# Illinois Commerce Commission

# Assessment of

# MidAmerican Energy Company's

# Annual Reliability Report and

# Electric Service Reliability

# For Calendar Year 2007

Pursuant to 83 Ill. Adm. Code 411.140

December 2008

## 1. Executive Summary

Pursuant to Section 16-125 of the Illinois Public Utilities Act and the Commission's electric reliability rules found in 83 Illinois Administrative Code, Part 411 ("Part 411"), MidAmerican Energy Company ("MEC" or "MidAmerican") filed its annual electric reliability report for the 2007 calendar year. Staff found that MEC's report fully complied with Part 411 reporting requirements.

Subsection 411.120(b)(H) requires that each utility include in its annual report the achieved level of each of three reliability indices: System Average Interruption Frequency Index ("SAIFI"), Customer Average Interruption Duration Index ("CAIDI"), and Customer Average Interruption Frequency Index ("CAIFI"). During 2007, MEC's SAIFI of 3.95 and CAIFI of 4.37 were the highest (worst) values reported by any of the six reporting utilities. These two system indices, taken together, indicate that, on average, MEC's Illinois customers experienced more interruptions during 2007 than the customers of any of the other reporting utilities. MEC's 2007 CAIDI of 291 minutes, which is the second highest (worst) value reported, indicates that, on average, MEC's interruptions lasted nearly five hours. In prior years, MEC has reported either the lowest (best) or one of the lowest CAIDI values of all the reporting utilities. For example, in 2006 MEC reported a CAIDI value of 87 minutes, which was the lowest CAIDI reported by any Illinois electric utility: 40% lower than the next lowest. In 2007, MEC's customers, on average, experienced more interruptions than the customers of any other reporting utility, and experienced longer interruptions than customers of all but one other utility: only AmerenIP's CAIDI was higher. MEC blames its poor reliability performance during 2007 on several severe storms that affected its Illinois operating area. Staff agrees that many of the electric service interruptions experienced by MEC's customers that occurred during 2007 occurred when severe storms tracked across MEC's operating area. However, Staff is concerned that the deteriorated condition of distribution facilities on some of MEC's distribution circuits exacerbated the effect these storms had on service reliability.

During the summer and fall of 2008, Staff inspected five of MEC's Illinois distribution circuits for which MEC reported higher than average SAIFI values during 2007. Staff found MEC's distribution facilities appeared to be in pretty good shape on three of the five circuits inspected. On Circuits 13-107-1 and 13-112-2, however, Staff observed a high number of deteriorated and broken facilities, such as cross arms, lightning arresters, and poles, that MEC should address. Staff also re-inspected a few specific locations on three additional distribution circuits where Staff identified reliability concerns at the time Staff previously inspected those circuits during the summer of 2007. While re-inspecting these locations Staff found that MEC had done a good job addressing the threats to reliability that Staff had previously identified. Staff's specific 2008 inspection findings are included in Attachment A to this report.

After reviewing MEC's reliability report and inspecting its circuits, Staff recommends that MEC:

- Perform thorough inspections of its distribution facilities more frequently than once every ten years, which is its current practice. More frequent inspections would provide MEC with an opportunity to identify and correct reliability threats prior to

interruption occurrence. For example, MEC could have repaired or replaced the deteriorated and broken facilities that Staff observed on Circuit 13-107-1 and Circuit 13-112-2.

- Perform routine maintenance tasks “routinely”. MEC should clear vegetation growth, replace blown lightning arresters, tighten hardware, and replace broken cross arms and/or braces soon after they are discovered so that customers do not have to endure interruptions due to the facilities failing catastrophically during moderate storms.
- Continue with its efforts to install animal protection on distribution equipment. Staff commends MEC for its reduction in animal related interruptions during 2007, and suggests that MEC keep up its animal guard installation efforts so that the number of animal related interruptions continues to decrease.
- Eliminate the numerous vines that have grown up its distribution poles and guy wires to the primary conductor level. These vines, in addition to being a potential cause for an interruption, render some of MEC’s poles impossible for linemen to climb and make some equipment inaccessible.
- Remind its inspectors to continually look for National Electrical Safety Code (“NESC”) violations. MEC has agreed to methodically correct NESC violations per its corrective action plan, included as Attachment B to this report. Staff believes that MEC’s corrective process would only improve if more of its employees were noting and reporting NESC violations as they perform their normal daily field work. Many NESC violations are readily observable, and it does not always require a dedicated NESC inspection to identify them. For example, Staff observed two locations during its 2008 distribution circuit inspections where MEC's distribution conductors were in violation of the NESC due to inadequate ground clearance.

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## 2. Introduction

This document assesses the reliability report that MidAmerican Energy Company ("MEC" or "MidAmerican") filed for the 2007 calendar year, and evaluates MEC's reliability performance for that year.

83 Illinois Administrative Code Part 411.140 requires the Commission to assess the annual reliability report of each jurisdictional entity and evaluate the entity's reliability performance. Code Part 411.140 requires the Commission evaluation to:

A) Assess the reliability report of each entity.

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

C) Identify trends in the jurisdictional entity's reliability performance.

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

E) Identify, assess, and make recommendations pertaining to any potential reliability problems and risks that the Commission has identified as a result of its evaluation.

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

## 3. Customers and Service Territory

MEC reported that it provided electric service to approximately 84,250 Illinois customers during 2007. MEC's Illinois service territory includes urban areas near the Quad Cities[1] as well as the surrounding rural areas and smaller communities within the counties of Rock Island, Henry, and Mercer.

## 4. Description of Electric Distribution System

In its reliability report MEC states that its distribution system in Illinois is made up of 13.2 and 4kV circuits, utilizing 8,086 miles of overhead conductor, and 748 miles of underground conductor. MEC's distribution circuits originate at substations that are supplied by MEC-owned 161kV and 69kV transmission lines that loop through the Quad Cities area.

Subsection 411.120(b)(3)(G) requires MEC to report on the age and condition of its distribution and transmission facilities. With Attachment D to its reliability report MEC indicated that the average age of its substation equipment is 26 years; the average age of its poles and fixtures is 33 years; the average age of its distribution transformers is 24 years; and the average age of its underground conductors and devices is 20 years.

MEC reported that it schedules a complete ground patrol and inspection of each distribution circuit on a 10-year cycle, and that follow-up maintenance and construction is performed as required. MEC also stated that it notes and addresses problems on its distribution circuits that its own employees find during periodic inspection of line equipment, such as capacitors, reclosers, and voltage regulators, and that its tree

[1] The Quad Cities consist of Davenport and Bettendorf in Iowa, and Rock Island and Moline in Illinois.

trimmers find when trimming trees adjacent to power lines. Based on the results of its inspections and follow-up maintenance and construction activity, MEC concluded that it adequately maintains its facilities to provide safe and reliable service to its Illinois customers.

Staff believes that 10 years between complete inspections of each of MEC's Illinois distribution circuits is far too long, and that utilizing such a long inspection cycle prevents MEC from staying aware of the condition of some of its distribution facilities. This topic is discussed further later in this report.

## 5. Assessment of Company's Reliability Report

83 Illinois Administrative Code Part 411.120(b) requires each non-exempt jurisdictional entity to file an annual reliability report for the previous calendar year by June 1 of the current year. MEC's 2007 reliability report was filed on schedule and contained all the information necessary to comply with Subsection 411.120(b)(3) requirements. Staff found that MEC's reliability report was organized in a logical manner and that finding information within the report and the attachments was not difficult.

## 6. Historical Performance Relative to Established Reliability Targets

Subsection 411.140(b)(4)(A-C) establishes electric service reliability targets that jurisdictional entities (utilities) 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. The Commission's service reliability targets contained in Part 411 are listed in Table 1:

**Table 1: Service Reliability Targets**

| Immediate primary source of service operation voltage | Maximum number of interruptions in each of the last three years | Maximum hours of total interruption duration in each of the last three years |
|---|---|---|
| 69kV or above | 3 | 9 |
| Between 15kV & 69kV | 4 | 12 |
| 15kV or below | 6 | 18 |

Subsection 411.120(b)(3)(L) requires each utility to provide a list of every customer, identified by a unique number, who experienced 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, all regulated Illinois electric utilities agreed to report on all 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 plans or has taken to address the customer reliability concerns. At the conclusion of the initial agreement period, Staff approached each of the reporting utilities to request that they continue reporting both controllable and uncontrollable interruptions beyond 2007. In January 2008, all reporting utilities agreed to continue reporting on all interruptions (rather than only controllable interruptions) through the

year 2012. This interruption information is included in a supplement to each utility's annual reliability report.

In a Supplemental Report to its 2007 Reliability Report, MEC stated that during 2007, 245 of its Illinois customers experienced interruptions in excess of the Commission's reliability targets. This is a significant increase from the 52 Illinois customers listed in MEC's Reliability Report covering 2006, and the 20 Illinois customers listed in MEC's Reliability Report covering 2005. Of the 245 customers that experienced interruptions that exceeded the reliability targets during 2007, the vast majority of them (241) experienced more than 6 interruptions each year for at least 3 consecutive years (frequency target). Only four of MEC's Illinois customers experienced interruptions in excess of the duration target. As Table 1 indicates, the duration target for circuits operating at 15kV or below is 18 hours of interruption time each year during 3 consecutive years.

All of MEC's 241 customers that experienced interruptions in excess of the frequency target during 2007 were supplied by only four different distribution circuits, as shown in Table 2. Table 2 illustrates that MEC has two circuits, Circuits 13-101-4 and 13-102-3, that have supplied customers who experienced more than six interruptions each year for several consecutive years. [2] In fact, two of MEC's customers, identified as customer # 512606901 and customer # 665406601 in MEC's 2007 Supplemental Report, have experienced more than six interruptions each year since 2002. During 2007, these two customers, and 28 other MEC customers in Illinois, experienced more than 16 interruptions.

**Table 2: MEC's Distribution Circuits that Supplied Customers who Experienced Interruptions that Exceed Frequency Targets**

| Circuit ID | 2007- # Customers Exceeding Frequency Target | 2006- # Customers Exceeding Frequency Target | 2005- # Customers Exceeding Frequency Target | 2004- # Customers Exceeding Frequency Target |
|---|---|---|---|---|
| 13-101-4 | 24 | 17 | 10 | |
| 13-102-3 | 35 | 35 | 10 | 136 |
| 13-27-1 | 178 | | | |
| 13-28-2 | 4 | | | |
| Other Circuits | 0 | 0 | 0 | 39 |
| Total Customers | 241 | 52 | 20 | 175 |

MEC stated that all 24 customers supplied by Circuit 13-101-4 that experienced interruptions in excess of the frequency target were supplied via the same tap in Henry

[2] The Commission's Part 411 reliability target is exceeded only if an individual customer experiences more than six interruptions for three consecutive years. For example, in order for the reliability target to be exceeded in 2004, the customer would have had to experience more than six interruptions during 2002, 2003, and 2004.

County, and that the most frequent outage cause affecting these customers was animal related. In 2006 MEC installed animal protection on the tap. MEC also inspected the entire circuit in 2006, and as a result of the inspection, it tightened hardware, replaced rotten cross-arms, poles, and blown lightning arresters, and repaired ground wires and guy markers. MEC stated that in 2007, it performed another inspection of the circuit based upon outages that occurred during 2006, and as a result developed and completed projects that installed or repaired guy guards, fuse tags, guy grounding, lightning arresters, and replaced poles and cross arms. In addition, in May of 2008 MEC installed a recloser on the tap that supplies the 24 customers so that they would experience fewer sustained interruptions.[3]

MEC's 35 customers supplied by Circuit 13-102-3 that experienced interruptions in excess of the Commission's reliability targets were all supplied via two tap fuses. MEC stated that it completed a circuit inspection in 2007 that focused on problem areas identified by the outages that occurred during 2006. Based upon this inspection, MEC stated it developed and completed seven work projects to: replace poles, cross arms, and guying; install ground wire molding and guy markers; and repair ground rods and ground wires. In May of 2008, MEC installed a recloser on both of the problematic taps it identified. MEC stated it re-inspected a portion of Circuit 13-102-3 in 2008, and, as a result of that inspection, replaced 8 poles, 4 lightning arrestors, and installed supplemental fusing at two locations.

MEC's 178 customers supplied by Circuit 13-27-1 who experienced interruptions during 2007 that exceeded the Commission's frequency reliability target are all downstream of a single recloser. MEC stated that it completed an inspection and several work projects in 2007 that repaired or replaced guy markers, ground wire and molding, ground rods, poles and cross arms, and installed fusing, lighting arrestors, and animal protection.

MEC's four customers supplied by Circuit 13-28-2 that experienced interruptions in excess of the Commission's frequency target during 2007 are all supplied through the same fuse. MEC explained that the interruptions were chiefly due to animals, trees, and lightning. MEC stated it completed a work project in April of 2008 to install lightning and animal protection, and that tree trimming was scheduled to be performed during 2008.

Historically, MEC has achieved a lower system CAIDI than most other reporting utilities, and, prior to 2007, MEC reported that none of its distribution customers experienced interruptions in excess of the Commission's duration target of 18 hours of interruption during 3 consecutive years (refer to Table 1). However, MEC reported that four of its customers experienced interruptions exceeding the Commission's duration reliability target during 2007. In other words, four of MEC's customers experienced interruptions

[3] The function of a recloser is to automatically open to de-energize a section of a distribution circuit after the recloser detects a fault (short-circuit), and then to "re-close" after a few seconds to re-energize the affected section of distribution circuit. If the fault condition was temporary, such as a limb falling on the wires on its way to earth, the section of distribution circuit will then stay energized and the utility's customers will have experienced only a brief momentary interruption. If the fault condition is permanent, the recloser will sense the fault condition again and automatically de-energize the distribution circuit a second time, and there might be a 3rd or 4th cycle. If the fault persists, utility personnel need to investigate the cause and determine when it is safe to re-energize the affected distribution line sections by manually closing the recloser.

during 2005, 2006, and 2007 that exceeded 18 hours in total duration time each year. The number of interruptions each customer experienced is not considered when determining whether this target has been exceeded – only the total duration time associated with all the interruptions during the calendar year. MEC stated that during 2007, its Circuit 13-S-6 supplied two of MEC's four Illinois customers that experienced interruptions in excess of the Commission's duration reliability target, and its Circuit 13-38-4 supplied the other two. For all four of these customers, MEC blamed the long interruption duration times on a severe ice storm that occurred in February. For the years 2005 and 2006, MEC stated multiple tree-related outages caused a cumulative duration time each year to exceed 18 hours, and noted that MEC performed tree trimming on both circuits in 2007.

Subsection 411.140(b)(4)(D) requires the Commission's assessment to determine if MEC has a process in place to identify, analyze, and correct service reliability for customers who experience a number or duration of interruptions that exceeds the reliability targets. Staff strongly believes that when one or more customers experience interruptions that approach or exceed the Commission's reliability targets, an electric utility's minimal action should be to inspect its distribution facilities supplying the affected customers, and then to aggressively remove any additional threats to reliable service that it finds during its inspections, even if those threats do not relate directly to the service interruptions that have already occurred. In December of 2005, MEC reported that it had begun monthly reviews of customers experiencing 3 or more interruptions during a 3-month rolling window, and quarterly reviews of customers experiencing 7 or more interruptions in a 12-month rolling window. While Staff was very encouraged to learn about MEC's review process and hoped it would help improve reliability for individual customers who experience multiple interruptions, Staff is disappointed by the number of and duration of interruptions to individual customers within MEC's Illinois operating area during 2007.

Staff continues to worry that MEC's corrective actions take too long. For example, as discussed above, MEC blamed the long duration times during 2005 and 2006 for the four customers supplied by Circuit 13-S-6 and Circuit 13-38-4 on multiple tree-related interruptions, but reported that it did not perform tree trimming on Circuits 13-S-6 and Circuit 13-38-4 until 2007. MEC customers who are experiencing a long cumulative duration of interruptions due to trees should not have to wait two years for MEC to take steps to improve its service by trimming the troublesome trees. If trees are causing interruptions to pockets of customers on a distribution circuit, MEC should trim those trees that are affecting reliability to individual customers immediately, regardless of the scheduled trim date for the remainder of the circuit. Such "hot-spot" trimming is a necessary part of a utility's maintenance program. Staff has concluded that, while MEC appears to have a process in place to identify, analyze, and correct service reliability for customers who experience a number or duration of interruptions that exceed the Commission's reliability targets, MEC should modify its process so that corrective action occurs more promptly.

## 7. Analysis of Reliability Performance

Reliability indices can be used to compare the reliability performance of several utilities, and provide an indication of whether an individual utility's performance is improving or degrading over time. Since each reporting utility uses its own reporting and recording methods, direct reliability index comparisons between utilities are not exact, but can still be informative.

Table 3 (a-c) shows the SAIFI, CAIDI, and CAIFI indices for 2007 as submitted by each reporting utility. Each index table is sorted from best to worst performance:

**Table 3: 2007 Reliability Indices for Reporting Utilities**

**a) SAIFI**

| UTILITY | SAIFI |
|---|---|
| AmerenCILCO | 1.16 |
| AmerenIP | 1.38 |
| AmerenCIPS | 1.46 |
| ComEd | 1.53 |
| Mt. Carmel | 2.56 |
| **MidAmerican** | **3.95** |

$$\textbf{SAIFI}=\frac{\text{Total \# Customer Interruptions}}{\text{Total \# Customer Served}}$$

**b) CAIDI**

| UTILITY | CAIDI |
|---|---|
| Mt. Carmel | 63 |
| AmerenCIPS | 146 |
| AmerenCILCO | 151 |
| ComEd | 193 |
| **MidAmerican** | **291** |
| AmerenIP | 346 |

$$\textbf{CAIDI}=\frac{\text{Sum of all Interruption Durations}}{\text{Total \# Customer Interruptions}}$$

**c) CAIFI**

| UTILITY | CAIFI |
|---|---|
| AmerenCILCO | 1.98 |
| AmerenIP | 2.13 |
| AmerenCIPS | 2.13 |
| ComEd | 2.24 |
| Mt. Carmel | 2.74 |
| **MidAmerican** | **4.37** |

$$\textbf{CAIFI}=\frac{\text{Total \# Customer Interruptions}}{\text{Total \# Customers Affected}}$$

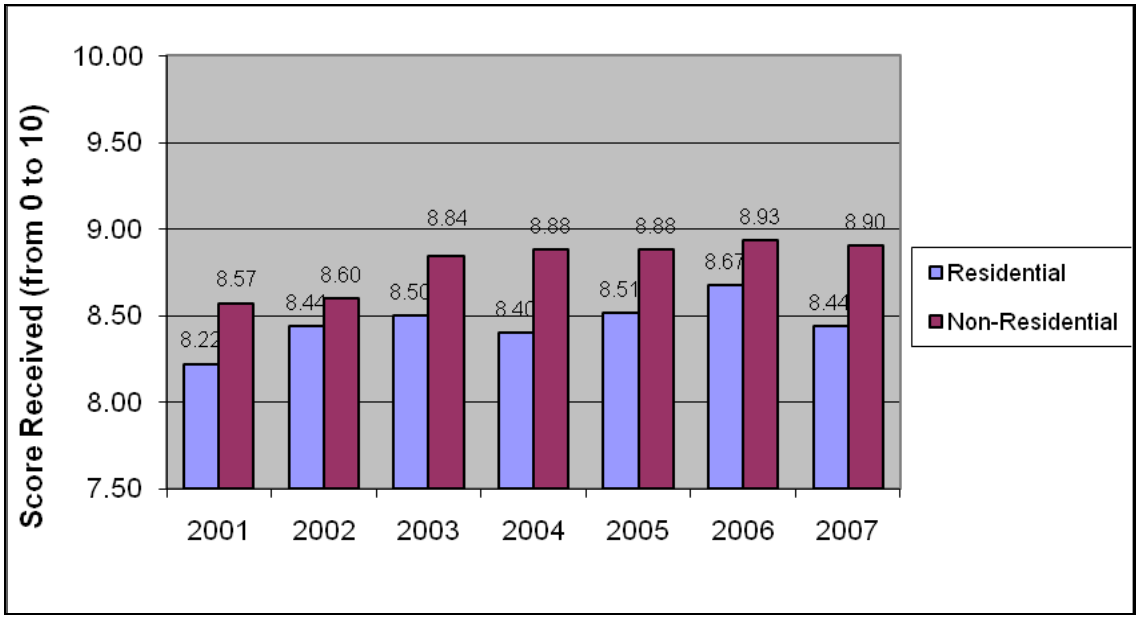
When comparing the indices reported by all the utilities that filed reliability reports for 2007, Staff observed:

- MEC's SAIFI of 3.95 was the highest (worst) reported for 2007: about 144% higher than the average of the values reported by the other five utilities.
- MEC's CAIDI of 291 was the second highest reported for 2007: about 62% higher than the average of the values reported by the other five utilities.
- MEC's CAIFI of 4.37 was the highest reported for 2007: about 95% higher than the average of the values reported by the other five utilities.

MEC stated it had no Illinois customers receiving power from another utility or ARES during 2007. Therefore a comparison of interruption frequency and duration for MEC's customers buying from MEC versus buying from another utility or ARES is not possible.

Independent survey results indicate that for 2007, MEC's residential customers gave MEC a reliability score of 8.44 out of 10, and its non-residential customers gave MEC a reliability score of 8.90 out of 10. These are slightly lower scores than MEC reported for the 2006 calendar year, but substantially similar to the scores that MEC has received for reliability in recent years, as illustrated by Figure 1. Given the decline in reliable service that MEC provided many of its customers during 2007, Staff does not know why MEC's reliability scores remained so high.

**Figure 1: MEC's Customer Survey Scores for Providing Reliable Electric Service (2001-2007)**




MEC reported that during 2007, it received roughly 33% more complaints from its Illinois customers about excessive outage frequency than during 2006: 160 complaints vs. 120 complaints. MEC reported no 2007 customer complaints remain unresolved.

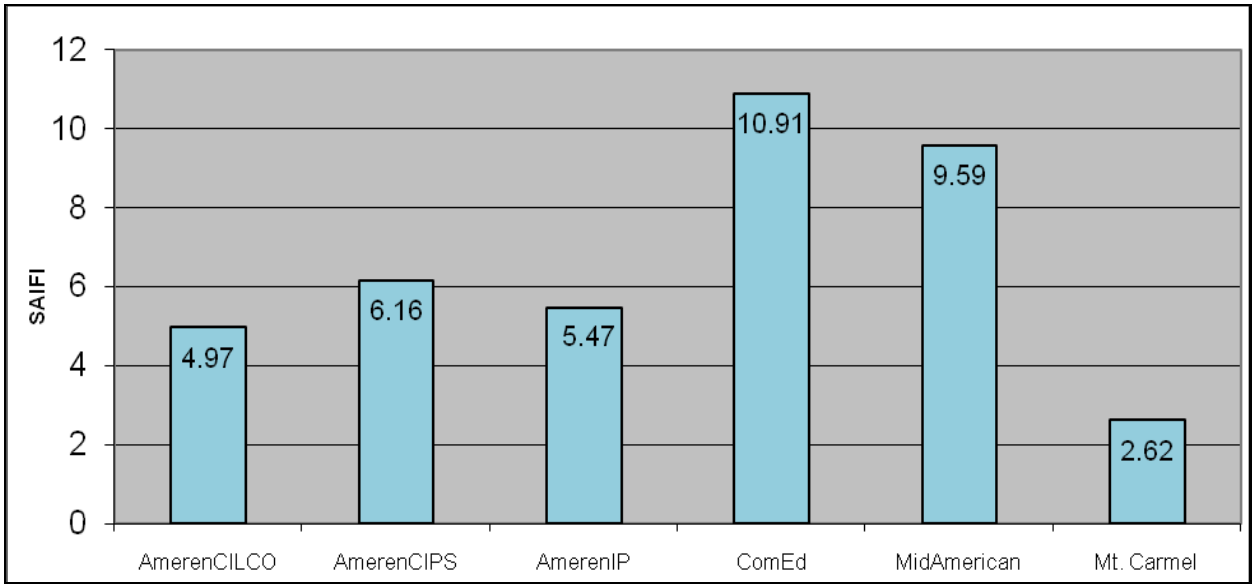
Worst Performing Circuits

Section 411.120 requires utilities to report worst performing circuits and state corrective actions taken or planned to improve the performance of those circuits. Worst performing circuits for each reporting utility are its 1% of circuits that had the highest SAIFI, CAIDI, and CAIFI during the report year. For 2007, MEC reported four circuits as worst performing circuits: the same two circuits due to both SAIFI and CAIFI, and two circuits due to CAIDI.

In its annual report, a utility must report on its worst performing circuits even if all its circuits performed well during the year: the Part 411 requirement is simply that the utility report its circuits that performed the worst based on each reliability index. Since designating a circuit as a worst performing circuit does not necessarily indicate that the circuit performed poorly, comparing the index values for worst-case circuits from utility to utility can be useful when assessing the relative performance of distribution circuits among several utilities.

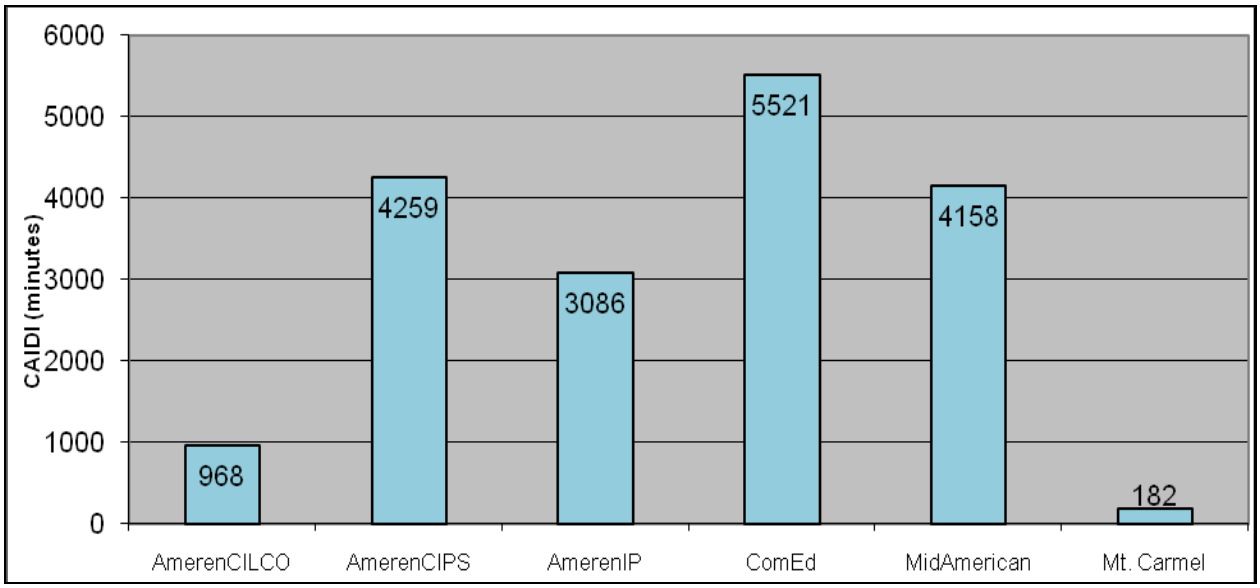
- Figure 2 shows the highest value of SAIFI each utility reported for an individual distribution circuit for the 2007 calendar year. The values reported by the utilities ranged from 2.62 at Mt. Carmel Public Utility Company to 10.91 at ComEd. The SAIFI of 9.59 that MEC reported for Circuit 13-40-4 was the second highest of the values reported. For the preceding year, 2006, the SAIFI that MEC reported for Circuit 13-40-4 was 0.84. For 2006, MEC reported its worst case single-circuit SAIFI was 6.18 for Circuit 13-42-1. For 2007, MEC reported that the SAIFI for Circuit 13-42-1 improved to 3.14.

**Figure 2: Highest SAIFI for 2007 Worst Performing Circuits Reported by each Utility**



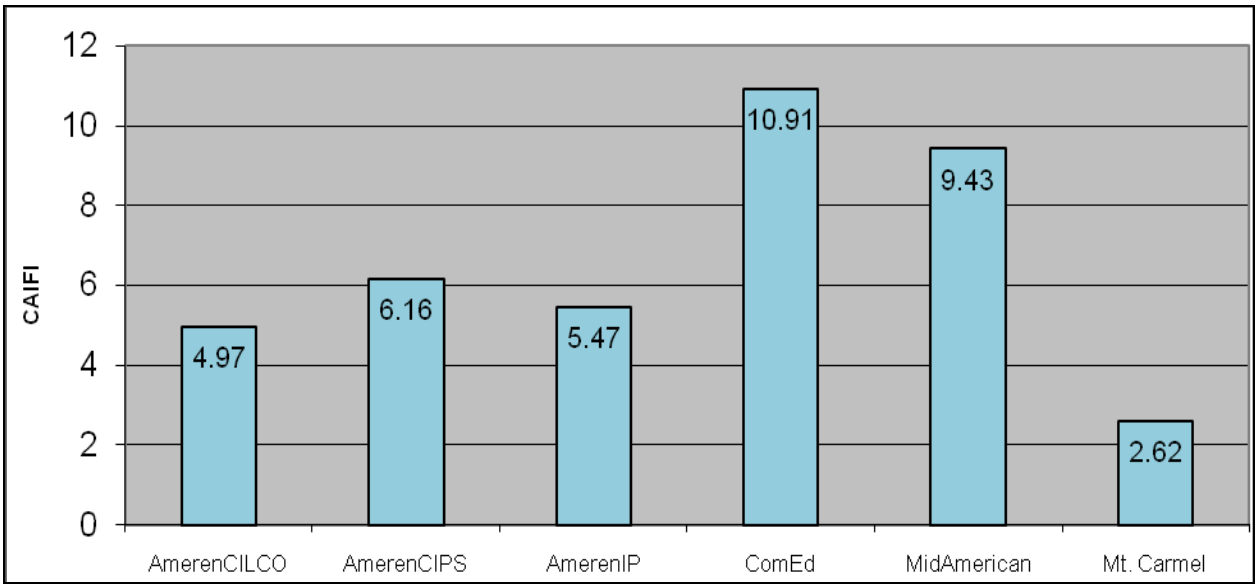

- Figure 3 shows the highest value of CAIDI each utility reported for an individual distribution circuit for the 2007 calendar year. The values reported by the utilities ranged from 182 minutes at Mt. Carmel to 5521 minutes at ComEd. The value of 4158 minutes that MEC reported for Circuit 4-23-1 was the third highest of the values reported. For the preceding year, 2006, the CAIDI that MEC reported for Circuit 4-23-1 was 299 minutes. For 2006, MEC reported its worst case single-circuit CAIDI was 378 minutes for Circuit 13-107-1. For 2007, MEC reported that the CAIDI for Circuit 13-107-1 worsened to 603 minutes.

**Figure 3: Highest CAIDI for 2007 Worst Performing Circuits Reported by each Utility**



- Figure 4 shows the highest value of CAIFI each utility reported for an individual distribution circuit for the 2007 calendar year. The CAIFI values reported by the utilities were nearly the same as the SAIFI values, ranging from 2.62 at Mt. Carmel Public Utility Company to 10.91 at ComEd. The value of 9.43 that MEC reported for Circuit 13-40-4 was the second highest of the values reported.4 For 2006, MEC reported that the CAIFI for Circuit 13-40-4 was 1.19. For 2006, MEC reported that its worst case single-circuit CAIFI was 6.11 for Circuit 13-42-1. For 2007, MEC reported that the CAIFI for Circuit 13-42-1 improved to 3.05.

**Figure 4: Highest CAIFI for 2007 Worst Performing Circuits Reported by each Utility**




MEC included statements in its reliability report regarding the operating and maintenance history of its four distribution circuits designated as its 2007 worst performing circuits, and listed corrective actions it has taken or plans to take:

- MEC reported that Circuit 13-40-4, which supplies 2010 customers in Moline, was a worst performing circuit during 2007 due to both SAIFI and CAIFI. MEC stated there were nine outages to the entire circuit. These nine outages were due to overhead-equipment failures, lightning, and trees. MEC described its corrective actions, stating that during 2006 and 2007 it inspected the entire circuit and as a result of the inspection replaced and straightened poles, tightened loose guys, and corrected NESC clearance violations. MEC stated that in 2007, it also replaced or performed maintenance on several distribution switches. MEC also stated that it completed installing 63 animal guards as well as installing and/or replacing fusing, grounding, down guys and cross arms in January of 2008. Lastly, in May of 2008, MEC replaced an inoperable main-line switch. MEC estimates its cost for the reliability-

[4] The equations that define SAIFI and CAIFI, provided under Table 3, illustrate that only the denominators for the two indices are different. Based upon the equations that define them, CAIFI should always be equal to or greater than SAIFI. None-the-less, for several circuits MEC reported a CAIFI lower than SAIFI. MEC stated that this occurred because its SAIFI values are calculated using end-of-year customer counts on its circuits.

related work completed on Circuit 13-40-4 during 2007 and early 2008 totaled approximately $50,000. MEC reported that it most recently completed trimming trees adjacent to Circuit 13-40-4 in January 2007, and plans to trim on the circuit again in December 2009. Staff inspected Circuit 13-40-4 in September 2008, and observed very few visible threats to reliable service, and, as a result, believes that the actions MEC has taken, especially replacing deteriorated poles and cross-arms, trimming trees, and adding animal guards and fuses, will considerably improve the performance of Circuit 13-40-4.

- MEC reported that Circuit 13-102-3, which supplied 451 customers in 2007, was its circuit with the second highest SAIFI and CAIFI during 2007, largely due to eight outages to the entire circuit. These eight outages were due to overhead equipment failure, lightning, ice, and an unknown cause. Staff had inspected Circuit 13-102-3 on June 20, 2007, and, because of observations during that inspection, was not surprised that this circuit was listed by MEC as a worst performing circuit for that year. Below is an excerpt from Staff's assessment report for calendar year 2006 that discusses Circuit 13-102-3:

  > "When inspecting Circuit 13-102-3, Staff noted 17 locations where the distribution facilities appeared to be damaged or deteriorated, 5 locations where vegetation was close to or contacting the primary conductor and 7 locations requiring maintenance, such as lightning arrester replacement or the tightening of hardware. In addition, Staff noted 2 locations where guys appeared to be missing. Circuit 13-102-3 was in much worse condition than MEC's other circuits that Staff inspected during the summer of 2007. Staff was very disappointed by the large number of locations with deteriorated facilities on Circuit 13-102-3 (see Photos 6 to 13). Staff also noted that this is the distribution circuit that supplies 35 of the 52 MEC customers that experienced interruptions in excess of reliability targets. Since MEC informed Staff that it already created a project to replace over 300 poles on this circuit, and MEC committed to completing these pole replacements by the end of 2007, Staff did not note each deteriorated pole seen during the inspection. MEC did a good job installing lightning arresters throughout the circuit, but needs to replace the damaged ones. Staff is hopeful that MEC honors its commitment to replace the many deteriorated poles and other equipment on this circuit prior to the end of 2007. Staff's impression was that it would not take much of a storm to cause many of the deteriorated facilities on Circuit 13-102-3 to fail catastrophically."

  After completing an inspection of Circuit 13-102-3 during 2007, MEC stated it created and completed seven work projects to replace or repair poles, cross-arms, guys, and grounds. In 2008, MEC installed two reclosers and some supplemental fusing, and replaced eight poles and four lightning arrestors. MEC reported spending approximately $1,035,000 on reliability improvements to Circuit 13-102-3 during 2007 and 2008.

  Staff re-inspected a small portion of Circuit 13-102-3 during September of 2008, and was very impressed by the noticeable improvement in the condition of MEC's

distribution facilities. MEC stated it replaced more than 300 poles, and also replaced deteriorated cross-arms and broken braces. While Staff was very pleased with the generally improved condition of facilities on this circuit, Staff was also disappointed to observe several facility problems directly adjacent to MEC's recent work locations. For example, Staff noted two locations where the primary conductor was not tied to the insulator on the pole adjacent to a new pole. Staff also noted a disconnected cross arm brace and blown lightning arrester near a location where MEC had recently replaced poles. Staff is cautiously optimistic that MEC's extensive work on Circuit 13-102-3 will lead to improved performance for that circuit, but is concerned that MEC completed its projects without correcting some visible threats to reliable service located quite near the locations it was working.

- MEC reported that Circuit 4-23-1, which supplies 188 customers, was its worst performing circuit due to CAIDI. MEC explained that this was due to an interruption to one customer initiated during an ice storm that lasted nearly three-days. MEC indicated no reliability improvements have been completed on this circuit in the past 3 years, and did not indicate that any are planned. Staff is disappointed by this. Staff holds the opinion that every worst-performing circuit should at least be inspected to verify there are not visible potential threats to reliable service on the circuit that might cause it to become a worst performing circuit two years in a row – even if those threats are unrelated to interruptions that have already occurred.
- Circuit 13-R-2, which supplied only 15 customers during 2007, was MEC's other worst-performing circuit due to CAIDI. MEC reported that three customers supplied by the same distribution transformer experienced one interruption during an ice storm that lasted about 2.6 days. As with Circuit 4-23-1, MEC indicated that it did not plan or complete any reliability improvements for Circuit 13-R-2. Again, Staff believes MEC should inspect all of its worst-performing circuits.

<u>Staff's Circuit Inspections</u>

In 2008 Staff inspected five of MEC's distribution circuits that had higher SAIFI values during 2007 than MEC's system average: Circuit 4-25-1, Circuit 13-112-2, Circuit 13-108-2, Circuit 13-40-4, and 13-107-1. In addition, Staff re-inspected specific locations on three distribution circuits that Staff previously inspected during the summer of 2007: Circuit 13-27-1, 13-47-1, and 13-102-3. A representative from MEC accompanied Staff during most of these inspections. During Staff's inspections, Staff found that most of the facilities making up MEC's circuits inspected appeared to be in good condition, though Staff noted specific locations where MEC should repair or replace poles, cross arms, and braces. Whenever possible, Staff pointed out these locations to the MEC representative that accompanied Staff. Staff also sent a description of Staff's concerns about each noted location to MEC in a follow-up communication (see Attachment A). Additional information regarding each of MEC's circuits that Staff inspected follows:

- *Circuit 4-25-1 (4.2 kV): (SAIFI=4.68; CAIDI=91; CAIFI=4.40)*

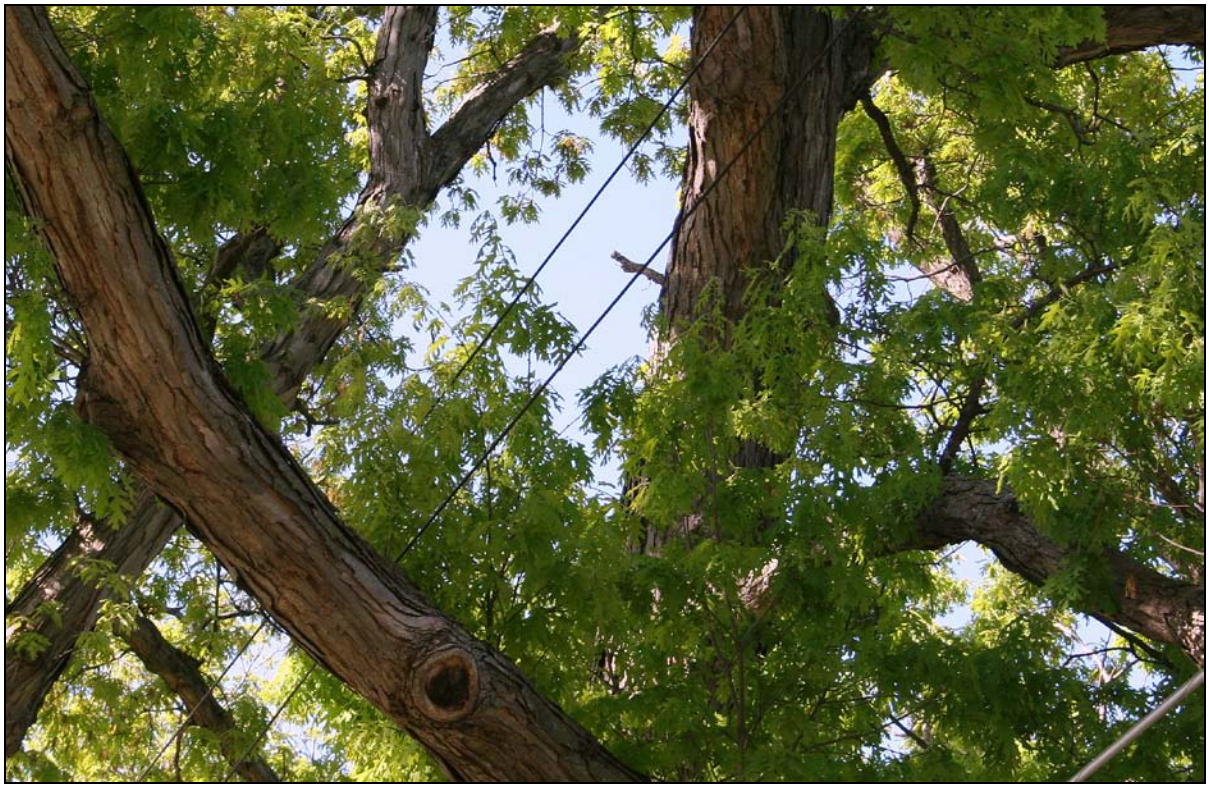
  Circuit 4-25-1, which supplies electricity to 358 customers in a residential area of Moline, was not reported as a worst performing circuit during 2007, but it had SAIFI and CAIFI values higher than MEC's system average values of 3.95 and 4.37, respectively. It is supplied by one of MEC's 12 kV circuits that is a worst performing

circuit: Circuit 13-40-4. Of the 16 interruptions that occurred on Circuit 4-25-1 during 2007, MEC reported that 5 were weather-related, 6 were tree related, 4 were caused by the failure of overhead equipment, and 1 was animal related.

MEC stated it conducted a complete inspection of this circuit in 2007. As a result of its inspection, MEC plans to replace poles, transformers and cross arms, raise secondary conductors, and repair grounds and guys. MEC plans to complete this work by the end of 2008. MEC reported that tree trimming was last completed on Circuit 4-25-1 in January 2007, and is scheduled again for December 2009.

During Staff's inspection, conducted in May of 2008, the only visible reliability threats that Staff noted were two locations where trees were contacting MEC's primary conductor. One of the locations involved a massive oak tree with limbs overhanging the lines, and new growth growing through and around the conductors (Photo 1).

**Photo 1: Massive oak tree with recent growth contacting the conductor of Circuit 4-25-1**



If it has not already done so, Staff recommends MEC return very soon to both locations to eliminate the existing tree contacts: certainly before the next scheduled trim in December 2009. Staff also recommends MEC continue to install animal protection on distribution transformers on this circuit, as many of the distribution transformers that Staff observed had no animal protection installed. Finally, Staff suggests that MEC install overhead fault indicators on accessible portions of the circuit before the conductors disappear into rear lot easements to make troubleshooting those locations easier and faster during interruption events.

- *Circuit 13-112-2 (13.2 kV): (SAIFI=6.06; CAIDI=243; CAIFI=6.01)*

  Circuit 13-112-2 supplies about 480 customers in rural Mercer and Rock Island Counties. This circuit covers a very large geographic area with low customer density, supplying the southwestern extremities of MEC's Illinois operating area, including portions of the community of New Boston. Circuit 13-112-2 was not one of MEC's worst performing circuits during 2007, but it had SAIFI and CAIFI values higher than MEC's system average. Of the 84 interruptions that occurred on Circuit 13-112-2 during 2007, MEC reported that 50 were weather-related, 4 were tree related, 14 were caused by the failure of overhead equipment, and 10 were animal related.

  MEC most recently conducted a complete inspection of Circuit 13-112-2 in 2001. MEC reported that in 2007 it installed 17 animal guards and replaced 18 lightning arrestors beyond a tap fuse near New Boston, and in 2008 planned to install nine voltage regulators to improve voltage levels. In 2008 MEC plans to inspect Circuit 13-112-2 for NESC violations, and conduct a ground line inspection of all poles on the circuit. MEC reported tree trimming was last completed on Circuit 13-112-2 in May 2006, and is scheduled again for May 2009.

  When inspecting Circuit 13-102-2 in August and September of 2008, Staff noted several locations where cross arms were deteriorated, insulator pins had fallen through the cross arm, or cross arm braces were broken or detached (Photos 2-4).

**Photo 2: Split cross arm and detached brace (13-112-2)**

**Photo 3: Detached cross arm brace (13-112-2)**

**Photo 4: Primary insulator pin fallen through cross-arm (13-112-2)**

Staff also noted several poles that had deteriorated or damaged pole tops or were severely shell-rotted (Photo 5), several blown lightning arrestors (Photo 6), a location where the neutral conductor was floating free because it had detached from the insulator (Photo 7) and another where the primary was floating because the insulator was broken (Photo 8), a broken ground wire, broken or detached down guys, and two locations with NESC violations due to inadequate ground clearance.

**Photo 5: Damaged pole top (13-112-2)**

**Photo 6: Two blown lightning arresters (13-112-2)**

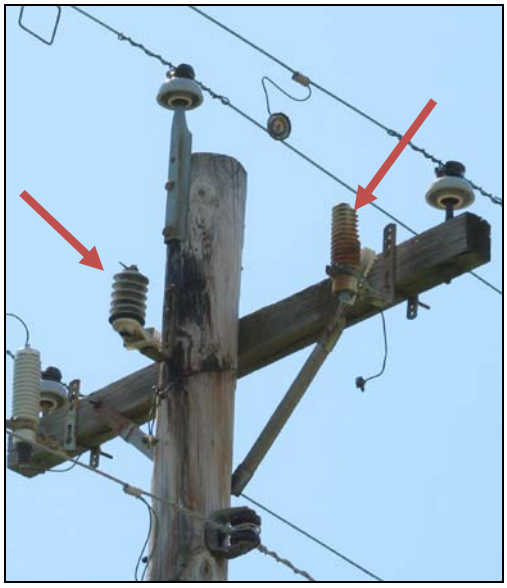


**Photo 7: Neutral detached from insulator (13-112-2)**

**Photo 8: Broken primary insulator with energized primary wire floating near pole below neutral (13-112-2)**

In addition, Staff noted more than a dozen locations where vegetation was near or contacting the conductor (Photo 9 and 10 are two examples).

**Photo 9: Energized transformer enveloped by vegetation (13-112-2)**

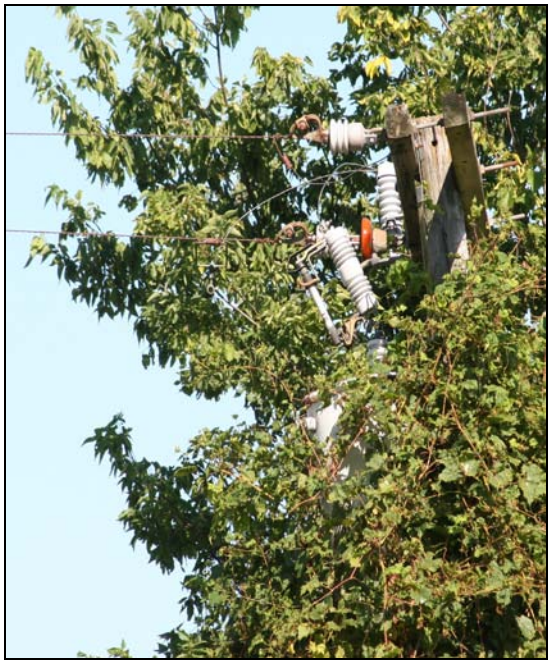


**Photo 10: Vines grown to primary level (13-112-2)**

Though many of vegetation issues that Staff noted on Circuit 13-112-2 were associated with fast-growing vines, Staff was concerned that MEC allowed the vines to envelop its distribution facilities to such a great extent. In addition to remedying the vegetation contacts on Circuit 13-112-2, MEC should examine the condition of its poles, cross arms, wooden insulator pins, and cross arm braces on this circuit, and replace those facilities that are broken and deteriorated so that MEC's facilities have adequate strength to withstand a moderate seasonal storm. Based upon the many locations where Staff observed threats to reliable service, Staff expects that Circuit 13-112-2 might have a high SAIFI again during 2008.

- *Circuit 13-108-2 (13.2 kV): (SAIFI=4.07; CAIDI=1456; CAIFI=4.07)*

  Circuit 13-108-2 supplies electricity to just over 900 customers in the rural areas of MEC's service territory in Mercer and Rock Island Counties. This circuit covers a large geographic area between the communities of Sherrard, Reynolds and Matherville. Circuit 13-108-2 was not a worst performing circuit during 2007, but its SAIFI during 2007 was higher than MEC's system SAIFI of 3.95. Of the 116 interruptions on this circuit during 2007, MEC reported that 93 were weather related, 6 were animal related, 6 were tree related, and 8 were due to overhead equipment failures.

  MEC stated in its reliability report that it most recently conducted a complete inspection of Circuit 13-108-2 in 2003. MEC reported that in 2006 it replaced transformer pads and cable tagging in one underground area of the circuit, replaced

underground cable in another underground area, and installed voltage regulators and two capacitor banks to improve delivery voltage. During 2008, MEC plans to conduct a circuit inspection to identify NESC violations, and perform a ground line inspection of all poles. MEC reported that tree trimming was last completed on Circuit 13-108-2 in March 2004, and was scheduled again for March 2008.

When inspecting Circuit 13-108-2, Staff noted 6 locations where lightning arresters were blown, broken, or had been removed (Photo 11). Staff also noted cross arms and poles that appeared as if they should be replaced (Photo 12-14), loose hardware, and 2 locations where vegetation had grown to the primary level of the pole.

**Photo 11: Broken Lightning Arrester (13-108-2)**

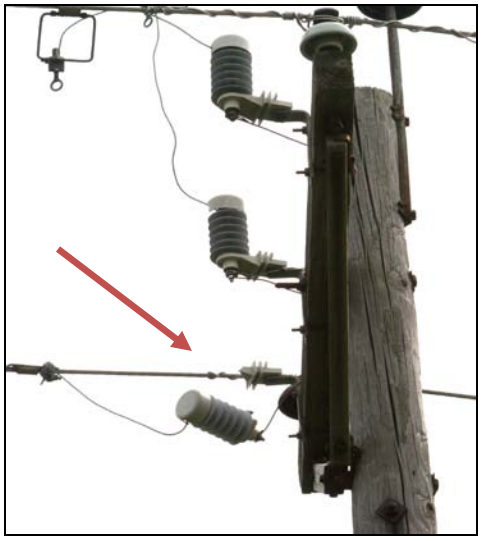


**Photo 12: Neutral pin fallen through spitting cross-arm (13-108-2)**

**Photo 13: Gooseneck insulator bracket for primary mounted at rotted pole top (13-108-2)**

**Photo 14: Gooseneck insulator bracket for primary mounted at rotted pole top near woodpecker holes (13-108-2)**

Other than the locations described above, Staff found the facilities making up Circuit 13-108-2 to be in fairly good condition. Staff was pleased with MEC's placement of lightning arresters throughout this large rural circuit, but noted that several were blown or had been removed and not replaced. It also appeared MEC had done a good job fusing taps off of the main line. MEC should continue installing animal guards on distribution transformers: Staff observed that many had none installed. Circuit 13-108-2 would likely perform much more reliably if MEC would take corrective action at only a few locations where its facilities are in bad shape.

- *Circuit 13-40-4 (13.2 kV): (SAIFI=9.59; CAIDI=75; CAIFI=9.43)*

  Circuit 13-40-4 supplies electricity to over 2000 customers in a residential area of Moline. Circuit 13-40-4 was MEC's worst performing circuit due to SAIFI during 2007, with a SAIFI that was more than 2.5 times MEC's system average. Of the 95 service interruptions that occurred on this circuit during 2007, MEC attributed 60 to weather, 16 to overhead equipment failure, 11 to animals, and only 4 to trees, which Staff found surprising given the trees in the area the circuit travels through. MEC explained that the high SAIFI was due to nine interruptions during the year that affected the entire circuit, two of which occurred during major storms.

  MEC stated that it most recently completed an inspection of Circuit 13-40-4 in 2006. As a result of that inspection, MEC replaced and straightened poles, removed old pole stubs, tightened loose guys and corrected identified NESC violations. In addition, in 2007 MEC maintained or replaced 12 switches on the circuit. In late 2007, MEC installed animal guards, installed or replaced fusing, and replaced rotten cross arms. This project was completed in January, 2008. In 2008, MEC also replaced 1 additional switch that was found to be inoperable, and to complete a ground line inspection on all poles, and identify and correct any additional NESC violations that might remain. MEC reported that tree trimming was last completed on Circuit 13-40-4 in January 2007, and is scheduled again for December 2009.

  Based upon its very high 2007 SAIFI, Staff was very surprised during its September 2008 inspection to discover that Circuit 13-40-4 appeared to be in excellent condition. MEC's corrective actions taken on this circuit during late 2007 and during 2008 should result in improved service reliability for customers in future years.

  Staff noted only two visible reliability issues: a vine grown to the primary level at one location, and some new tree growth brushing the primary at another. Staff notes that this 13.2 kV circuit is the source for MEC's Circuit 4-25-1, which was discussed previously. Based upon Staff's inspections, Staff expects that both Circuit 13-40-4 and Circuit 4-25-1 will perform much better in future years.

- *Circuit 13-107-1 (13.2 kV): (SAIFI=7.51; CAIDI=603; CAIFI=7.46)*

  Circuit 13-107-1 supplies approximately 800 customers in an extensive rural area of Mercer and Rock Island Counties located between Reynolds, Matherville, and Millersburg. Though MEC did not report 13-107-1 as a worst performing circuit, its SAIFI was approximately double MEC's system average. Of the 132 service interruptions that occurred on this circuit during 2007, 106 were weather related, 6

were animal related, 8 were tree related, and 9 were attributed to overhead equipment failure.

MEC stated that it most recently completed an inspection of the entire circuit in 2000, and that no significant improvements have occurred on the circuit within the past three years. During 2008, MEC plans a ground line inspection of all poles, which will include identifying all NESC deficiencies. MEC reported tree trimming was last completed on Circuit 13-107-1 in August 2007, and was scheduled again for August 2010.

Staff inspected Circuit 13-107-1 during September of 2008, and noted 7 locations where MEC's distribution poles appeared to be damaged or deteriorated (Photo 15 and 16), 9 locations with damaged or deteriorated cross arms or braces (Photo 17-19), 5 locations where hardware was visibly loose on the pole (Photo 20), 8 locations where lightning arresters were blown, damaged, or missing, and 1 location where the neutral conductor was laying on the branches of a pine tree. Staff noted that while MEC had appeared to do a good job initially installing lightning arresters throughout the circuit, many signs of lightning damage existed, and MEC needs to replace several damaged and/or missing arresters. Staff's impression of Circuit 13-107-1 was that significant damage and multiple interruptions could occur during any moderate storm due to the many deteriorated facilities. Staff encourages MEC to inspect this circuit itself soon, and then promptly replace the broken and/or deteriorated facilities that it finds.

**Photo 15: Recent lightning-damage to pole top (13-107-1)**

**Photo 16: Gooseneck insulator bracket mounted in splitting pole top (13-107-1)**

**Photo 17: Lightning damaged cross arm with insulator pin precariously attached to arm (13-107-1)**

**Photo 18: Splintered cross arm (13-107-1)**

**Photo 19: Broken brace (13-107-1)**

**Photo 20: Loose pole top pin (13-107-1)**

*Re-inspections*

In September 2008, Staff re-inspected specific locations on three of MEC's distribution circuits where Staff noted problems during its 2007 inspection. Staff's re-inspection allowed Staff to learn whether MEC made repairs to locations that Staff noted during its 2007 inspections.

- In 2007, Staff had noted that a pole appeared to be failing on Circuit 13-47-1 at the corner of 18th Street and 1st Avenue A, in Rapids City. During Staff's September 2008 re-inspection, Staff found that MEC had replaced the pole.
- In 2007, Staff noted two locations on Circuit 13-27-1 where trees were contacting the primary conductors, and one location where there was inadequate ground clearance per NESC requirements. Staff found that MEC had eliminated the tree contacts, and that MEC had raised its conductors adequately to satisfy NESC requirements.
- In last year's (2006 annual) assessment report, Staff was very critical of the condition of MEC's facilities that make up Circuit 13-102-3. During September 2008, Staff re-inspected a small portion of Circuit 13-102-3, located in Henry County, east of Interstate 74. With a SAIFI of 9.34 during 2007, Circuit 13-102-3 was one of MEC's worst performing circuits during 2007. Staff found that MEC did an impressive amount of work to improve this circuit. In the small portion of this huge circuit that Staff re-inspected, Staff noted dozens of new poles and cross-arms. MEC stated it invested approximately $1,050,000 during the period 2006-2008 in upgrades to Circuit 13-102-3 in an effort to improve the reliability of service to the customers it supplies. Staff was very pleased to see that MEC replaced so many failing facilities, but suggests that MEC assure that customers benefit from all of its good work by conducting a follow-up inspection to correct the miscellaneous reliability threats that remain. For example, during Staff's re-inspection of only a very small percentage of the circuit, Staff noted two locations where the primary was not tied to the pole-top pin insulators (Photo 21), a blown lightning arrestor, and a detached cross arm brace (Photo 22). It appeared to Staff that MEC has done a very good job replacing deteriorated or damaged facilities in order to improve reliability, but that its work will not result in maximum reliability gains if it leaves other reliability threats uncorrected on the circuit.

**Photo 21: Primary conductor detached from pole top pin (13-102-3)**

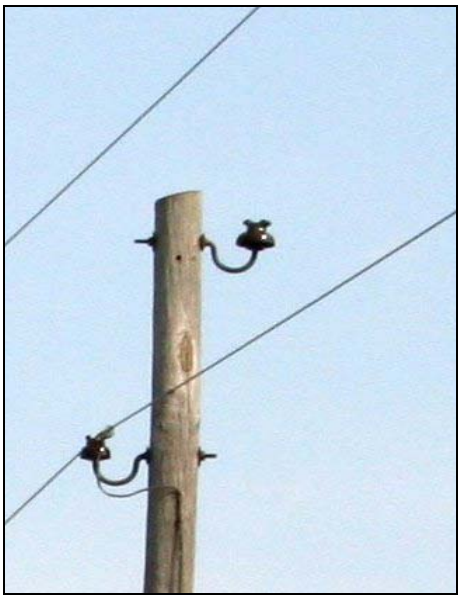


**Photo 22: Brace detached from cross arm (13-102-3)**

Tree Trimming:

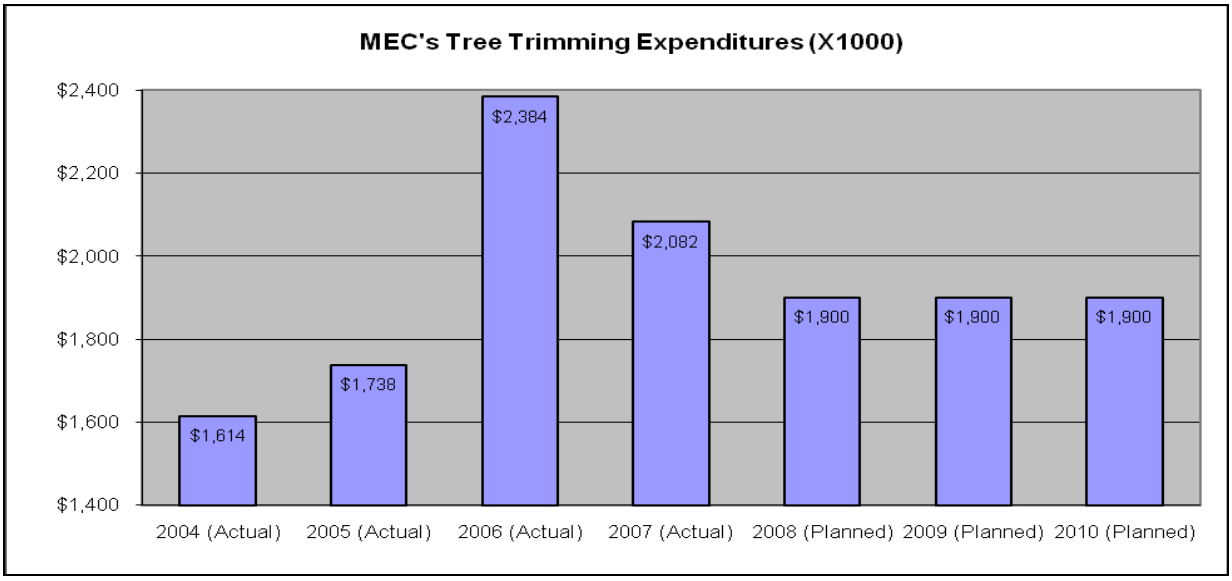
As a result of its 2008 inspections, Staff concluded that MEC had generally done a pretty good job keeping trees clear from its distribution facilities. MEC indicated that it trims the trees that grow adjacent to its distribution circuits every 3 to 4 years, and, other than the few locations where new growth or fast growing vines were close to or contacting the primary, Staff found MEC's tree trimming efforts to be satisfactory.

Despite Staff's favorable impression regarding MEC's tree trimming efforts based upon Staff's inspections, MEC reported a higher number of tree related interruptions during 2007 than in prior years. Its customers endured 318 tree-related interruptions during 2007, which is approximately 14% more than in 2006, and 52% more than in 2005. Staff believes that interruptions categorized as "weather related" and/or "unknown" sometimes involve trees. The number of MEC's interruptions attributed to the combined categories of "tree related", "weather related", and "unknown" increased by more than 200% from 2006 to 2007: from 941 in 2006 to 2890 in 2007. MEC reported a 352% increase in the number of interruptions categorized as weather related: from 537 in 2006 to 2428 in 2007. MEC stated that 1902 of the 2428 weather related interruptions that occurred in its Illinois operating area during 2007 occurred during four severe winter storms. These storms occurred on February 24, February 29, December 1, and December 11.

Though the number of tree related interruptions occurring within MEC's Illinois service area increased during 2007, MEC's actual expenditures for trimming trees decreased by about 13% when compared to 2006. Even so, MEC's actual expenditures in 2007 were 19% higher than its budgeted amount, and 20% higher than in 2005. MEC explained that it does not budget its tree trimming expenditures associated with storm response.

Figure 5 illustrates MEC's actual annual expenditures for tree trimming for the years 2004 through 2007, and its budgeted (planned) annual tree trimming expenditure for 2008-2010. All expenditures are shown in actual year dollars.

**Figure 5: MEC's Distribution Tree Trimming Expenditures for Illinois in Actual Dollars**



National Electrical Safety Code (NESC) Violations

All NESC violations pose a threat to public safety, and some NESC violations also threaten the reliability of service that electric utilities provide to customers. During its 2008 inspections, Staff noted two locations on MEC's distribution circuits with NESC violations: both relating to inadequate conductor ground clearance. MEC promptly took corrective action at both locations.

During 2007, MEC worked cooperatively with Staff to develop a plan under which it will inspect each of its Illinois circuits and correct any NESC violations that it finds; conveying its progress to Staff in quarterly reports. Under the plan, MEC agreed to inspect each of its Illinois distribution circuits during the four-year period between April 1, 2008, and March 31, 2012, in order to identify NESC violations that might exist. MEC agreed to correct each of the NESC violations it identifies no later than 12 months after discovery, so that all identified violations will be corrected by March 31, 2013. Staff found MEC's NESC Corrective Action Plan to be a reasonable approach to systematically identify and correct NESC violations that exist on MEC's Illinois distribution circuits. A copy of MEC's NESC Corrective Action Plan is included as Attachment B to this report.

Earlier in this report, Staff stated its belief that MEC's 10-year distribution circuit inspection cycle is far too long. Some of the deficiencies that Staff found during its inspections, which Staff has illustrated with photographs in this and prior assessment reports, reinforce Staff's belief. Staff has observed structures on some of MEC's circuits that appear to Staff to have deteriorated over time to an unsafe and unreliable condition. Staff noted above that MEC's NESC Corrective Action Plan provides MEC with four years to inspect all of its Illinois distribution circuits for the purpose of identifying NESC violations. Staff suggests that MEC maintain a 4-year inspection cycle for its distribution circuits even after the first four-year cycle of MEC's NESC Corrective Action Plan is completed. This would allow MEC to identify many of its deteriorated structures and repair or replace them before their degraded condition became so serious, and before the number of locations with deteriorated structures became so large that distribution reliability and system safety are degraded. Staff is convinced that MEC's adoption of a 4-year inspection cycle followed by prompt correction of all identified deficiencies, instead of the 10-year inspection cycle MEC now utilizes, would provide improved safety to the public and improved reliability for MEC's electric customers.

Staff emphasizes service reliability in its assessment reports because reliability is the subject of Code Part 411, which requires the reports. However, MEC should recognize that structures allowed to deteriorate to a condition that can no longer adequately support its facilities violate NESC Rules 253 and 261. For example, Note 2 for Table 261-1A of the NESC states the following:

> Wood and reinforced concrete structures shall be replaced or rehabilitated when deterioration reduces the structure strength to 2/3 of that required when installed. If a structure is replaced, it shall meet the strength required by Table 261-1A. Rehabilitated portions of structures shall have strength greater than 2/3 of that required when installed.

It also seems clear from Staff's field observations, particularly on MEC circuits 13-107-1 and 13-112-2, that MEC's 10-year inspection cycle violates NESC Rule 214.A.2, which is copied below.

> **214. Inspection and Tests of Lines and Equipment**
>
> A. When In Service
>
> 1. Initial Compliance With Rules
>
> Lines and equipment shall comply with these safety rules when placed in service.
>
> 2. Inspection
>
> Lines and equipment shall be inspected at such intervals as experience has shown to be necessary.
>
> *NOTE:* It is recognized that inspections may be performed in a separate operation or while performing other duties, as desired.

Again, Staff's experience and observations have caused Staff to conclude that MEC's routine 10-year inspection cycle of its distribution circuits is much too long. Instead of utilizing a 10-year inspection cycle, Staff enthusiastically suggests that MEC continue inspecting each of its distribution circuits at least once every four years as it is now doing as part of MEC's NESC Corrective Action Plan. These more frequent inspections would not only improve reliability, but it would allow MEC to minimize safety hazards and NESC violations.

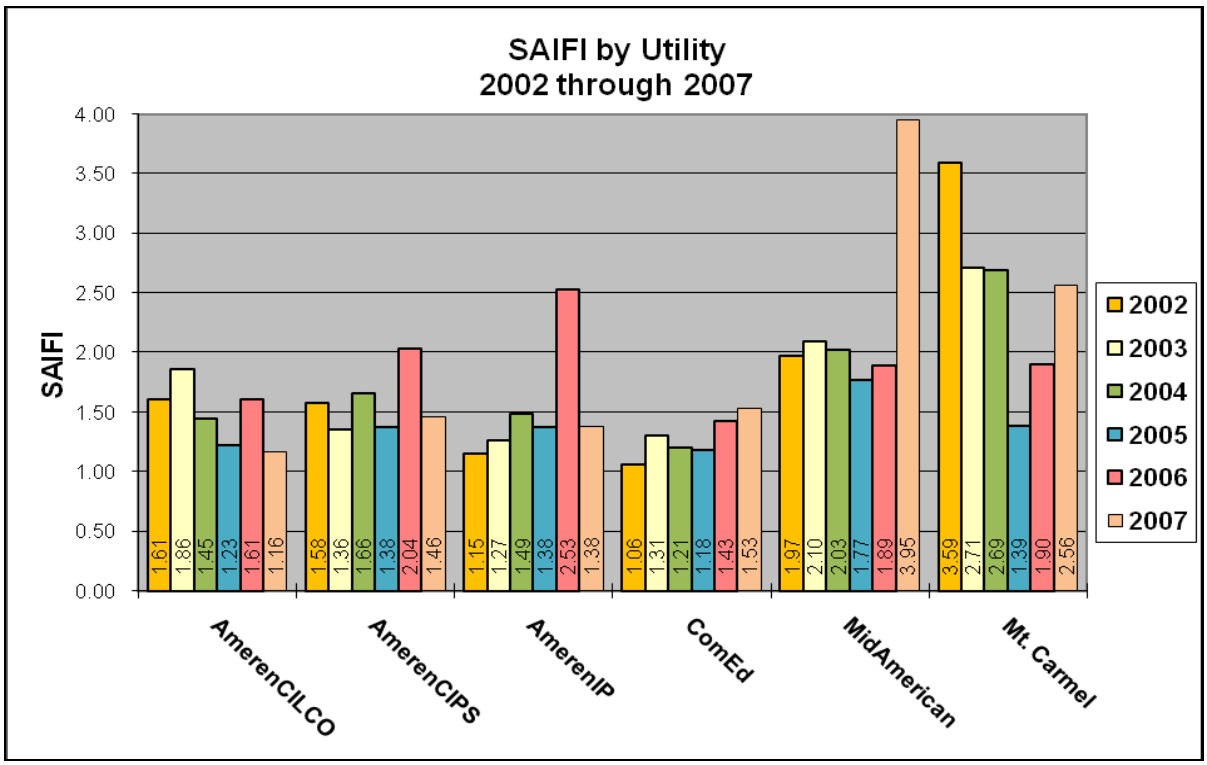
## 8. Trends in Reliability Performance

After reporting relatively high SAIFI and CAIFI reliability indices during most years from 2002 to 2006, MEC's SAIFI and CAIFI worsened further for 2007. Six electric utilities filed reliability reports for 2007, and not only were MEC's SAIFI and CAIFI the highest reported, but MEC's CAIDI, which has historically been one of the lowest, was the second highest reported by any utility. MEC attributes its higher reliability indices for 2007 to the severity of storms that affected its Illinois operating area, particularly the two storms in February and two in December. Staff does not doubt that the occurrence of these storms caused MEC's reliability indices to be higher than they otherwise would have been. However, when inspecting MEC's distribution circuits during 2008, Staff noted deteriorated facilities at several locations and concluded that the poor condition of some facilities likely contributed to the service interruptions that occurred during the 2007 storms.

A comparison of MEC's reliability performance to the reliability performance of all reporting utilities follows:

➢ *SAIFI:* Figure 6 shows system SAIFI values for years 2002-2007 for reporting electric utilities:

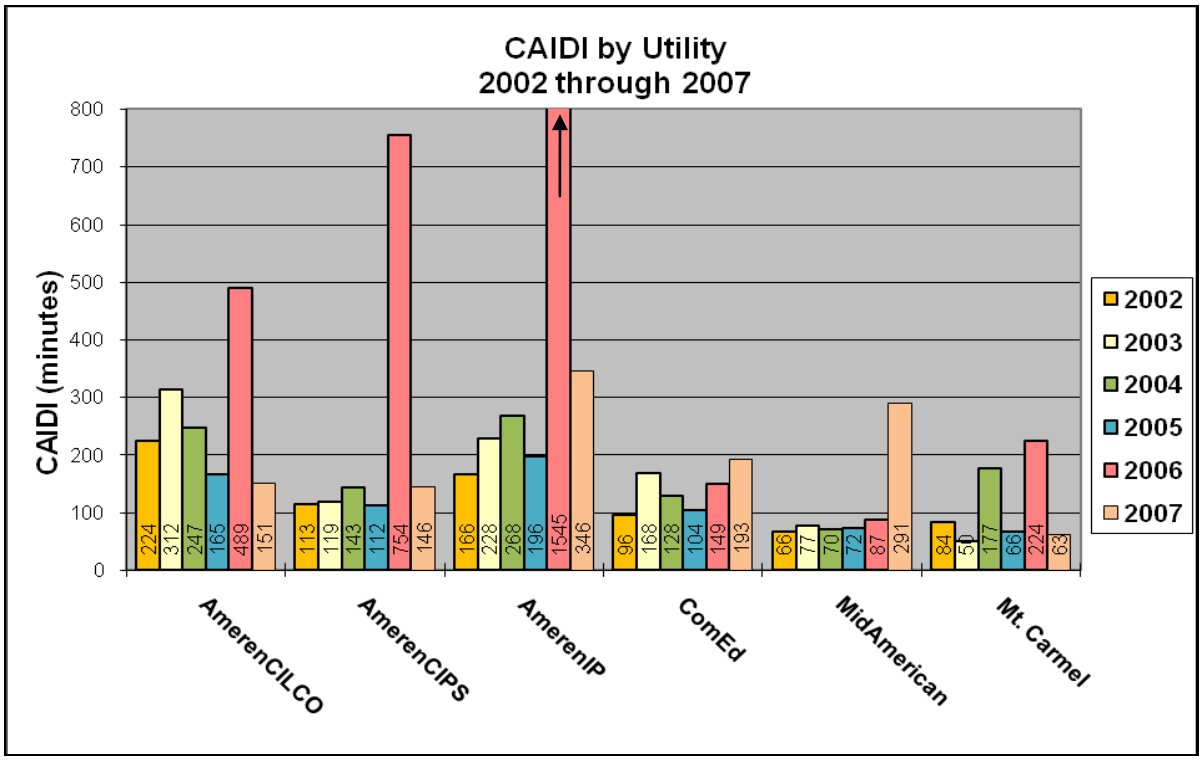
**Figure 6: SAIFI by Utility**




- In 2002, MEC's SAIFI was the second highest (worst) reported, about 21% higher than the average of SAIFI values reported by the other utilities that filed reliability reports for the 2002 calendar year (MEC's 2002 SAIFI=1.97).
- In 2003, MEC's SAIFI increased (worsened) by approximately 6%, and was again the second highest reported, about 35% higher than the average of the SAIFI values reported by the other reporting utilities (MEC's 2003 SAIFI=2.10).
- In 2004, MEC's SAIFI decreased (improved) by about 3% from its 2003 value, and was again the second highest reported, about 42% higher than the average of the SAIFI values reported by the other reporting utilities (MEC's 2004 SAIFI=2.03).
- In 2005, though MEC's SAIFI decreased (improved) by about 13%, MEC's SAIFI was still the highest of reporting utilities (MEC's 2005 SAIFI=1.77).
- In 2006, MEC's SAIFI increased (worsened) by about 7%, but three other utilities reported higher values. MEC's SAIFI was very close to the average value reported (MEC's 2006 SAIFI=1.89).
- In 2007, MEC's SAIFI increased (worsened) by 109%, and was the highest value reported, 144% higher than the average of the SAIFI values reported by the other utilities (MEC's 2007 SAIFI=3.95).

- *CAIDI:* Figure 7 shows system CAIDI values for years 2002-2007 for reporting electric utilities:

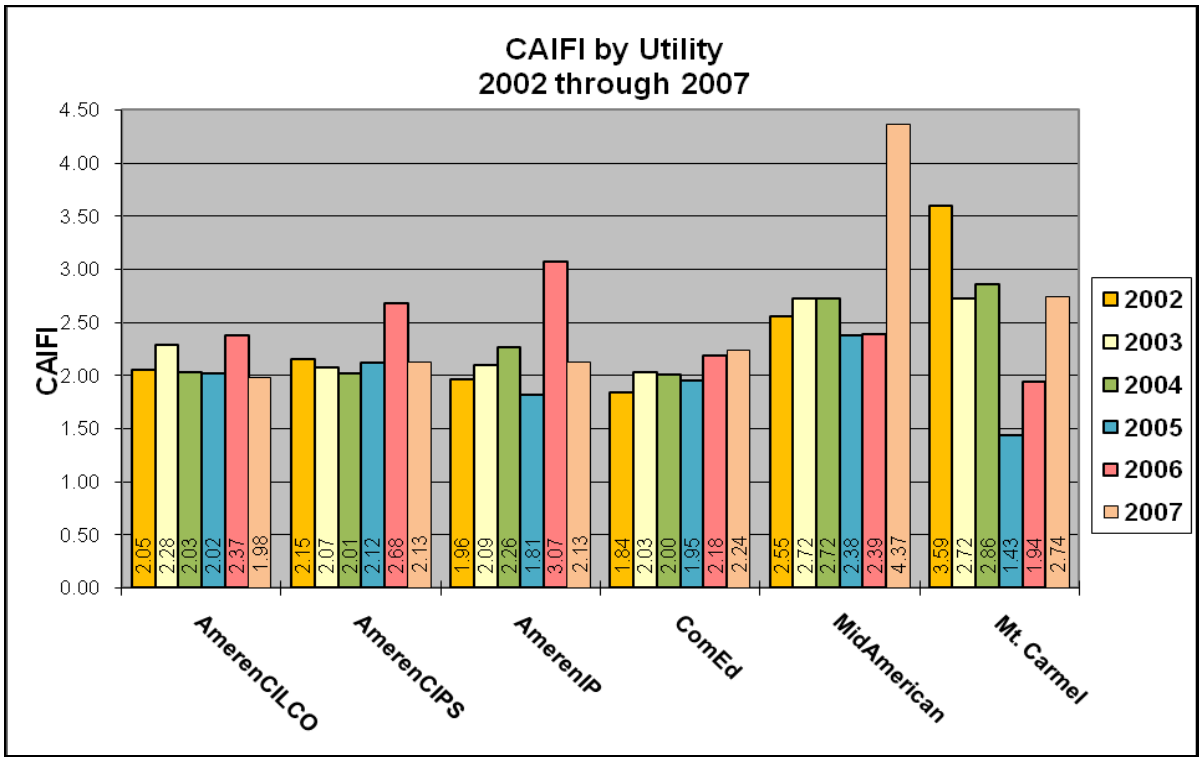
**Figure 7: CAIDI by Utility**




- In 2002, MEC had the lowest (best) CAIDI reported, approximately 50% lower than the average of the CAIDI values of the other utilities that filed reliability reports for the 2002 calendar year (MEC's 2002 CAIDI=66).
- In 2003, MEC's CAIDI increased (worsened) by approximately 16%, but was still about 55% lower than the average of the CAIDI values reported by the other utilities (MEC's 2003 CAIDI=77).
- In 2004, MEC's CAIDI decreased (improved) by approximately 9%, and was again the lowest reported, about 60% lower than the average of the CAIDI values reported by the other reporting utilities (MEC's 2004 CAIDI=70).
- In 2005, MEC's CAIDI increased (worsened) by approximately 3%, and MEC reported the second lowest CAIDI value, 46% lower than the average of the CAIDI values reported by other reporting utilities (MEC's 2005 CAIDI=72).
- In 2006, MEC’s CAIDI increased by about 21%, but, despite this increase, MEC’s CAIDI was the lowest reported, 86% below the average value reported by the other reporting utilities (MEC’s 2006 CAIDI=87).
- In 2007, MEC’s CAIDI increased (worsened) by about 235%, and was the second highest value reported, about 62% higher than the CAIDI values reported by the other reporting utilities (MEC’s 2007 CAIDI=291).

- *CAIFI:* Figure 8 shows system CAIFI values for years 2002-2007 for reporting electric utilities:

**Figure 8: CAIFI by Utility**




- In 2002, MEC's CAIFI was about 14% higher (worse) than the average of the CAIFI values reported by the other utilities that filed reliability reports for the 2002 calendar year (MEC's 2002 CAIFI=2.55).
- In 2003, MEC's CAIFI increased (worsened) approximately 6% and was the highest (worst) value reported, about 25% higher than the average of the CAIFI values reported by the other utilities (MEC's 2003 CAIFI=2.72).
- In 2004, MEC's CAIFI stayed about the same as its 2003 value and was about 36% higher (worse) than the average of the CAIFI values reported by the other reporting utilities (MEC's 2004 CAIFI=2.72).
- In 2005, though MEC's CAIFI decreased (improved) by nearly 13%, MEC again reported the highest (worst) CAIFI value, 38% higher than the average of the CAIFI values reported by the other reporting utilities (MEC's 2005 CAIFI=2.38).
- In 2006, the CAIFI value that MEC reported was nearly the same as its value for 2005, but, due to higher values reported by the other utilities, MEC's CAIFI was about 2% below the average value reported by the other utilities (MEC's 2006 CAIFI=2.39).
- In 2007, MEC's CAIFI increased (worsened) by about 83% and was the highest (worst) value reported, approximately 95% higher than the average of the CAIFI values reported by the other utilities (MEC's 2007 CAIFI=4.37).

A comparison between the changes in MEC's reliability indices from 2006 to 2007 to changes in the average of the indices from all the other reporting utilities for the same period reveals that MEC's reliability indices worsened significantly while the average of the reliability indices of the other reporting utilities improved:

- MEC's SAIFI increased (worsened) by about 109%; the average of the SAIFI values of the other reporting utilities decreased (improved) by about 15%.
- MEC's CAIDI increased (worsened) by about 234%; the average of the CAIDI values of the other reporting utilities decreased (improved) by about 72%.
- MEC's CAIFI increased (worsened) by about 83%; the average of the CAIFI values of the other reporting utilities decreased (improved) by about 8%.

Interruptions to Individual Customers

MEC's reliability report lists the number of customers that experienced various quantities of interruptions during the year. This information indicates, to some extent, the reliability of service that MEC provided to individual customers.

- *Zero interruptions*: During 2007, only 10% of MEC's Illinois customers experienced zero interruptions. This value was 21% during 2006, 25% during 2005, 31% during 2004, 21% during 2003, and 24% during 2002.
- *3 or Fewer Interruptions*: During 2007, 52% of MEC's Illinois customers experienced 3 or fewer interruptions. This value was 85% during 2006, 86% during 2005, 80% during 2004, 79% during 2003, and 80% during 2002.
- *7 or More Interruptions*: During 2007, 16.7% of MEC's customer experienced 7 or more interruptions. This value was 3.9% during 2006, 2.6% during 2005, 6.4% during 2004, and 3.7% during 2003.

Figures 9 and 10 illustrate that 2007 was generally not a good year for reliable service to individual customers within MEC's operating area.

**Figure 9: Percent of MEC Customers with 3 or Fewer Interruptions Annually (2002-2007)**

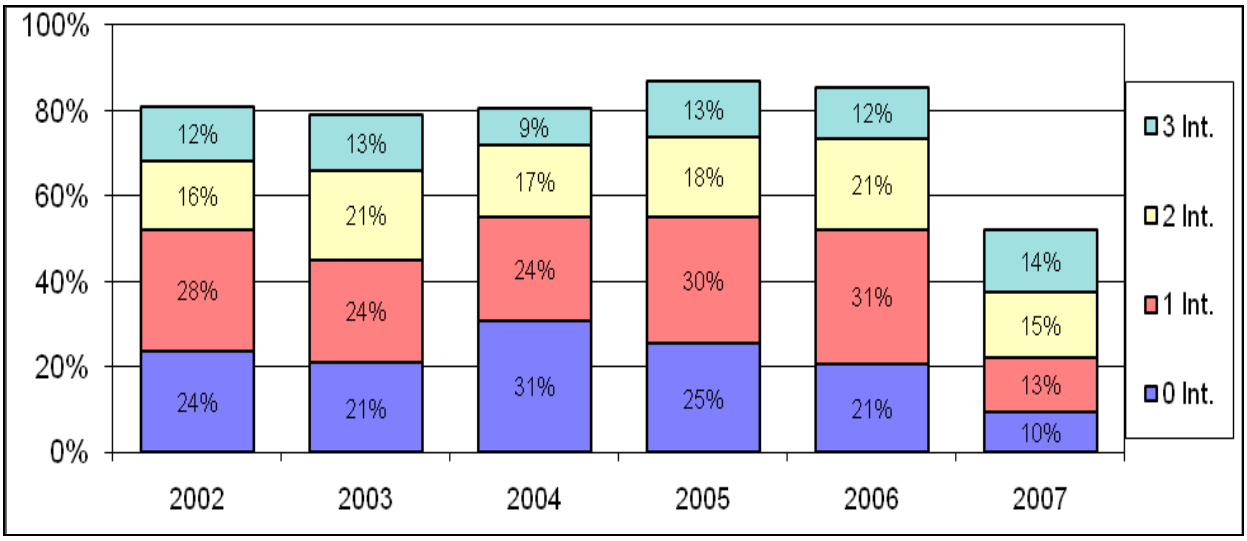
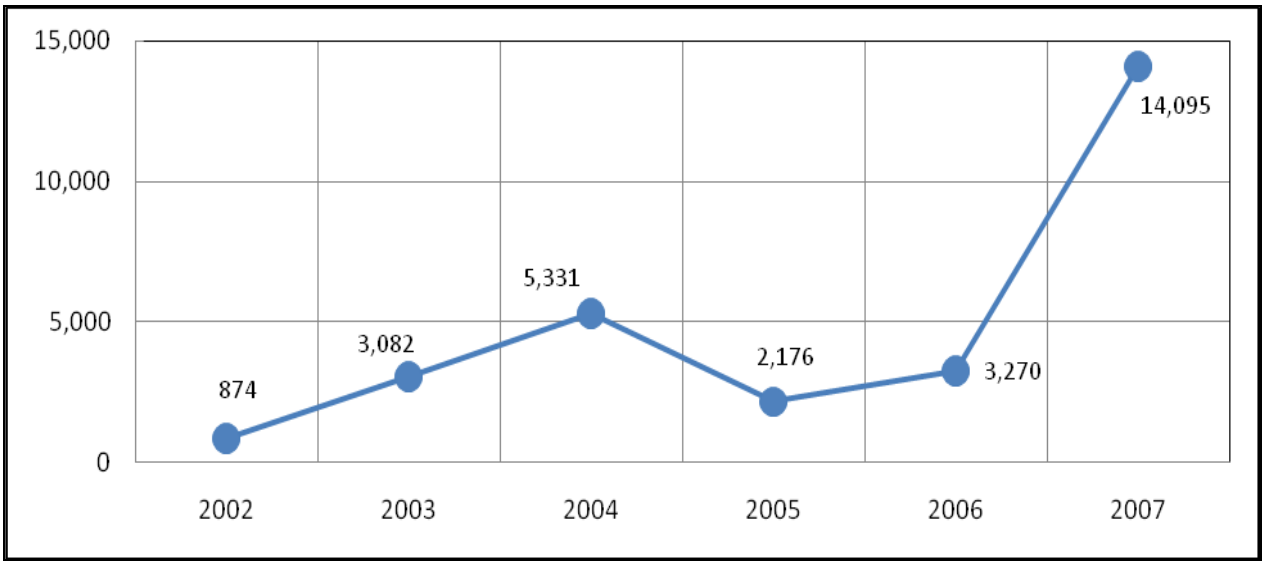


**Figure 10: Number of MEC Customers Experiencing 7 or More Interruptions Annually**




MEC's 2007 reliability performance is in sharp contrast to 2005 and 2006 when more than 85% of MEC's customers experienced 3 or fewer interruptions, and fewer than 4% of MEC's customers experienced 7 or more interruptions. By comparison, during 2007, more than 4% of MEC's customers experienced 10 or more interruptions. Staff is concerned by the statistical degradation of reliable service that MEC provided to its customers during 2007. Staff understands that MEC's service area was hit by several storms during the year and that during extreme weather conditions MEC cannot guarantee that no interruptions will occur. However, Staff is not convinced that even several severe storms can explain why 263 of MEC's customers experienced 16 or more interruptions during 2007, or why 3 customers experienced 21 or more. These high numbers of interruptions to customers should embarrass MEC and prompt it to take preventative action to protect these customers from a repeat of their interruption experiences from 2007. Staff is concerned that MEC did not take action to prevent so many interruptions from occurring in the first place. MEC should review the design of the portions of its distribution system that supplies these individual customers that experienced so many interruptions and conduct field inspections of its facilities. MEC should follow-up its review and inspections with appropriate modifications, maintenance and reinforcements. Staff does not believe any Illinois electric utility should expect its customers to endure as many interruptions as some of MEC's customers endured during 2007.

Customer Interruption Cause Categories

Table 4 shows MEC's interruptions for 2004-2007 attributed to the various interruption categories listed in Table-A of Part 411. Table 4 illustrates that there were significantly more interruption events on MEC's Illinois distribution system during 2007 than during any of the three previous years, and more than twice the number that occurred during 2005.

**Table 4: MEC's Interruptions by Cause for Calendar Years 2003 to 2006**

| Interruption Cause | Interruptions by Cause | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2007 | | 2006 | | 2005 | | 2004 | |
| Weather Related | 2428 | 57.3% | 537 | 20.8% | 308 | 15.2% | 628 | 25.6% |
| Animal Related | 550 | 13.0% | 831 | 32.2% | 629 | 31.0% | 673 | 27.4% |
| Overhead Equipment Related | 495 | 11.7% | 567 | 22.0% | 497 | 24.5% | 546 | 22.3% |
| Tree related | 318 | 7.5% | 280 | 10.9% | 209 | 10.3% | 244 | 10.0% |
| Unknown | 144 | 3.4% | 124 | 4.8% | 138 | 6.8% | 104 | 4.2% |
| Intentional | 90 | 2.1% | 50 | 1.9% | 44 | 2.2% | 43 | 1.8% |
| Other | 66 | 1.6% | 30 | 1.2% | 14 | 0.7% | 19 | 0.8% |
| Underground Equipment Related | 64 | 1.5% | 75 | 2.9% | 86 | 4.2% | 87 | 3.5% |
| Public | 60 | 1.4% | 64 | 2.5% | 82 | 4.0% | 85 | 3.5% |
| Transmission and Substation Equipment | 18 | 0.4% | 14 | 0.5% | 14 | 0.7% | 18 | 0.7% |
| Jurisdictional Entity/Contractor Personnel-Errors | 2 | 0.0% | 8 | 0.3% | 6 | 0.3% | 5 | 0.2% |
| Customer | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Other Alternative Supplier/Utility | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| TOTAL (all causes) | 4235 | 100.0% | 2580 | 100.0% | 2027 | 100.0% | 2452 | 100.0% |

Four interruption causes accounted for nearly 90% of the interruptions on MEC's Illinois system during 2007, the same four causes that accounted for more than 80% of the interruptions on MEC's system during each of the previous 3 years. These interruption causes are animals, overhead equipment failure, weather and trees. Table 4 illustrates that animals have historically caused the most interruptions on MEC's Illinois distribution system, but that in 2007 the number of interruptions attributed to weather far overshadows all other causes: accounting for more than 57% of MEC's interruptions.

When inspecting MEC's distribution circuits during 2008, Staff noted that MEC has been installing animal guards on many of its distribution transformers. MEC reported fewer animal-caused interruptions during 2007 than in any of the previous three years. While Staff cannot prove this reduction in animal related interruptions was due to MEC's continued installation of animal guards, it seems to Staff to be likely. The number of interruptions MEC attributed to overhead equipment failure during 2007 was lower than during 2006, but very close to the 2005 level, and MEC reported a higher number of tree related interruptions during 2007 than in prior years. Staff believes that the

increased number of tree related interruptions is linked to the increased number of weather related interruptions, since trees that normally would not contact the utility's distribution lines might be blown into them during periods of high winds, or weighed down onto them after a snow or ice storm.

The number of individual interruptions identified in Table 4 is not, by itself, indicative of how MEC's customers were affected by these interruptions. For example, a tree-caused interruption might be isolated by a tap fuse so that the interruption affects only 10 customers for an hour. Elsewhere, an overhead equipment failure on the mainline might affect 1000 customers for five hours. Each of these events would be counted in Table 4 as one interruption, however, the tree-caused interruption would result in 10 customer-interruptions (10 customers X 1 interruption) and 600 customer-minutes (10 customers interrupted X 60 minutes of duration), while the overhead equipment failure would result in 1000 customer-interruptions (1000 customers X 1 interruption) and 300,000 customer-minutes (1000 customers interrupted X 300 minutes of duration). Figure 11 illustrates that during 2007, MEC's customer-interruptions due to weather, overhead equipment failure, and trees all increased dramatically.

**Figure 11: MEC's Customer-Interruptions: Top Four Causes**

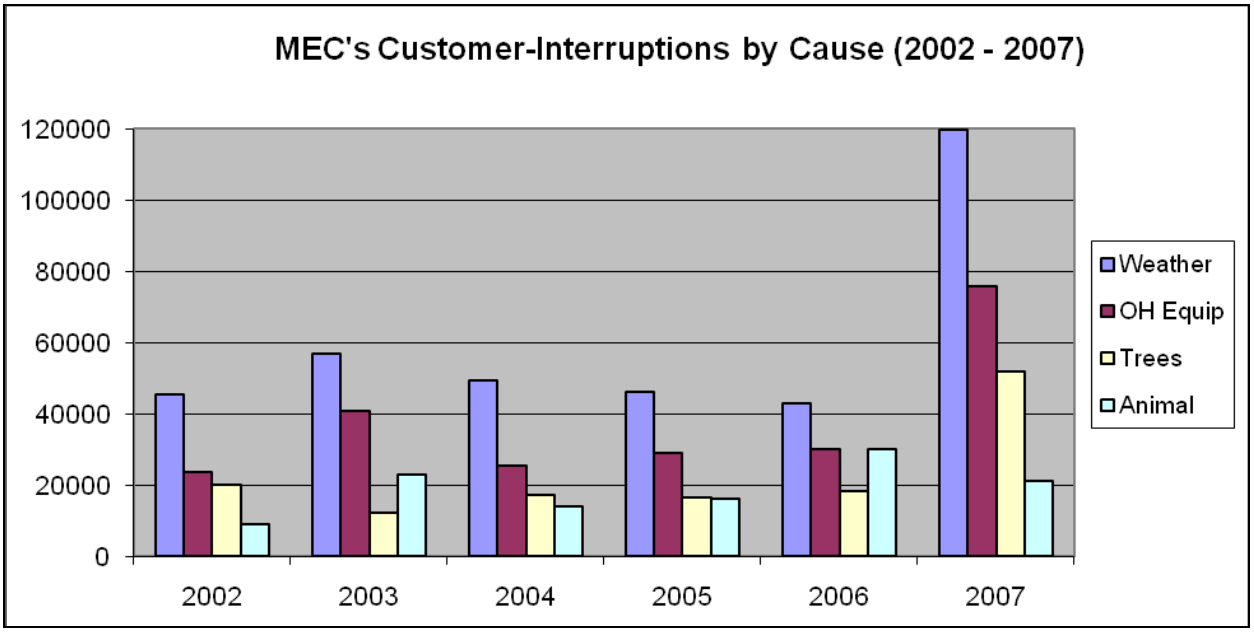
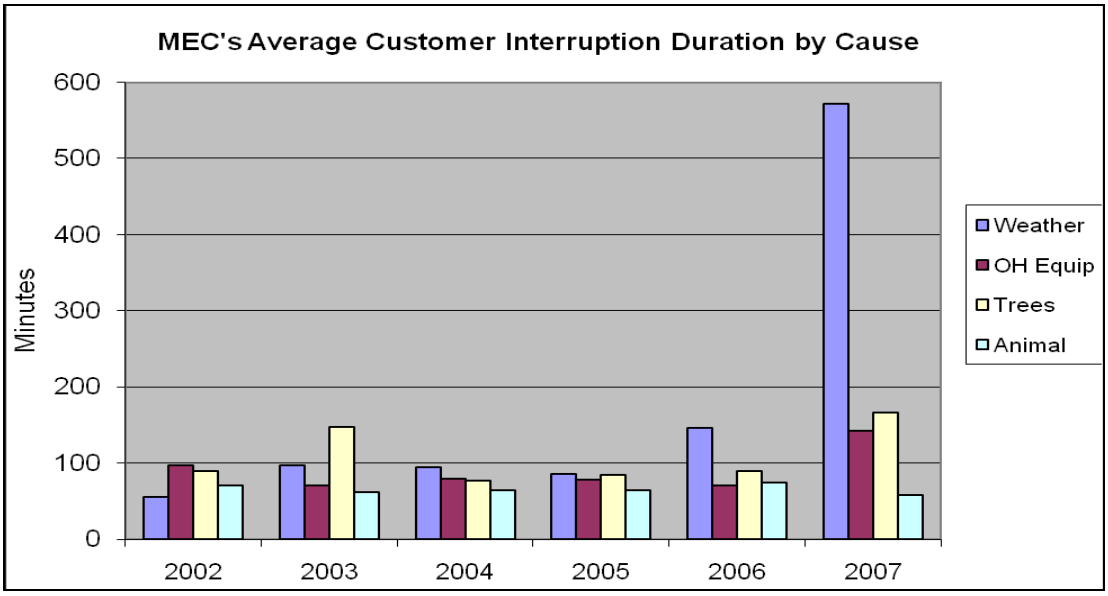



Figure 12 illustrates that, once MEC's customers experienced an interruption caused by weather, overhead equipment failure, or trees, during 2007, the average duration of those interruptions increased substantially when compared to prior years. Staff was distressed to learn that MEC's average duration for interruptions associated with overhead equipment failures and trees were approximately twice as long during 2007 as in 2006, and MEC's average durations for interruptions due to weather were nearly 4 times longer. Conversely, Staff was pleased that in 2007 the average duration of MEC's interruptions due to animals decreased.

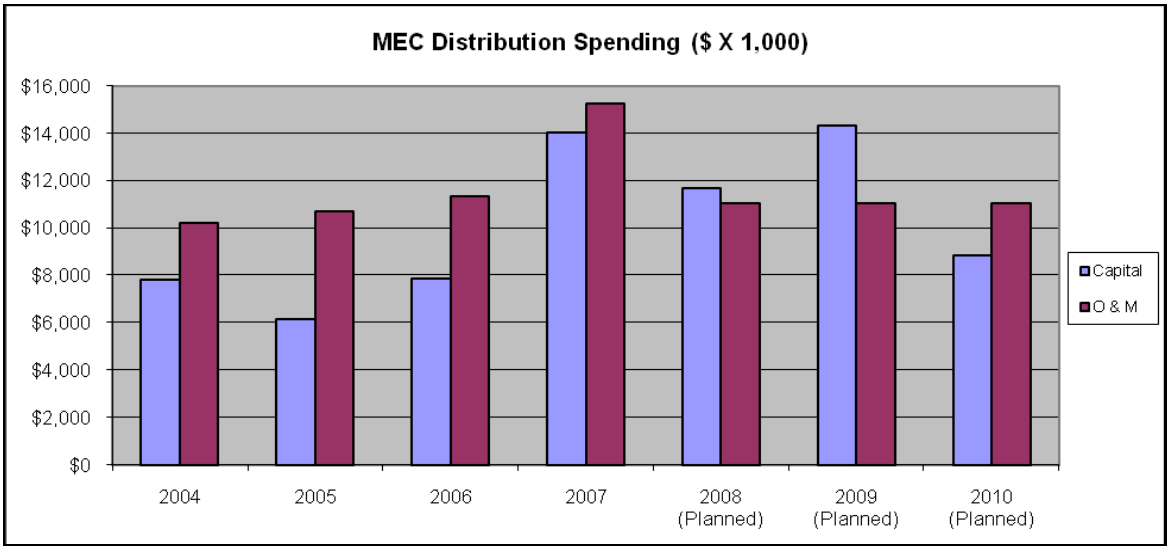
**Figure 12: MEC's Interruption Durations: Top Four Causes**




## 9. Plan to Maintain or Improve Reliability

MEC's actual annual distribution expenditures for the years 2004 through 2007 and budgeted expenditures for the years 2008 through 2010 are illustrated by Figure 13.

**Figure 13: MEC's Distribution Spending (2004-2009)**




MEC's budget for the years 2008 through 2010 includes approximately $11 million annually for distribution O&M, which is about equal to MEC's annual O&M expenditures during the years 2004-2006. MEC's budget for capital expenditures varies with the timing of planned capital projects. MEC does not know whether or not severe storms will track across its Illinois operating area, so its actual spending during the years 2008 through 2010 could vary from the projected flat O&M budget.

Specific distribution projects relating to reliability that MEC plans to complete during 2008 include (1) replacing 2700 feet of underground cable in a commercial development in Milan where customers have experienced several interruptions due to cable failures, and (2) converting 14 overhead spans to underground in an area of East Moline where access to the overhead lines and and/or tree contacts have been a problem. In addition, MEC stated it will be performing complete circuit inspections to identify and correct NESC violations according to its NESC Corrective Action Plan. In Attachment B to its reliability report MEC, listed several on-going inspection and maintenance programs and its 2007 expenditures for each. MEC also identified the following on-going maintenance programs for its distribution system in Illinois: tree trimming, circuit inspection, wood pole and steel tower inspection and treatment, and inspection of switches, capacitors, reclosers and regulators. Staff agrees that the specific projects and maintenance programs that MEC identified in its reliability report are necessary for MEC to maintain or improve the reliability of service it provides to its distribution customers.

MEC projects that its transmission O&M spending will be approximately $1.4 million each year during 2008-2010, and that its transmission capital spending will be $300 thousand or less during each of those years. In 2008, MEC expects that its transmission capital expenditures will consist almost entirely of the installation of a sound attenuating wall at its new Oak Grove 345-161kV substation.

## 10. Potential Reliability Problems and Risks

Staff has the following concerns about MEC's distribution system and distribution operations:

- Staff is concerned that, rather than acting to prevent additional interruptions from occurring on a given distribution circuit, MEC appears to routinely wait until the circuit performs very poorly before it makes any substantive improvements. Moreover, MEC's apparent approach of accumulating work locations for maintenance into one huge project means that customers are sometimes subjected to service interruptions that could have been avoided had MEC addressed specific facility problems sooner. For example, Staff, in its 2006 assessment of MEC's reliability performance, noted a high number of deteriorated facilities on MEC's circuit 13-102-3. In Section 10 of Staff's assessment report for the 2006 calendar year, Staff stated:

  "Staff believes the deteriorated condition of many of the poles, arms, and braces on MEC's Circuit 13-102-3 could certainly negatively impact service to customers. It is this circuit that supplies 35 of MEC's customers that experienced more than 6 interruptions during at least 3 consecutive years. MEC had inspected Circuit 13-102-3 on its own prior to Staff's inspection and created a work package that allegedly corrects the conditions at many of the locations Staff noted, but Staff was concerned by the condition of the facilities on this circuit and that MEC had not yet made its corrections at the time of Staff's inspection."

Circuit 13-102-3 was one of MEC's worst performing circuits during the 2007 calendar year due to SAIFI. Circuit 13-102-3 is an illustration that information available to MEC through circuit inspections could be useful in predicting future circuit performance. One problem with waiting until a distribution circuit performs very poorly before initiating corrective action is that the corrective actions can take a long time to execute. Customers can be subjected to unreliable service for a long time. Staff encourages MEC to be more proactive with its maintenance so that repeated customer interruptions are avoided. When Staff re-visited a portion of Circuit 13-102-3 as part of its 2008 inspections, Staff was very impressed with the quantity of work that MEC performed on this circuit in order to improve reliability, and Staff commends MEC for taking its corrective actions seriously on this circuit. None-the-less, it was apparent to Staff that at least some of the deteriorated facilities that Staff observed on Circuit 13-102-3 during its 2007 inspections had existed for several years before Staff noted them, and even longer before MEC repaired or replaced them. Had MEC repaired or replaced those deteriorated facilities on an on-going basis Staff believes it is likely that far fewer interruptions would have occurred on the circuit, so that Circuit 13-102-3 would have achieved a SAIFI much lower than 9.34 during the 2007 calendar year.[5]

- Staff remains concerned that MEC's practice of conducting thorough circuit inspections only once every ten years is not frequent enough to keep MEC aware of the condition of its own facilities. MEC's listing of Circuit 13-102-3 as a worst performing circuit the year after Staff observed so many facility issues reinforced Staff's concern. More frequent inspections of its distribution facilities would give MEC the opportunity to become aware of and repair deteriorated and/or broken facilities before they cause so many interruptions to customers.
- Staff remains concerned about MEC's high number of animal-related interruptions. MEC is doing a good job adding animal protection to locations where animal related interruptions occur, but the number of animal related interruptions, though reduced for 2007, remains relatively high for MEC's customers. Staff simply encourages MEC to keep up the good work it has been doing in this regard.
- Staff is concerned that MEC allows some vegetation to reach its primary conductors. Staff was generally pleased with the vegetation clearances on the circuits that Staff inspected. Even so, Staff observed locations where new tree growth or fast-growing vines had grown near or to the primary level. MEC should keep all types of vegetation clear of its primary conductors.
- Staff is concerned by the high number of lightning arresters that were blown or missing. While Staff feels that MEC does a good job with covering its rural circuits with lightning arresters to protect its customers and equipment during lightning storms, Staff noted that many of MEC's arresters are blown, or have been removed from their brackets.

[5] Based upon Staff's records from 1998 to present, the 2007 SAIFI of 9.34 that MEC reported for Circuit 13-102-3 is the 3rd highest (worst) SAIFI that MEC has reported for any circuit for any year, and the 5th highest SAIFI for a single circuit reported by any utility for any year.

## 11. Implementation of the Plan Listed in the Previous Reliability Report

MEC's plan from its 2006 report projected that its 2007 distribution O&M expenditures would total approximately $9.96 million, and its distribution capital expenditures about $6.80 million. MEC's actual 2007 distribution O&M expenditures were $15.36 million, and its actual distribution capital expenditures were $14.03 million. These figures equate to increases over 2007 projections of 54% for O&M and 106% for capital. MEC stated that the additional O&M and capital expenditures were due to storm-related recovery activities.

MEC's 2006 plan for its transmission system included projected 2007 O&M expenditures of $1.28 million, and projected capital expenditures of $293 thousand. MEC's actual transmission expenditures during 2007 consisted of $3.54 million for O&M and $1.98 million for capital. These figures equate to increases over 2007 projections of approximately 175% for transmission O&M spending, and approximately a 573% for transmission capital spending. MEC attributed its increase in transmission O&M spending to storm-related recovery activities, and its increased transmission capital spending on costs associated a new 345-161 kV substation.

In Attachment C to its reliability report, MEC provides updates on several specific and ongoing transmission and distribution projects carried over from 2006 to 2007. MEC provides actual 2007 expenditures and, if applicable, projected 2008 expenditures, for each project. Staff agrees with MEC that the projects MEC lists in Attachment C should maintain or improve electric service reliability.

## 12. Summary of Recommendations

Staff makes the following recommendations:

- MEC should perform more frequent thorough inspections of its distribution facilities. These inspections would provide MEC with an opportunity to gain knowledge about the condition of its facilities and identify and correct reliability threats prior to interruption occurrence. MEC should perform thorough inspections of its facilities located beyond individual protective devices whenever the cause of the device operation is unknown, or whenever a group of customers supplied by a protective device experience multiple interruptions.
- MEC should streamline its process to allow corrective action to eliminate threats to reliable service soon after those threats are identified. MEC should perform relatively routine maintenance tasks, such as clearing vegetation growth, replacing blown lightning arresters, or replacing broken cross arm braces, right away. Staff was pleased to find that MEC had replaced many deteriorated poles and cross arms on Circuit 13-102-3, but concerned that customers supplied by this circuit had to endure so many interruptions for so long prior to MEC's corrective actions.
- MEC should continue with its efforts to install animal protection on distribution equipment. The number of animal related interruptions on MEC's Illinois system decreased during 2007, and Staff commends MEC for the increasing number of distribution transformers on which it has placed animal protection. Staff simply

suggests that MEC keep up its good work in this area so that its number of animal related interruptions continues to decrease.

- On the circuits Staff inspected, Staff found that MEC had, for the most part, done a good job keeping trees trimmed clear from the conductor. However, MEC should address the numerous vines that have grown up on its distribution poles and guy wires, rendering some of the poles un-climbable, and completely screening some of its pole-mounted equipment from view (refer again to Photos 9 and 10). MEC should identify the best method to address this seemingly wide-spread problem, be it mechanically cutting the vine, or applying herbicide early in the season, and then its field personnel should routinely attend to the vines when working on or inspecting distribution circuits.
- MEC should periodically remind its personnel to look for NESC violations and provide them with an easy method to submit locations that they observe where NESC violations exist. Staff identified two locations during its 2008 distribution circuit inspections where MEC's conductors had inadequate ground clearance based upon NESC rules. Staff notes that MEC was very responsive in correcting these two violations. MEC has agreed to follow the “MidAmerican Energy Company National Electrical Safety Code Corrective Action Plan”, a copy of which is included in Attachment B, to correct NESC violations in Illinois. However, MEC’s scheduled inspections under its NESC corrective action plan need not be the only information source that MEC utilizes to identify the location of violations. MEC’s employees that drive throughout its operating area as part of their normal duties could provide MEC with useful information about NESC violations.

**Rockrohr, Greg**

**From:** Rockrohr, Greg
**Sent:** Monday, September 29, 2008 3:04 PM
**To:** @ Jared, Robert
**Cc:** sfmcgivern@midamerican.com; Buxton, Roy; Stoller, Harry
**Subject:** Staff's 2008 inspections of MidAmerican distribution circuits
**Attachments:** 2008_MEC Summary of Field Inspection.xls

During 2008, I inspected five of MidAmerican's electric distribution circuits that operate in Illinois, and in addition revisited specific locations on three circuits that I initially inspected during 2007. The attached file provides a summary of my 2008 inspections. I hope this information, which is based upon notes I took during the circuit inspections, is useful to your company. The worksheets are not represented as capturing all of the potential reliability problems that may exist on the circuits that I inspected. In many cases, there were portions of the circuits that I did not see. My inspections are not intended to take the place of the thorough, detailed inspections that your company should periodically perform.

Requested action:

When inspecting Circuit 13-112-2, I noted apparent National Electric Safety Code ("NESC") clearance violations at the two locations shown in bold font in the attached worksheet for that circuit. At both of the locations that are bolded, it appeared that the neutral conductor has inadequate ground clearance. In addition, it also appeared the primary conductor has inadequate ground clearance at the second location listed (1512 65th St.). Please provide me with the measured height of the conductors at the noted locations. If, after measurement, MEC discovers that the conductor clearance is less than that allowed by NESC Table 232-1, please also provide MidAmerican's plans and schedule to modify its facilities at the location(s) to obtain the required ground clearances. Please provide this information to me by October 28, 2008.

If you have any questions about the information contained in the attached summaries, or the information I am requesting regarding conductor ground clearance, please contact me directly.

Thank you,

Greg Rockrohr
Illinois Commerce Commission
217-524-0695

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **5/21/08** |
| **Circuit:** | **4-25-1** | **Inspector:** | **Rockrohr (ICC)** |
| **Gen. Notes:** | Moline. Tree trimming completed 1/07. Trees observed contacting primary at 2 locations -otherwise nothing noted.<br>4 kV circuit. F.I.'s might help where line is not visible from road. Supplied by 13-40-4?<br>2007 "Next 20" circuit: 5 weather, 4 OH, 6 Tree, and 1 Animal interruption. Some rear lot. Some old facilities but generally good shape. | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Tree growth contacting primary | 734 | Near 1953 W. 13th Ave. -Behind River Oaks Apts. |
| | Tree growing into primary | 737 | E/29th St.-lane called 29th Street Drive -Btw 16th&18th Ave. |

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **8/27/08** |
| **Circuit:** | **13-108-2** | **Inspector:** | **Rockrohr (ICC)/McGivern (MEC)** |
| **Gen. Notes:** | Matherville & rural. Tree trimming completed 3/08. Some vines grown up poles to primary level.<br>Rural with few trees. Generally in good shape, but there were some deteriorated arms.<br>2007 "Next 20" circuit: 93 weather, 8 OH, 6 Tree, and 6 Animal interruption. Good LA placement -lots of trf. without AG | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Deteriorated arm with Neutral pin fallen through -shell rot | 2 | 270th St. -1 span S/ Ridge Rd. |
| | 2 shell rot poles & gooseneck insul bracket barely attached | 3 & 4 | At E/L 230th St. -S/160th Ave. |
| | Broken lightning arrester | 5 | 170th Ave. btw. 220 St. & 230 St. |
| | Splinterred Cross Arm | 6 | 170th Ave. W/220 St. |
| | Lightning arrester with broken jumper | | 220th St. N/170th Ave. |
| | Blown lightning arrester | | 230th St. btw 160th Ave. & 170th Ave. |
| | Loose nut on x-arm mounted goose-neck brackets -2 poles | | Ridge Rd. E/230th St. |
| | Blown lightning arrester | | 150th Ave. btw 230th & 240th St. |
| | 3 poles have no nuts holding neutral pins in arm | | 160th Ave. btw 240th & 250th St. |
| | Vines up to primary level | | 240th St. N/176th Ave. |
| | 6 poles all extremely shell rot | | Tap to north of 170th Ave. - W/Switch # 1286 |
| | Blown lightning arrester | | 160th Ave. E/270th St. |
| | Vines up to primary level | | 147th Ave. E/270th St. |
| | Neutral pin fallen through arm | | 290th St. N/140th Ave. |
| | Lightning arrester missing from bracket | | 255th St. S/Ridge Rd. |

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **9/23/08** |
| **Circuit:** | **13-40-4** | **Inspector:** | **Rockrohr (ICC)/McGivern (MEC)** |
| **Gen. Notes:** | Moline. Tree trimming completed 1/07. Lots of trees but trimming looked good overall.<br>Supplies 4-25-1?<br>2007 Worst Performing circuit: 60 Weather, 16 OH, 4 Tree, 11 Animal, 3 Other, and 1 UG. Circuit appeared to be in good shape. | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Vine to primary | 1 | Alley Btw 25th & 26th St & Btw. 11th & 12th Ave. |
| | Primary thru tree growth | 2 | 10th Ave. E/26th St. |

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **9/24/08** |
| **Circuit:** | **13-107-1** | **Inspector:** | **Rockrohr (ICC)/McGivern (MEC)** |
| **Gen. Notes:** | Rural btw Reynolds & Millersburg in Mercer Co. Tree trimming completed 8/07. No vegetation issues noted.<br>Very long circuit with lightning arresters throughout, several blown. Some deteriorated x-arms and poles. Last MEC inspection: 2000<br>2007 "Next 20" circuit: 106 Weather, 9 OH, 8 Tree, and 6 Animal. Areas of circuit had lightning damage -several blown/missing LA's. | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Lightning damaged pole top | 2 to 4 | 105th St. West -N/190th Ave. |
| | Broken x-arm brace | 5 | 105th St. West -S/176th Ave. West |
| | Broken x-arm brace | 6 | 105th St. West -at 1st Tap to west S/176th Ave. West |
| | PT pin coming loose from pole | 7 & 8 | 176th Ave. West @ 132nd St. West |
| | Lightning damaged pole top, x-arm & x-arm brace | 9 to 11 | 190th Ave. West - W/195th St. (4215 190th Ave. West) |
| | Deteriorated & splinterred pole top | 12 & 13 | 190th Ave. West - just W/42nd St. West |
| | Deteriorated & splinterred pole top | 14 & 15 | 208th St. at 120th Ave. |
| | Splitting x-arm | 16 & 17 | Ridge Rd. -5th pole E/175th St. |
| | Deteriorated x-arm and detached brace | 18 | 180th St. between 170th & 155th Ave. |
| | Neutral pin fallen thru x-arm | | 180th St. between 170th & 155th Ave. (N/above location) |
| | Lightning arrester bracket but arrester not present | | 170th St. between 170th & 155th Ave. |
| | Lightning arrester bracket but arrester not present | | 150th St. N/135th Ave. |
| | Blown lightning arrester | | Near 1569 135th Ave. |
| | Splitting x-arm | | Ridge Rd. -E/170th St. |
| | Loose nut on road-side insulator pin | | Ridge Rd. -E/170th St. (1702 Ridge Rd.) |
| | Loose nut on road-side insulator pin | | Ridge Rd. -E/175th St. |
| | Several shell-rot poles (11 poles look pretty bad) | | 175th St. -S/Ridge Rd. |
| | Deteriorated pole top | | 120th Ave. -5th E/165th St. |
| | Deteriorated x-arm | | 120th Ave. -6th E/165th St. |
| | Broken ground | | 160th St. -S/120th Ave. |
| | Lightning arrester bracket but arrester not present (2 | | 160th St. -S/120th Ave. |
| | Nut loose on insulator pin | | 120th Ave. between 142nd St. & 150th St. |
| | Broken ground | | 120th Ave. - 1st pole E/208th St |
| | Splitting x-arm with neutral pin layng over | | 120th Ave. between 208th St & 212th St. |
| | Pole with trf. leaning over pretty far | | 210 St. between 150th Ave. & 170th Ave. (#1585 210th St.) |
| | Neutral pin fallen thru x-arm | | 210th St. S/150th Ave. |
| | Blown lightning arrester (2 locations) | | 190th Ave. West -E/119th St. West |
| | Lightning arrester removed -not replaced | | 205th St. -S/190th Ave. West |
| | Lightning arrester bracket but arrester not present | | 84th St. West -N/190th Ave. West |
| | Neutral conductor laying in pine tree | | 76th St. West -N/176th Ave. West |
| | Nut loose on insulator pin -road side | | 176th Ave. West -between 42nd St. West & 56th St. West |
| | Broken ground wire | | 42nd St. West -N/190th Ave. West |
| | Blown lightning arrester | | 42nd St. West -N/190th Ave. West (@ Seven Hills Ranch) |

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **9/25/08** |
| **Circuit:** | **13-102-3** | **Inspector:** | **Rockrohr (ICC)** |
| **Gen. Notes:** | Rural Henry County. Limited reinspection of this circuit -along County Rd. 1500 North on drive back to Springfield<br>Observed that lots of deteriorated facilities noted in '07 had been replaced (prior inspection by Staff was 6/20/07.)<br>2007 worst performing circuit. | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Primary detatched from insulator (floater) | 19 | 1500 N. -btw Osco Slab & 900 E (near #9389) |
| | Primary detatched from insulator (floater) | 20 | 1500 N. -2nd pole E/1000 E |
| | Detached x-arm brace | 21 | 1500 N. -1st pole W/Liken Rd. (1250 E) |
| | Blown lightning arrester | | Near intersection of 1500 E. & 1400 N. |

| Summary of Distribution Circuit Field Inspection by ICC Staff | | | |
|---|---|---|---|
| **Utility:** | **MidAmerican** | **Date:** | **8/26/2008 & 9/25/08** |
| **Circuit:** | **13-112-2** | **Inspector:** | **Rockrohr (ICC)/McGivern (MEC)** |
| **Gen. Notes:** | Rural Mercer & RI Co.: Trees last trimmed 5/06. A couple locations had trees close or contacting -several vines to primary level. Mostly routed through areas with few trees. Some deteriorated facilities. Good LA placement -but several blown. Many trf. without AG's 2007 "Next 20" circuit: 50 weather, 14 OH, 10 animal, 4 tree, 4 other, 2 public. Could use some new poles, arms and LA replacement. | | |
| ***Map No.*** | ***Item Description*** | ***Photo(s)*** | ***Location*** |
| | Disconnected x-arm brace | 2 | 183rd Ave. W -W/224th St. W. |
| | Splitting x-arm | 3 | 234th St. W -S/169th Ave. W |
| | Pin coming loose on deteriorated pole top | 4 & 5 | 170th Ave. W -W/236th St. W |
| | Neutral conductor detached & floating | 6 | 245th St. W -S/ 170th Ave. W. |
| | Broken pole top | 7 | Tap W/ 245th St. W & S/170th Ave. W. |
| | Vines to primary level | 8 | Tap W/ 245th St. W & S/170th Ave. W. |
| | Broken insulator causing detached primary (floater) | 10 & 11 | 170th Ave. E/Mueler Rd. (@916 170th) |
| | Vines growing over trf. | 12 | Near E/L 80th St. S/Mueler Rd. (157th Ave.) |
| | Wood pin thru x-arm | 13 | Tap E/65th St. -N/157th Ave. |
| | Blown lightning arrester | 14 | 180th Ave -W/280th St. W. |
| | Vines covering trf. | 16 | 15 St. S/160th Ave. @ E/L |
| | Broken ground wire | | 15 St. S/160th Ave. (a few spans N of E/L) |
| | Pole leaning severely | | 170th Ave. -W/350th St. W |
| | Blown lightning arrester | | At Switch #1043 -190th Ave. W -E/322 St. W. |
| | Vines to primary level | | Tap extending S/190th Ave. W -E/322 St. W. |
| | Vines to primary level | | 65th St -N/170th Ave. |
| | Tree contacting primary | | 170th Ave. -E/65th St. |
| | 2 poles with vines to primary | | 80th St -N/157th Ave. |
| | Vines to primary level | | 157th Ave. -W/80th St. |
| | Neutral pin fallen through arm | | 176th Ave. W -E/80th St. |
| | Vines growing over trf. | | 176th Ave. W -E/80th St. |
| | Blown lightning arrester | | 85th St. N/170th Ave. |
| | **Neutral conductor appears to have very low clearance** | | **Tap W/ Mueller Rd. just S/ 170th Ave.** |
| | Blown lightning arrester | | 180th Ave -E/95th St |
| | Disconnected Down guy | | Corner of 180th Ave. & 234th St. W. |
| | Blown lightning arrester | | At 183rd Ave. W & 224th St. W. |
| | Blown lightning arrester | | 224th St. -S/ Switch # 1032 |
| | Broken down guy | | 95th St. at curve N/170th Ave. |
| | Vines to primary level -2 poles | | 252nd St. W -N/ 170th Ave. -at near curve in road |
| | Shell rot pole | | 284th St. W -S/155th Ave. W |
| | Vine to primary | | 155th Ave. W -E/284th St. |
| | 2 shell rot poles | | 155th Ave. W -E/284th St. |
| | Vines to primary at 3 poles | | Mueller Rd. -S/170th Ave. at E/L |
| | **Very low primary and neutral conductors** | | **65th St -S/155th Ave. (at address # 1512)** |
| | Vines to primary | | 155th Ave -W/57th St. |
| | Tree contacting primary | | 54th St. W/155th Ave. |
| | Failing x-arm | | 140th Ave. -E/30th St. |
| **ICC representative Rockrohr completed inspecting this circuit and noted the following on 9/25/08** | | | |
| | Neutral pin fallen through arm | 17 | 55th St. -4th pole N/95th Ave. |
| | Deteriorated arm and detached brace | 18 | 45th St :+/-10th pole S/130th Ave. |
| | One x-arm brace missing | | 45th St: +/-14th pole S/130th Ave. |
| | Detached x-arm brace | | Burger Bluff Rd: N/120th Ave.-at pole with tap to west |
| | 6 adjacent shell rot poles | | 120th Ave. -W/Burger Bluff Rd. |
| | Shell rot pole | | Burger Bluff Rd: 2nd N/120th Ave. |
| | Vines to primary level | | 65th St N/115th Ave. |
| | Vines to primary level | | 115th Ave. E/ 65th St. |
| | Arrester brackets with arresters removed (3 locations) | | Mannon Rd. Btw. 90th Ave & 70 St. |
| | Trees growing very close to primary | | 42nd St. Btw 95th Ave. & 96th Ave. |

# MidAmerican Energy Company
# National Electrical Safety Code
# Corrective Action Plan

This document provides the details for the steps MidAmerican Energy Company ("MEC") will take to address National Electrical Safety Code ("NESC") violations on its Illinois electric system. This corrective action plan includes steps required to make one-time corrections for locations where MEC or its predecessor companies did not originally build its facilities in compliance with NESC requirements and locations that no longer comply with NESC requirements due to changing conditions.

## Inspections

MEC agrees to perform inspections of all its electric distribution lines in Illinois. MEC's inspections will locate and identify all types of NESC violations. MEC will schedule these inspections to begin by April 1, 2008, will commence mitigation work on NESC violations immediately and proceed continuously until completed, and will complete one cycle of these inspections by March 31, 2012.

## Mitigation Efforts

MEC will perform corrective action on all NESC violations that pose an imminent danger to public or employee safety on an emergency basis within 24 hours of discovery.

Remaining mitigations are broken down into three parts.

### Part 1 Mitigation –normal ongoing process

MEC will complete corrective action on all NESC violations within 90 days of discovery, unless the NESC violation qualifies for Part 2 or Part 3 Mitigation. Types of NESC violations MEC will correct within 90 days of discovery include:

- Inadequate clearances, except as covered under Part 3 Mitigation,
- Single crossarm at RR or interstate highway crossing,
- Downguys and overhead guys that are not effectively grounded or not properly insulated and not covered by Part 2 Mitigation.
- All other types of NESC violations

### Part 2 Mitigation –One-time "catch-up" program, to cease on 3/31/2013.

Part 2 Mitigation includes downguys and overhead guys that are not effectively grounded or not properly insulated but are fully intact, in good condition, and not expected to fail during the next year. Also included are deteriorated facilities (poles and crossarms) that will be rebuilt, are not considered an immediate safety hazard, and are not expected to fail during the next year. MEC will complete corrective action at each location within 12 months of discovery, with all corrective action completed no later than March 31, 2013.

Part 3 Mitigation – communications cable clearance issues

Part 3 Mitigation is limited to communications cable clearance issues. MEC will notify the communication cable owner by written letter of the NESC clearance violation within 30 days of discovery. MEC will correct clearance violation caused by its facilities within 90 days. MEC will monitor the efforts of the communications companies in correcting violations caused by their facilities with the goal of the communications companies correcting their violations within 180 days.

**Costs and Man-Hour Requirements**

MEC understands the need to track the costs of correcting the NESC violations, and MEC will provide the Illinois Commerce Commission ("Commission") actual costs of the repairs made. In addition, MEC will update initial projections of total costs and resource requirements for system corrections as detailed below after the first period inspections are completed. These updated estimates may vary from quarter to quarter as MEC collects additional actual data through inspections and experiences correction costs.

To complete the work detailed in this plan MEC estimates it will incur the following costs and resource requirements.

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| O&M Costs ($) | Redacted | | | | | |
| O&M Man-hours | | | | | | |
| Capital Costs ($) | | | | | | |
| Capital Man-hours | | | | | | |
| Total Costs ($) | | | | | | |
| Total Man-hours | | | | | | |

**Reporting**

MEC will submit to the Commission Staff by July 31, 2008, an initial quarterly report that will include (a) NESC violations identified and corrected during the period from April 1, 2008 through June 30, 2008; (b) actual costs and man-hours expended during the quarter for O&M and capital work; and (c) updated cost and man-hour estimates as provided in this plan. MEC will submit subsequent quarterly reports to Commission Staff by the end of the first month following each calendar quarter.

MEC will continue reporting under this plan until it has corrected all NESC violations it has identified under this plan and has reported that fact to the Commission.

MEC anticipates that it may request confidential treatment for its quarterly reports. MEC acknowledges that Commission Staff may need to prepare non-confidential summaries of such reports for purposes of its reports to the Commission.

Part 1 NESC Issues

Beginning with data collected in 2008, MEC will provide a quarterly report to ICC Staff by the end of the first month following each quarter (i.e. first report by July 31, 2008 to include NESC violations identified between 4/1/08 and 6/30/08). MEC's report will include the following.

- Running total of NESC violations located and identified since 4/1/08 –by type.
- Total number of new NESC violations located and identified that quarter – by type
- Total number of NESC violations corrected during that quarter – by type

As soon as it is recognized, MEC will notify ICC Staff of any individual item that will not be corrected within the 90-day window. MEC will also summarize these exceptions in that quarter's reporting to include:

- Reason for not meeting 90-day commitment
- Projected date for completion
- Any associated process or technology issues identified

The quarterly reporting will also provide an update on any individual violation reported during the previous quarter that did not meet the 90-day commitment for correction.

Part 2 NESC Issues

Beginning with data collected in 2008, MEC will provide a quarterly report by the end of the first month following each quarter. MEC's report will include the following.

- Running total of NESC violations located and identified since 4/1/08
- Total number of new NESC violations located and identified that quarter
- Total number of NESC corrections corrected during that quarter

As soon as it is recognized, MEC will notify ICC Staff of any individual item that will not be completed within the 12-month window. MEC will also summarize these exceptions in that quarter's reporting to include:

- Reason for not meeting 12 month commitment
- Projected date for completion

The quarterly reporting will also provide an update on any individual item reported during the previous quarter that did not meet the 12-month commitment.

Part 3 NESC Issues

Beginning with data collected in 2008, MEC will provide a quarterly report by the end of the first month following each quarter. MEC's report will include the following.

- Running total of NESC violations located and identified since 4/1/08
- Total number of new NESC violations located and identified that quarter
- Total number of NESC corrections corrected during that quarter

As soon as it is recognized, MEC will notify ICC Staff of any individual item that will not be corrected within the 180 days. MEC will also summarize these exceptions in that quarter's reporting to include:

- Reason for not completing the correction within 180 days
- Projected date for completion
- Any associated process or technology issues identified

MidAmerican Energy Company

By: James Averweg

Name: James Averweg
Title: Vice President-Engineering

Dated: January 31, 2008