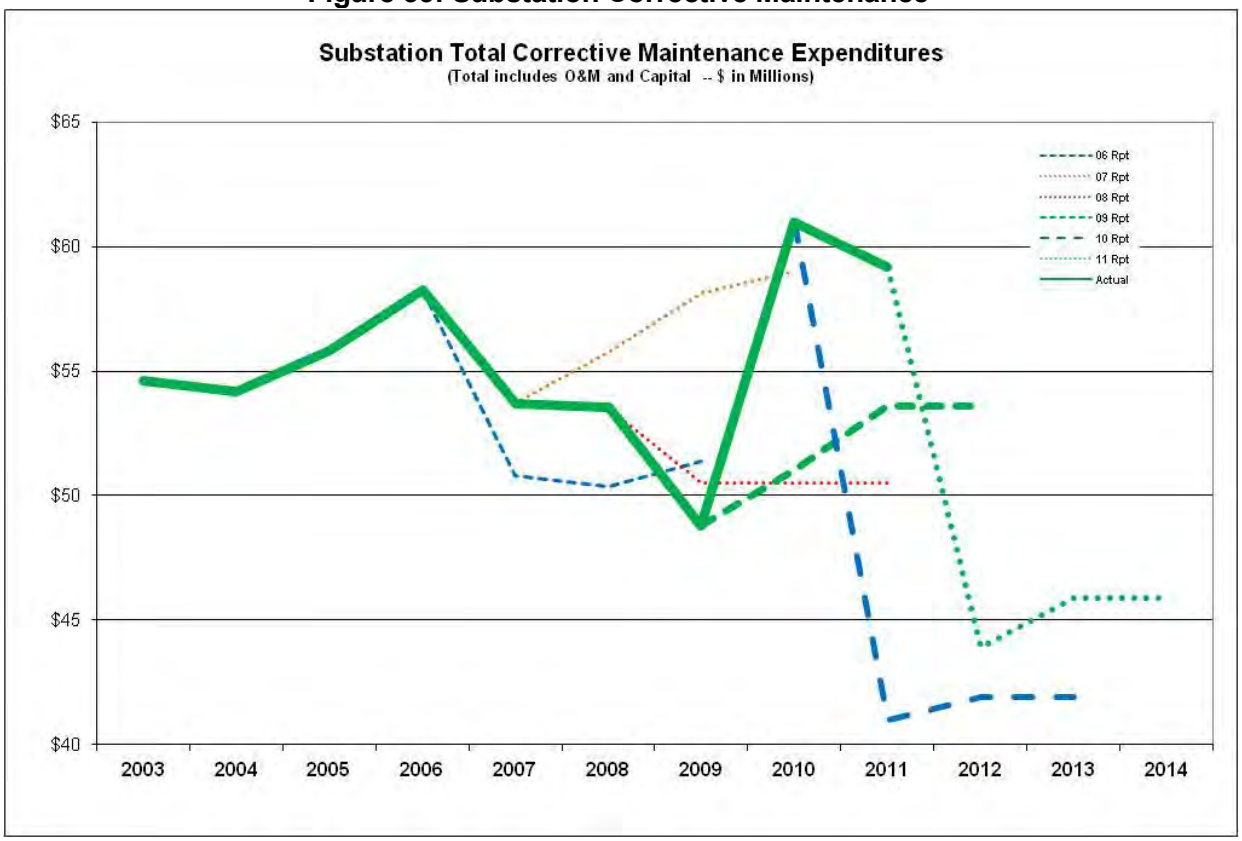
In addition to building new substations to meet increased demand and to improve customer reliability, it is important that maintenance be scheduled and completed in substations to insure maximum capability, flexibility and reliability during periods of high demand. Figures 32 and 33 show the trends in spending on substation preventive and corrective maintenance expenditures.

Figure 32: Substation Preventive Maintenance



Spending more on maintenance, all other things being equal, should result in improved equipment reliability and availability.

Figure 33: Substation Corrective Maintenance



During Staff's field inspections in previous years, Staff found instances of NESC violations, but few have been noted this year in Appendix A. Staff is encouraged that ComEd is actively looking for and addressing these NESC violations as part of its regular inspection[32] cycle. Staff was further encouraged to learn that ComEd found and is correcting line clearance issues associated with its transmission system.

10. Review of ComEd's Implementation Plan for the Previous Reporting Period

A report on the significant deviations from ComEd's 2010 plan for 2011 from 2011 actual spending levels was included in ComEd's 2011 reliability report in pages B-1 through B-6. Table 13 summarizes the data from ComEd's plan.

Table 13 Comparison of 2010 plan for 2011 to 2011 actual (in $ Million's)

	2010 Plan for 2011	Actual 2011	Var	% Var
Transmission System Improvements [see page B-3]	191	160	-31	-16.2%
Distribution Capacity [see page B-4]	58	49	-9	-15.5%
Substation [see page B-4]	52	72	20	38.5%
4kv, 12kv, & 34kv Circuit Improvements [see page B-5]	81	119	38	46.9%
Inspection and Maintenance [see page B-6]	105	158	53	50.5%
	487	**558**	**71**	**14.6%**

[32] "… The thorough inspection of 34kV lines are performed every 2 years and 4kV and 12kV lines are inspected every 4 years. …" ComEd response to Staff DR, ENG 2.09.

ComEd's explanations for their major variances in response to 411.120(b)(3)(B) appear reasonable.

11. Summary of Recommendations

Staff recommends the following actions:

- Staff recommends ComEd review and update its findings from the September 9, 2002, Direct-Stroke Lightning Protection Study for existing substations.
- Staff recommends ComEd continue to investigate problem areas and modify programs to advance *and maintain* a four-year (minimum) tree trimming cycle in compliance with NESC Rule 218 throughout its service territory.
- Staff continues to recommend that, as ComEd makes additional progress in re-establishing the trim zones and removing dead wood above conductors of its distribution circuits, ComEd investigate additional ways to address danger and hazard trees (defined in ANSI A300 72.5[33] and 72.8[34]).
- Staff recommends ComEd pursue more opportunities to educate customers on the reliability consequences of planting some types of vegetation beneath or near ComEd's distribution equipment.

[33] ANSI A300 72.5 **danger tree:** A tree on or off the right-of-way that could contact electric supply lines.
[34] ANSI A300 72.8 **hazard tree:** A structurally unsound tree that could strike a target when it fails. As used in this clause the target of concern is electrical supply lines.

Appendix A: Log of Summer Field Observations

The summary[1] for each inspection represents typical observations noted during the field inspections and **does not** represent all of the problems or potential problems that may exist.

To evaluate the overall trend of conditions in ComEd's service territory, Commission Staff conducted a series of field inspections in 2012. The purpose of the inspections was for Staff to see if there were any obviously visible reasons for poor reliability performance. For example, on distribution circuits Staff looked for problems such as poor tree trimming practices, broken or damaged equipment, rotten poles, and overly slack spans (low sagging lines), while at substations Staff looked for problems such as low or leaking oil, load tap changers regularly operated at extreme positions, and poor maintenance practices. It is important to note that it is not the purpose of Staff's field inspections to find problems for ComEd to fix[2] but rather to develop a picture of the overall condition of the power delivery infrastructure in ComEd's service territory.

Field Inspection Log

Utility: ComEd **Investigators: J. Stutsman (Staff) & Irma Zaragoza (ComEd)**

Feeder Ckt: R6378 **City: Rockford, Rockford Twp, Shirland Rural, Machesney Park** **Voltage: 12kV** **Date: Monday, June 18, 2012**

Photo ID	Drawing No.	Location Description	Observations at this Location
688-706		**TSS163 Roscoe Bert Substation**	Fence line Inspection: Asplundh Tree Trimming had arrived at the Substation shortly before I had arrived. They were there to do an inspection and provide ComEd an estimate for trimming the trees and vegetation around the Substation. There was a lot of heavy vegetation & trees growing into/onto/over the perimeter fencing North, West, and South sides of the Substation. Little vegetation was in the Substation yard around the power equipment. Some equipment was rusty. 2 transformers looked to have recently been partially repainted.

[1] Detail was provided ComEd indicating the location of most deficiencies found on the respective circuits by Staff.
[2] Though Staff would expect that those identified problems and the problems inferred would be addressed.

Appendix A: Log of Summer Field Observations

			1 transformer was visibally rusty and needed painting.
		Feeder Ckt: R6378 City: Rockford, Rockford Twp, Shirland Rural, Machesney Park Voltage: 12kV	
707-709	R6378-1	Device S1205	Riser for Circuit R6378 well identified.
710	1	1st pole down from S1205	Ground cover/molding missing
713-714	1	Pole 2067	Broken Ground molding/covering
715-716	NA	Feeder 6377 outside of Sta. – after 1st pole	Evergreens close to and into Primary
717-718	NA	Feeder 6377 outside of Sta.	Lots of marks/holes on poles from woodpeckers
719-720	NA	Unknown Circuit/Feeder Next to Sta.	Trees into Primary Burning on branches from contact with Primary Several locations including at 1 pole back from Xfmr
721	2	North of Xfmr 1C2 along Owen Center Rd	Old worn pole
722-723	2	3 locations on N Rockton Ave	Trees into Primary
-	2	2 locations on Elmwood Rd	Trees close/into Primary
724	7	N Rockton Ave South of Latham Rd	Trees into Primary & numerous splices from past breaks in Primary
-	7	N Rockton Ave North of Latham Rd	Tress close/into Primary
-	7	Latham Rd between N Rockton Ave and Owen Center Rd	Trees close/into Primary
-	7	Owen Center Rd North of Latham Rd	2 locations of Old/worn Poles
725	9	Near device 31021 354744	Trees into Primary
726-727	9	At Cemetery East Fence	Cross-Arm Brace disconnected/broken

Appendix A: Log of Summer Field Observations

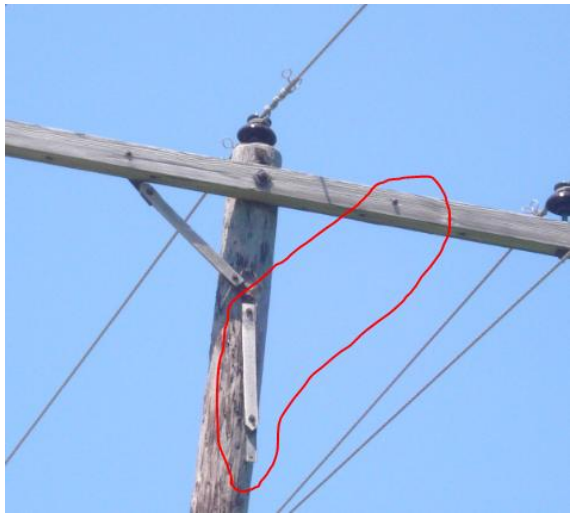
728-729	9	5792 Latham Rd, Rockford	Splintered Cross-Arm and Split Pole Top Loose bolt on insulator mount in Pole Split
-	10	Stephens Rd just West of Meridian Rd	Trees close/into Primary
-	10	Harrison Rd just South of Oliver Rd	Trees close/into Primary
-	11	Freeport Rd/Hwy 75 btwn Harrison Rd and Meridian Rd	Trees close/into Primary
-	11	Harrison Rd South of Freeport Rd	Bad/Old Poles
-	11	Wishop Rd btwn Harrison Rd and Meridian Rd	Trees close/into Primary
730	12	Boswell Rd North of Shirland Rd	Line Hose on Roadside Primary
731	12	Boswell Rd North of Shirland Rd	Overhang above Primary
732	14	9769 Yale Bridge Rd, Rockton, IL	Vine covered Pole to Top of Pole
-	14	Yale Bridge Rd near device 1A1	Loose down guys
-	14	Yale Bridge Rd between Boswell Rd and Cannell Rd	2 locations Trees close/into Primary
-	14	Boswell Rd just South of Yale Bridge Rd	Vine on Pole
		Feeder Ckt: RANDOM City: Mendota	
733	NA	506 N. 42nd Rd Mendota, IL	Damaged Cross-Arm – Insulator Pin Exposed
734	NA	346 N. 42nd Rd Mendota, IL	Spalding of outer shell of Pole
735-736	NA	N 41.54094 W 089.09454	Blown Arrestor Road Side
737-738	NA	N 41.554820 W 089.092023	Arrestors have “curly” leads – i.e. high impedance that lowers effectiveness of the Arrestor
-	NA	Approx. 700 yards East of Above location	Arrestors have “curly” leads – i.e. high impedance that lowers effectiveness of the Arrestor

Appendix A: Log of Summer Field Observations

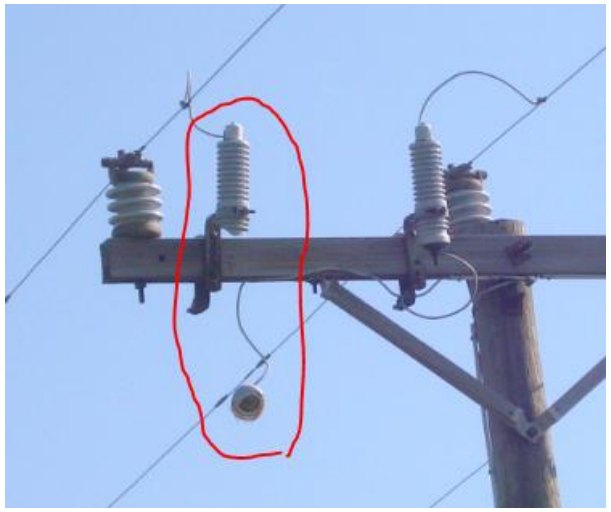
Heavy Vegetation in/around fence & station yard
698 Roscoe Bert Substation

Rusty equipment needing attention and painting
691 Roscoe Bert Substation

Trees into Primary & Burning on Branches
720 unknown Circuit next to Roscoe Bert Substation



Cross-Arm Brace disconnected/broken
726



Blown Arrestor – road side Primary
736

Field Inspection Log

Utility: ComEd **Investigators: J. Stutsman (Staff)**

Feeder Ckt: C298 **City: Chicago, Niles** **Voltage: 12&4kV** **Date: Wednesday, October 3, 2012**

Photo ID	Drawing No.	Location Description	Observations at this Location
844-861		**TSS129 Niles Substation**	Fence line Inspection: Rain – difficulty observing location Oil levels that are visible from fence-line are OK Gate Post grounded, gate not bound to gate post Little vegetation in yard -- Minor vegetation growing into/near fence Dead vines on poles and guy wire of circuits going into yard Dead vines on 3 bank near substation Animal fence in yard protecting distribution equipment Animal guards not on 2 over-head circuits going into yard Rust visible on some equipment
		Feeder Ckt: C298 City: Chicago & Niles Voltage: 12-4kV	
	C298-1	42.0115 -87.77419	Over-hang above Primary on both sides of street in ROW but cleared away from Primary
	C298-1	42.011379 -87.776717 7166 N. Ionia Ave	Over-hang above Primary on both sides of street in ROW but cleared away from Primary
862	C298-1	7113 N. Sioux Ave	Vegetation clear of Primary but again Serious Over-Hang above Primary on both sides of street – new hardware, including new cross-arms, visible
	C298-1	Circuit Crossing N. Hawatha Ave South of McAlpin Ave	Over-hang above Primary on both sides of street in ROW but cleared away from Primary
	C298-1	Circuit East of N. Hawatha Ave – East of Device #0532002	Vegetation/Over-hang close to Primary

Appendix A: Log of Summer Field Observations

	C298-1	Circuit Crossing N. Hawatha Ave South of Mendota Ave	Over-hang above Primary on both sides of street in ROW but cleared away from Primary
		General Area observation	Lots of Work has been done on the circuit with new hardware clearly visible
863-867	C298-2	6873 N. Leoti Ave	Lots of new hardware and poles clearly visible. Heavy over-hang above Primary Spacer cable being used in parts of ROW Primary close to large Oak Tree trunk that also over-hangs Primary – spacer cable assembly keeps primary from touching trunk by a few inches According to homeowner ComEd had taken out many dead/diseased trees in the immediate area According to homeowner ComEd service has had no outages since March

Animal Fence around Distribution Equipment in Substation
Animal Guards not on primaries of 2 overhead distribution circuits
858 Niles Substation

Spacer Cable keeps primary from touching Tree
Lots of overhang in the area
863

Utility: ComEd **Investigators: J. Stutsman (Staff)**

Feeder Ckt: E791 City: Bull Valley, Wonder Lake, Greenwood, Greenwood TWP Voltage: 12&4kV Date: Wednesday, October 3, 2012

Photo ID	Drawing No.	Location Description	Observations at this Location
868-876		**DCE79 Wonder Lake Substation**	**Fence line Inspection:** Rain – difficulty observing location Oil levels that are visible from fence-line are OK Gate Post grounded, gates are bound to gate post Little vegetation in yard -- Some vegetation growing into/near fence Last weed application 6/16 on Red Tag on Station Fence Transformer 1 missing animal guard on 1 phase of 12kV Secondary Transformer 1 has rust on tank and radiator Oil on tank and radiator from past leaks No animal guards on 12kV lines into station yard
		Feeder Ckt: E791 City: Bull Valley, Wonder Lake, Greenwood, Greenwood TWP Voltage: 12-4kV	
	E791-8	ROW between Alden Rd and Coral Rd visible from Ridge LN	Lots of Over-hang above Primary in ROW looking both directions from Ridge LN
	E791-8	ROW between Alden Rd and Coral Rd visible from WestWood Dr	Heavy Over-hang above Primary in ROW looking both directions from WestWood Dr
877	E791-8	Pole in ROW between Alden Rd and Coral Rd -- West from WestWood Dr	Vines growing up Pole
	E791-7	1 pole North of device #434208 along WestWood Dr	Split pole top – but noted that pole top is bolted closed

Appendix A: Log of Summer Field Observations

878-879	E791-7	ROW between W. Sunset Dr and Shady LN visible from WestWood Dr	Lots of Over-hang above Primary in ROW looking both directions from WestWood Dr
880	E791-7	ROW between Shady LN and Memory TRL visible from WestWood Dr	Lots of Over-hang above Primary in ROW looking both directions from WestWood Dr
		General Observation	Did not see trees touching Primaries

Vegetation growing into Fence;
No animal guards on 12kV lines into Substation
872 DCE79 Wonder Lake Substation

Extensive Over-hang above Primary in ROW

879

Appendix A: Log of Summer Field Observations

Utility: ComEd **Investigators: J. Stutsman (Staff)**

Feeder Ckt: Random **City: Multiple Locations** **Voltage: looked like only 12kV** **Date: Wednesday, October 3, 2012**

Photo ID	Drawing No.	Location Description	Observations at this Location
		Feeder Ckt: Random City: Multiple Locations Voltage: Looked like only 12kV	
881-882	NA	Btwn 414 N. Hughes Rd, Woodstock, IL and intersection of US14 & CR-T68	Broken Cross-Arm Brace
883-884	NA	781 S Dimmel Rd., Woodstock, IL	Broken Cross-Arm Brace
	NA	Approx 1-2 miles W. of above	Trees into Primary
885-888	NA	2267 Kishwaukee Valley Rd	Primary Insulator Mount near Failure Pole subsidence

Appendix A: Log of Summer Field Observations

Broken/disconnected Cross-arm Brace
884

Primary Insulator Mount Near Failure
885

Field Inspection Log

Utility: ComEd **Investigators: J. Stutsman (Staff)**

Feeder Ckt: J5672 **City: Lockport TWP, Cresthill, Joliet, Lockport** **Voltage: 12&4kV** **Date: Tuesday, October 9, 2012**

Photo ID	Drawing No.	Location Description	Observations at this Location
889-914		**TDC456 Joliet Central Substation**	**Fence line Inspection:** Yard clear of Vegetation and clean of trash – Red Veg tag on fence 2 of 3 Gates have grounded Gate Posts and gates are bonded to gate posts Transformers appear in good condition Dead vines on poles and guy wire of circuits going into yard Dead vines on 3 bank near substation Animal guards not on 2 over-head circuits going into yard Rust visible on some equipment Transformer 73 Tap Changer OK, Oil OK Transformer Cooling radiators look clean Transformer 71 – Oil level in Bushings on Primary side is low but this is a cool day with low loads – doesn't seem low enough to be a concern Relay house looks good on outside Poles to Transmission line are Rusty Transmission line parallel to train tracks outside substation – towers are Rusty Static wires on tower not attached to tower or station line going into substation Only one HV ckt into Substation is protected by static wire Red Fire Box is visible next to Front Gate.
		Feeder Ckt: J5672 City: Lockport TWP, Cresthill, Joliet, Lockport Voltage: 12-4kV	
915-917	J5672-1	560 N. Joliet St., Joliet IL	Visible signs of past Problems with Vines growing in Riser and up Guy Line
920	J5672-1	1 pole North of previous location	Double Cross-Arms are each split – one is showing subsidence on end

Appendix A: Log of Summer Field Observations

918	J5672-1	1 pole South of 560 N. Joliet St. Joliet IL at 3-bank	Remnants of Vines on 3-Bank – Visible sign of past Problems
921-922	J5672-3	~2161 N. Broadway St., Joliet, IL DEV: 484.332.075	Old pole – subsidence on top and shell Rot
923-926	J5672-3	1 pole S. of Above DEV: 484.332.A4	Shell rotted pole Cover missing from pole ground wire. Significant subsidence of Pole Top Bolt holding Transformer on Pole is loose
927-930	?	DEV: 26.484261.S2 Across from 1616 State St.	Shell Rotted Pole Subsidence on Pole Top Cover missing from pole ground wire Disconnected Cross-Arm brace Discolored Transformer Tank possibly due to overheating in past
931	?	1 Pole N. of above @ 1605 State St.	Questionable/Bad Pole
932-933	?	1701 State St. (2 poles S. of 26.484261.S2)	Primary in Tree Questionable/Bad Pole w/Shell Rot Missing ground wire cover
934-935	?	1709 State St.	Some Shell Flaky Cross-Arm Twisted Ground Wire outside of Ground cover
936-937	J5672-4	1 pole S of DEV: 2233 along Grandview St – 2 poles S of Barry	New Pole in place with line hose on each side of it
938	J5672-4	100 Grandview DEV: 484.344.100	Another Pole being replaced
939	J5672-4	104 Grandview 1 pole N. of DEV 434822	Another Pole being replaced
940-941	J5672-4	From Grandview looking E. on ROW btwn Barry Ave & Rev. Walton Drive	Picture of ROW
944	J5672-4	From Grandview on RiverView	ComEd crew installing a new pole as I was in the area
942-943	J5672-4	110 Riverview	Bad Pole w/Shell Rot Next to Evergreen Tree ~2' from trunk of tree
	J5672-4	107 Riverview area	Talked to Customer Customer was watching ComEd replace the pole down the street Customer stated that ComEd needed to Replace a lot of poles in his area
945	J5672-9	1967 Englewood Ave (on Green Garden PL)	Spalding of pole Shell – possible Shell Rot?
946	J5672-4	145 Princton Ave	Bad pole with subsidence on pole top

Appendix A: Log of Summer Field Observations

947-948	J5672-4	298 Weslyan St.	Bad-Shell rotted Pole with subsidence on pole top Large bush/tree growing next to pole
949-951	J5672-4	DEV: 484.344.D9	Squirrel sitting on secondary cross-arm – example of why we need animal guards
952-953	J5672-4	1 pole East of Above	Damage on pole below cross-arm Twisted Cross-arm
	J5672-5	2 poles West of Barrett St 153 Barrett St., Lockport	Vines growing up Pole
	J5672-5	Corner of Barrett St. and North Ave.	Loose down guy wire
954	J5672-5	DEV: 26484342-A8 Across Street from Fairmont School	3 Bank Pole leaning 10+degrees Ground wire cover/molding is loose Transformer discoloration looks like transformer had gotten hot in the past
955	J5672-5	DEV: 26.484342.A8(? this pole and pole above have same Device # on them) Behind 225 Nobes Ave	No cover/molding on Ground Wire Vines growing up Ground Wire Pole shell is pitted
956	J5672-5	1 pole West of Above	Bad Pole Top w/Subsidence
957-958	J5672-6	289 Connor Ave. DEV: 484.274.S9	Vines on Transformer 2-Bank
959-960	J5672-7	1731 Daviess Ave. Lockport	Bad Pole with Shell Subsidence
961-964	J5672-7	1740 Prairie Ave. Behind 321 May St.	Bad Pole and Bad Pole Top with subsidence Very loose insulator mount/support Near Failure
965-968	J5672-9	949 Rosalind St. Joliet	Bad Pole Cross-arms used to make an extension on Pole top Missing Guy guard for Distribution Circuit

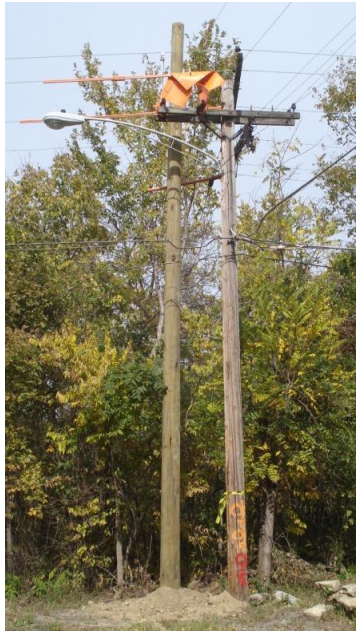
Appendix A: Log of Summer Field Observations

Rusty Poles in Station Yard
897 Joliet Central Substation

Vines growing in riser and up guy lines
915

Disconnected Cross-arm brace, bad pole and pole top
930

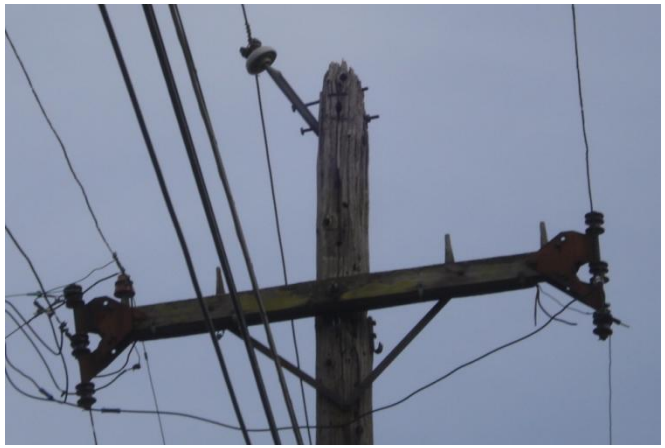
Appendix A: Log of Summer Field Observations



One of many Pole Replacements
938

Bad pole with large tree growing near base
942

Tree/brush growing near base of Pole
948



964: Primary Insulator mount near failure

Appendix A: Log of Summer Field Observations